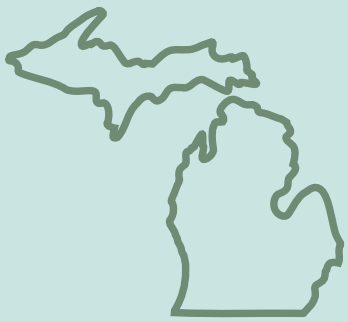
ECONOMIC IMPACT POTENTIAL

AND CHARACTERIZATION OF MUNICIPAL SOLID WASTE IN MICHIGAN

2016



WEST MICHIGAN SUSTAINABLE BUSINESS FORUM

DEQ

GRAND VALLEY STATE UNIVERSITY

FTC&H

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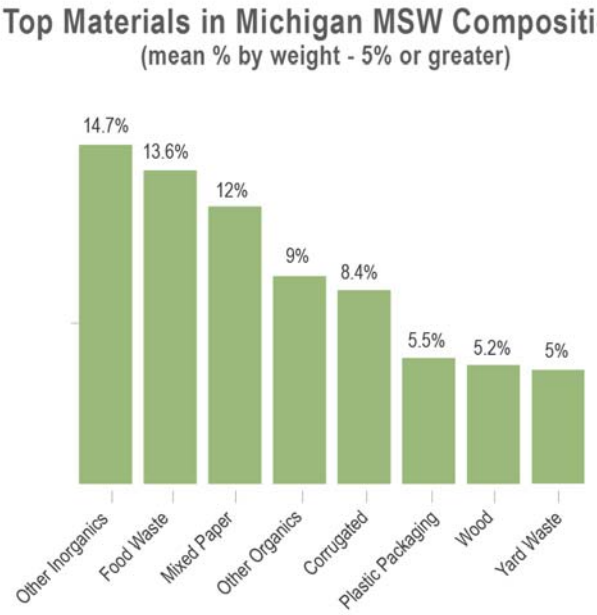
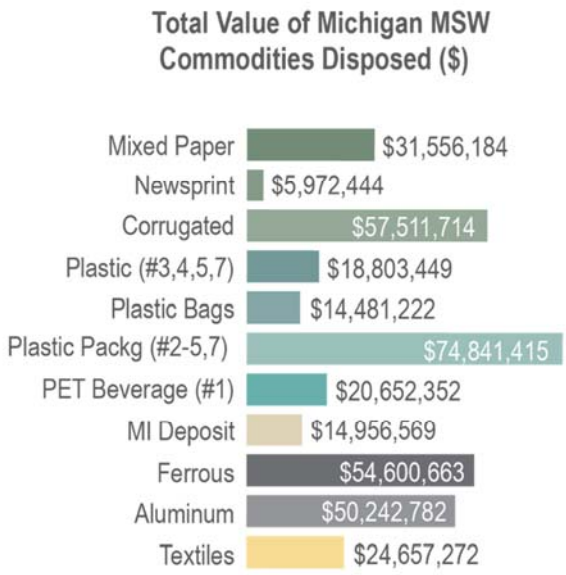
We would like to thank the following
organizations for their support,
without which, this project would not be possible.

IN BRIEF

This study provides information and analysis on the composition of municipal solid waste currently landfilled and incinerated in Michigan, and the economic value of this material.





We estimate total material value of Michigan MSW disposed in landfills and incinerators of as much as **$368 million per year.** If all of this material was recovered and sold to the market it would have an estimated **total economic impact of up to $399 million per year**, and employment impact of up **2,619 jobs**.

RECOMMENDATIONS FOR RECYCLING RATE IMPROVEMENT
1. Aggressively promote efforts to increase recovery of corrugated cardboard, prioritizing commercial audiences.
2. Support efforts to increase availability and usage of conventional recycling programs with a goal to increase recovery of non-corrugated paper products, metal, and high-value plastic resins HDPE and PET.
3. Through recovery or source reduction, decrease the quantity of electronic waste disposed of in Michigan landfills by half.
4. Promote source reduction and diversion of food waste.
5. Promote source reduction of low-value plastic resins.
6. Initiate efforts to increase recycling channels for textiles and promote availability of textile recycling.
7. Educate the public on the financial difficulties of recycling and waste diversion.
8. Pursue opportunities for further study highlighted in this report.

Suggested Citation: Schoonmaker, D., Lowen, A., Isely, P., and Kneisel, A. Michigan Municipal Solid Waste Characterization and Valuation: Opportunities for Economic and Environmental Impact. West Michigan Sustainable Business Forum; Grand Valley State University, 2016.

About West Michigan Sustainable Business Forum

West Michigan Sustainable Business Forum is a network of business, government, non-profits and academia dedicated to promoting business practices that demonstrate environmental stewardship, economic vitality, and social responsibility.

Founded in 1994 under a fiduciary arrangement, the forum became an independent 501c3 non-profit in 2009. It is today the leading organization for practitioners of beyond-compliance sustainability practices in the state and an active facilitator of participatory community sustainability initiatives, promoting positive change and operational improvements through education and collaboration.

A marketplace of ideas, discussion and problem-solving around sustainable business for diverse and often competing interests, the forum serves as

- A mechanism for professional development, networking and tribe-building for practitioners and organizations.
- A platform for investments in shared capacity to address organizational, industry and community sustainability concerns.
- A boundary organization providing linkages between industries, governments, non-profit interests, and academia.

This report is a product of the WMSBF Waste Task Force, an effort to mobilize the regional business community to improve local recycling rates and promote the development of a circular West Michigan economy. Launched in 2013, it is a collaboration of West Michigan Sustainable Business Forum member organizations and other partners that provide recycling and composting services or education to local businesses, citizens and other stakeholders. It is interdisciplinary in nature, and has proven unique in its ability to facilitate collaboration and shared capacity among competitors and conflicting interests.

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About Michigan Department of Environmental Quality

The Michigan Department of Environmental Quality (MDEQ) promotes wise management of Michigan's air, land, and water resources to support a sustainable environment, healthy communities, and vibrant economy. This project was funded primarily through a $50,300 grant from the MDEQ.

About Grand Valley State University

Grand Valley State University is a four-year public university. It attracts more than 25,000 students with high-quality programs and state-of-the-art facilities. Grand Valley is a comprehensive university, serving students from all 83 Michigan counties and dozens of other states and foreign countries. Grand Valley offers undergraduate and graduate degree programs in 200+ areas of study from campuses in Allendale, Grand Rapids, and Holland, and from regional centers in Muskegon and Traverse City. The university is dedicated to individual student achievement, going beyond the traditional classroom experience, with research opportunities and business partnerships. Grand Valley employs more than 2,000 people and is committed to providing a fair and equitable environment for the continued success of all.

About FTCH

More than 50 years after its founding, nearly 400 staff members in six regional offices have made FTCH one of the premiere professional consulting firms in the U.S. Architecture, engineering, environmental sciences, and construction management are the cornerstones of FTCH's services and integrated project approach. With the technical capabilities and understanding to take even the largest projects from initial concept to completion, we are a hands-on, design-oriented practice at heart. Our team of experts takes pride in our commitment to integrity in design, connection to our clients, and creativity at our core.

About this Study

In his 2012 special message on energy and the environment Governor Rick Snyder acknowledged the low recycling rate in Michigan and committed to creating a plan to improve that rate. In response, the Michigan Department of Environmental Quality (MDEQ) convened a stakeholder workgroup to begin a dialog to advance recycling in Michigan. One finding of that group was a need for more data and information to inform state and local decision makers.

A total of $250,000 in Community Pollution Prevention Grant Program funds were awarded to support three projects to collect data on Michigan's recycling rate. Projects were meant to provide information on the percentage of population with convenient access to recycling, places with high performing recycling programs, information on composition of municipal solid waste currently landfilled and incinerated, and the economic value of this material.

This study provides information and analysis on the composition of municipal solid waste currently landfilled and incinerated in Michigan, and the economic value of this material. Its findings are derived entirely from field studies, verifiable market prices for recycled commodities, and peer-reviewed academic studies.

In May 2014 the Michigan Recycling Coalition introduced the Michigan Recycling Index in its report, *Measuring Recycling in the State of Michigan*, which provided information on the percentage of the population with convenient access to recycling and general information on the performance of the recycling industry. A project of the Northeast Michigan Council of Governments will report further information on high-performing recycling programs, the composition of municipal solid waste and the economic impact of the recycling industry. Consulting firm Resource Recycling Systems is the primary author of both reports.

While it should be taken in context of the other data-gathering projects, this study was produced independently and is not necessarily intended as a complementary document.

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Acknowledgements

The project authors and WMSBF Waste Task Force would like to thank the following waste management professionals for their support of and participation in waste sort events. This project would not have been possible without their involvement.

Kent County Department of Public Works
Joe Elsen
Chris Finkbeiner
Lori Herrington
Cindy Kaiserlan
Keith King
Megan Mooney
Rick Osentoski
Dan Rose
JD Stencil
Nic VanderVinne

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Nancy Mauro
Janine Rachaba
Frank Romel
Jennifer VanDyken
Brad Vander Galien

Muskegon County Public Works
Patrick Carr
Bob Kunnen
Greg Leverence
Frank Smith

We would also like to thank the following individuals for providing information and data to the research team for use in this study.

Russ Boersma - Arrow Waste
Thad Cummings - My Green Michigan
Nick Carlson - Goodwill of Greater Grand Rapids
Michael Csapo - Resource Recovery and Recycling Authority of Southwest Oakland County
Steve Noble - Michigan Department of Environmental Quality
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Tom Turner - Spurt Industries

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EXECUTIVE SUMMARY

The economically practical diversion of otherwise useful solid waste from landfills and incinerators is a nearly universal environmental concern. Recycling is a ubiquitous entry point for sustainability initiatives across all scales, from homes and commercial offices to communities and industry.

In his 2012 special message on energy and the environment Governor Rick Snyder acknowledged the low recycling rate in Michigan and committed to creating a plan to improve that rate. In response, the Michigan Department of Environmental Quality (MDEQ) convened a stakeholder workgroup to begin a dialog to advance recycling in Michigan. One finding of that group was a need for more data and information to inform state and local decision makers.

This study provides information and analysis on the composition of municipal solid waste currently landfilled and incinerated in Michigan, and the economic value of this material. Its findings are derived from field studies, verifiable market prices for recycled commodities, peer-reviewed academic studies and similar reports from other Great Lakes states.

The Michigan Municipal Solid Waste Characterization and Valuation Study performed statistically significant waste sorts at sites regionally and statewide, and through this provided an economic valuation for waste diversion in terms of real material value, job creation, and other positive economic and environmental impacts.

Waste Characterization Sorting Events

Sample loads were sorted by hand into 22 different categories, weighed and returned to the waste stream. All sorting occurred within the tipping area of the landfill, incinerator or transfer station.

Sorting categories were defined in context of waste diversion potential through recycling and composting. As such, material definitions are not universally consistent with all waste data.

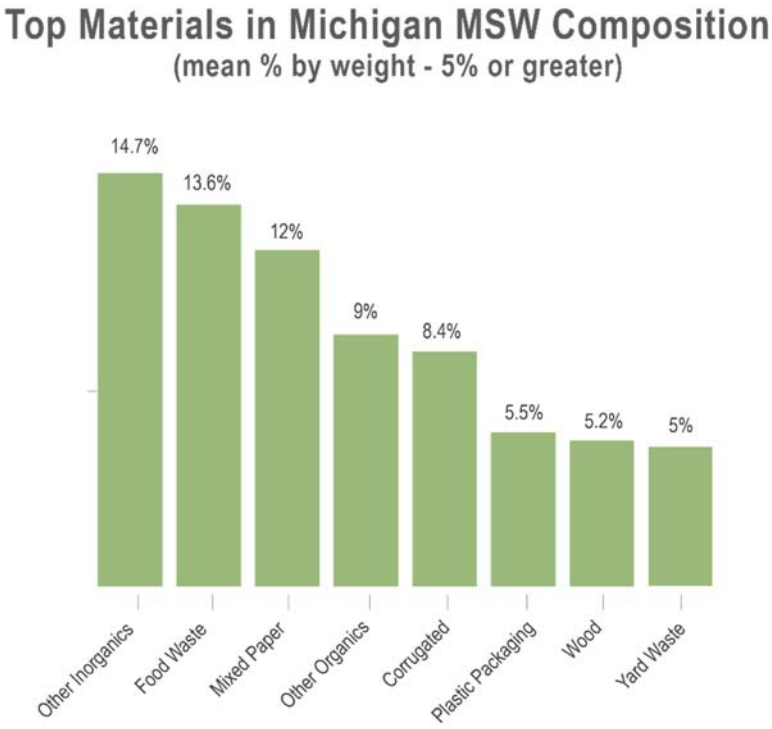
WASTE SORT LOCATION INFORMATION, SCHEDULE AND WEIGHT				
Host Site	Location	Operator	Sort Days	Weight Sorted (lbs)
South Kent Landfill	Byron Center	Kent County DPW	6/3 - 6/4	3,167.23
North Kent Transfer Station	Rockford	Kent County DPW	6/25 - 6/26	2,295.20
Waste to Energy Facility	Grand Rapids	Kent County DPW	6/9	3,088.90
Elk Run Landfill	Onaway	Republic Services	6/11	2,108.40
Central Sanitary Landfill	Pierson	Republic Services	6/23 - 6/24	2,262.90
Muskegon County Solid Waste Management	Ravenna	Muskegon County	5/20 - 5/21	2,886.21
Oakland Heights Development	Auburn Hills	Republic Services	6/16	3,039.75
Ottawa County Farms	Coopersville	Republic Services	5/27	1,785.40

Total Michigan MSW Landfilled and Incinerated

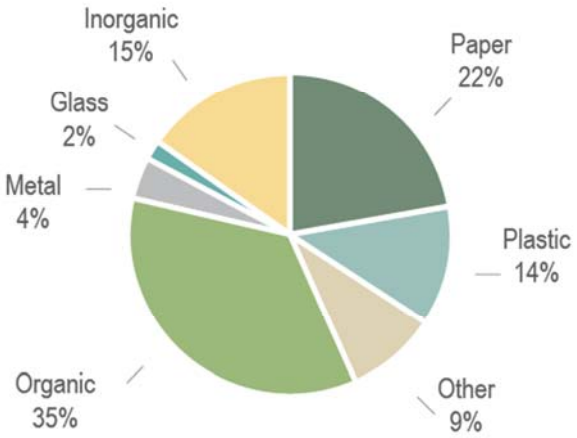
Michigan landfills report received volume to MDEQ on an annual basis. Based on these regulatory fillings there were 7,475,259 tons of MSW landfilled during the 2013-2014 fiscal year that came from Michigan. In addition, the Kent County Waste to Energy Facility in Grand Rapids and the Detroit Renewable Power facility in Detroit incinerated about 1,386,982 tons of MSW during 2014. Between these two sources we estimate the state generates 8,862,241 tons of MSW available for screening for recycling.

Composition Results

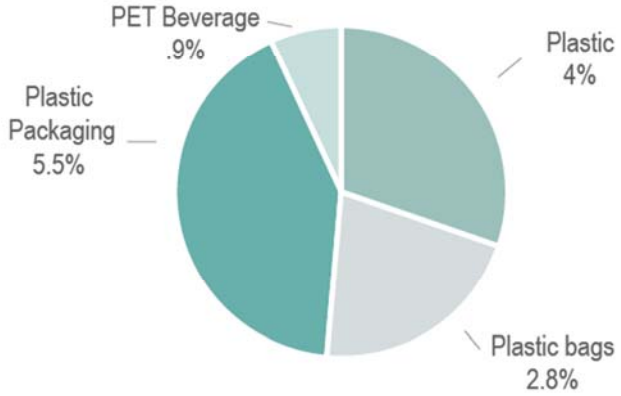
The first objective of this study was to provide an estimate of the statewide aggregate mixed municipal solid waste composition for Michigan. These results are detailed in the following figures:



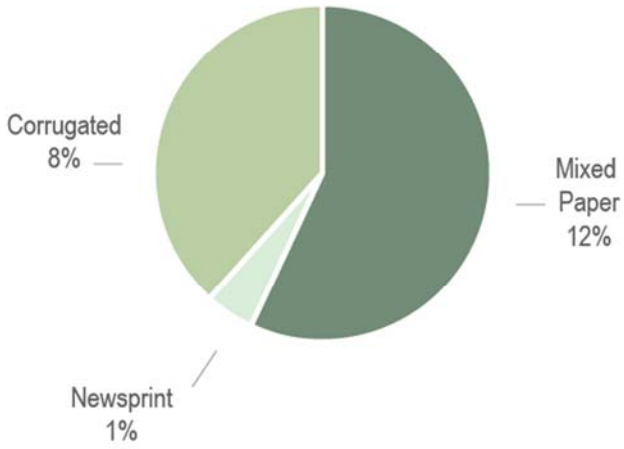
Michigan Municipal Solid Waste Composition
(mean % by weight)



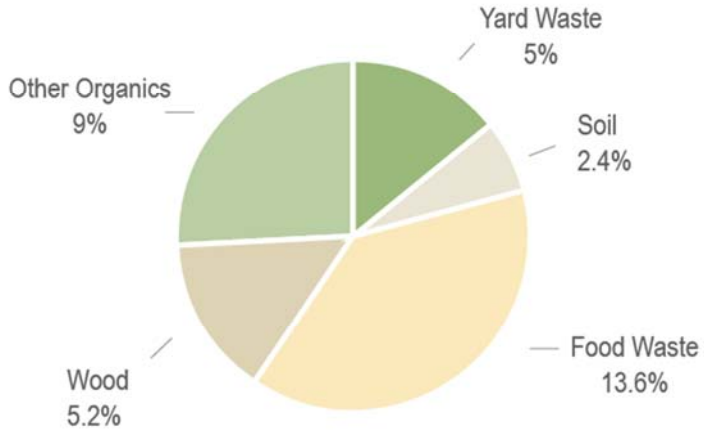
Plastics in Michigan MSW Composition
(mean % by weight)



Paper in Michigan MSW Composition
(mean % by weight)

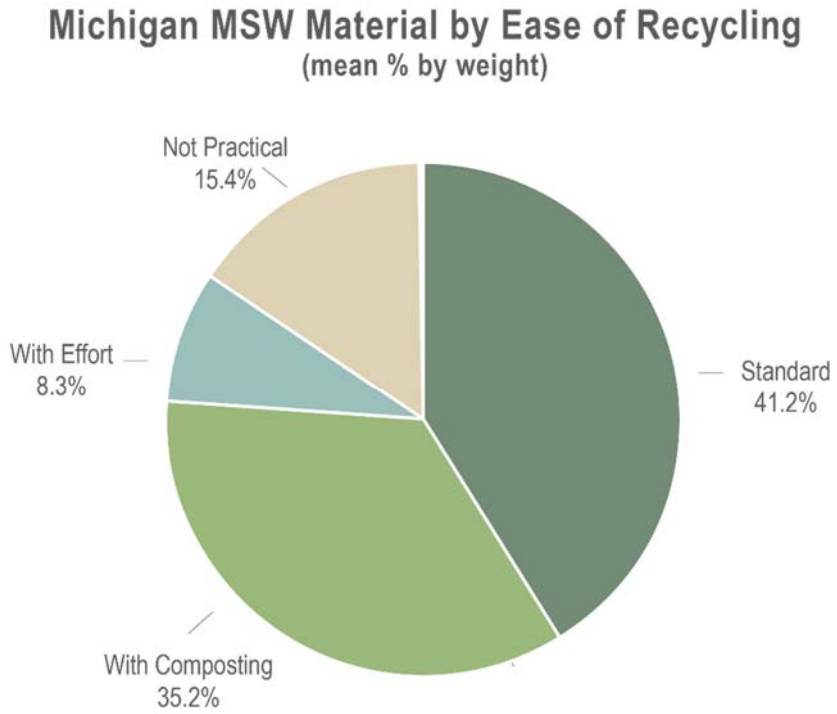


Organics in Michigan MSW Composition
(mean % by weight)



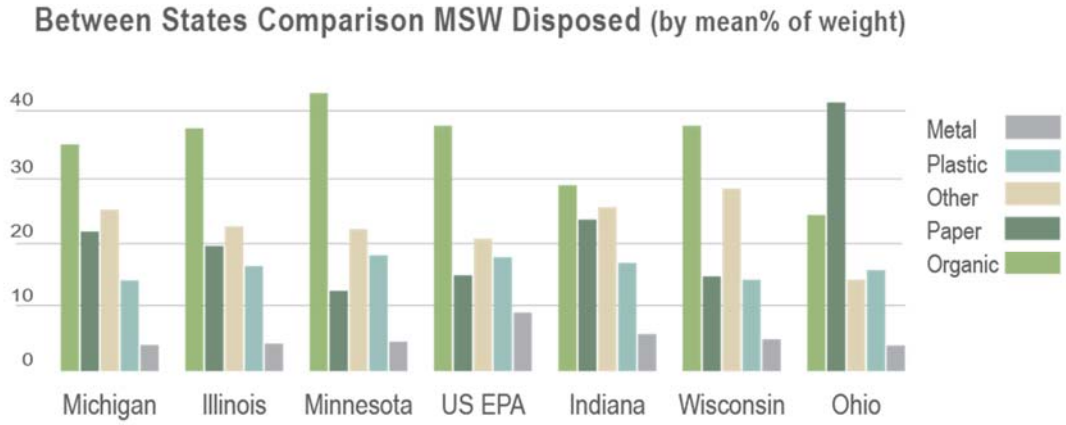
It is clear that the Snyder Administration's goal of doubling the recycling rate is attainable with sufficient time and resources. Most material currently being disposed of through landfills and incinerators could be recycled or composted in most metropolitan communities without great difficulty. As shown in the figure below, a plurality of material can be recycled through any commonly available recycling service (numbered plastic, glass, paper, metal).

An additional 35% could be composted, including food and yard waste, non-recyclable, compostable paper and other miscellaneous organic material. With some effort, most other materials could be recycled in many Michigan communities, including textiles, bulk items, electronic waste, soil, and household hazardous waste.



Comparison with Other Great Lakes States

Michigan is the last of the Great Lakes states to conduct a field study on MSW disposal characterization. In order to quantify potential differences between the state's characterization and that of its neighboring states we have reviewed characterization studies for Illinois (2015), Minnesota (2013), Indiana (2012), Wisconsin (2009) and Ohio (2004). We have also included data from the US EPA's most recent MSW characterization report from 2012, which was not generated from waste sorts. For comparison with the two most recent studies, Illinois reports a 38% recycling rate, Minnesota 68%, whereas Michigan has a 15% recycling rate, according to the Michigan Recycling Index.



- Michigan has a higher percentage of paper material disposed than the high-performing states. Paper is generally believed to be one of the more efficient materials to recycle, so it would be reasonable to assume that improvements would be most achievable in this category, and that high-performing state programs would have a lower percentage of this material than low-performing programs.
- Michigan has a lower percentage of plastic than all of the Great Lakes states. Plastic is generally believed to be more difficult to recycle, so it would be reasonable to assume that high-performing programs would have a higher percentage of material in this category, compared to lower percentages of materials less difficult to recycle.
- Minnesota is the only Great Lakes state with a lower percentage of paper than plastic. It is also the highest performing state, with a stated recycling rate of 68%.
- Michigan has a lower percentage of organic material. Organics are the most plentiful waste and not particularly easy to recycle, so it would be reasonable to assume that a high-performing state would have a higher percentage of material in this category.

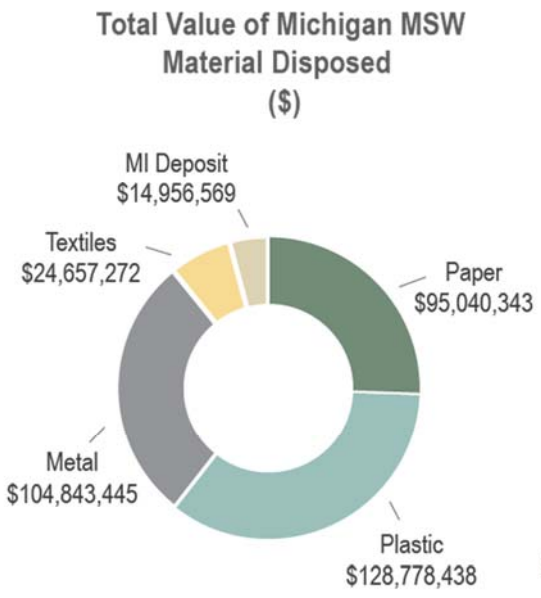
Material Valuation

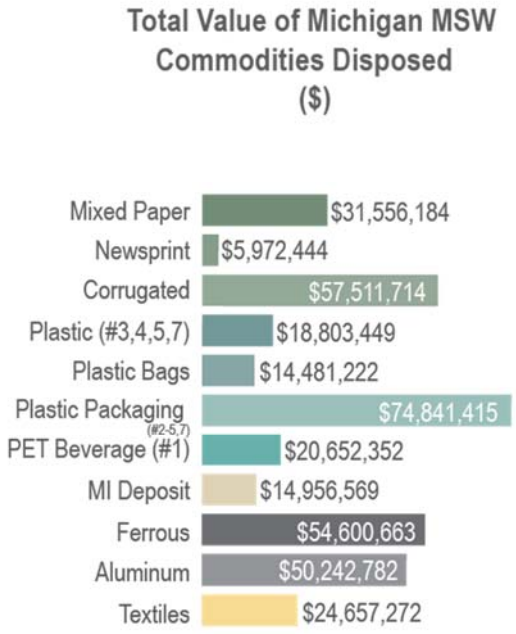
A primary benefit of increased recycling is the economic value found from reclaiming these resources and selling them to the market. We have collected commodity prices for each of our composition categories and calculated the value of the material currently being disposed. Our process for defining material value is simple and straight-forward: What will the market pay for a ton of the material in Michigan?

Only half of the 22 categories analyzed in the characterization have any material value to the market.

MARKET VALUE OF AVAILABLE RECYCLABLES						
Material	Available Quantity	Quality Adjustment	Predicted Low Price	Predicted High Price	Low Price Total Value	High Price Total Value
Mixed Paper	1,019,181	0.9	$33.90	$34.40	$31,098,212	$31,556,184
Newsprint	102,828	0.9	$60.86	$64.54	$5,632,700	$5,972,444
Corrugated	711,169	0.9	$78.23	$89.85	$50,072,698	$57,511,714
Plastic (#3,4,5,7)	346,060	0.9	$42.96	$60.37	$13,379,666	$18,803,449
Plastic Bags	233,975	0.9	$25.79	$68.77	$5,430,458	$14,481,222
Plastic Packaging (#2-5,7)	464,414	0.9	$117.93	$179.06	$49,291,787	$74,841,415
PET Beverage (#1)	79,190	0.9	$237.35	$289.77	$16,916,121	$20,652,352
MI Deposit	24,585	0.9	$622.33	$675.96	$13,769,911	$14,956,569
Ferrous	280,346	0.9	$143.46	$216.40	$36,195,945	$54,600,663
Aluminum	36,132	0.9	$1,437.16	$1,545.02	$46,735,061	$50,242,782
Textiles	308,216	0.8	$100.00	$100.00	$24,657,272	$24,657,272
TOTAL:	8,444,784				$293,179,831	$368,276,066

To account for the contamination of recycled materials and handling in the materials processing facilities we have applied a quality adjustment of 0.9 for all materials except textiles, which was 0.8.





The below summarizes findings for statewide material composition and value, and defines a net recycling value per ton for each material type accounting for indirect benefits and processing costs.

Together this data quantifies characterization of Michigan MSW disposed in landfills and incinerators by aggregate commodity value and as a net impact for recyclers and recycling communities.

MICHIGAN STATEWIDE COMPOSITION (by weight), AVAILABLE MATERIAL VALUATION ($ in millions) AND NET RECYCLING VALUE ($ per ton)

Material	Comp.	Value	Net	Material	Comp.	Value	Net
Paper				Other Wastes			
Mixed	12.07%	$31.6m	$1.81	Textiles	3.65%	$24.7m	$58.10
Newsprint	1.22%	$6.0m	$22.64	Bulk Items	1.20%	0	-41.90
Corrugated	8.42%	$58m	$55.48	Other Inorganics	14.65%	0	-41.90
Subtotal Paper	21.71%	$95.6m	---	*Subtotal Other Wastes*	19.50%	$24.7m	---
Plastic				Organic			
Plastic (#3,4,5,7)	4.10%	$18.9m	$18.48	Food Waste	13.57%	0	-41.90
Plastic Bags	2.77%	$14.5m	$26.87	Yard Waste	5.00%	0	-41.90
Plastic Packaging (#2-5,7)	5.50%	$74.8m	$137.16	Soil	2.36%	0	-41.90
PET Beverage (#1)	0.94%	$20.6m	$247.87	Wood	5.19%	0	-41.90
Polystyrene foam	0.71%	0	-41.90	Other Organics	9.05%	0	-41.90
Subtotal Plastic	14.02%	$128.8m	---	*Subtotal Organic*	35.17%	0	---
Metals				MI Deposits	0.29%	$15m	$673.10
Ferrous	3.32%	$54.6m	$186.62				
Aluminum	0.43%	$50.2m	$1,542.17	Household Hazardous	0.93%	0	-41.90
Subtotal Metals	3.75%	$104.8m	---				
				Electronics	2.49%	0	-41.90
Glass	2.15%	0	---				

Composition: Mean percentage of available material by weight.
Material Value: High percentage of aggregate value of available material according to verifiable commodity prices.
Net Recycling Value: High estimate of value per ton plus indirect benefits, minus processing costs.

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Ideally, efforts to promote recycling or composting improvements would prioritize those with the highest composition and net recycling value.

While there is an environmental or social case for promoting recovery of all MSW materials, there is no economic value in recovering many materials based on current economic conditions.

We should highlight emphatically that the material values used in this report are volatile and prone to change. At the time we conducted our research commodity prices were experiencing sharp declines. The situation will hopefully improve over time.

Due largely to the presence of HDPE plastic, plastic packaging would offer the most aggregate material value to the state. This is followed by corrugated cardboard, ferrous metal, aluminum and textiles, then all other materials.

One material exemplifies a high-value, high-quantity scenario: corrugated cardboard. Though not as prominent, textiles and plastic packaging offer a similar opportunity, though the latter is likely overstated due to the comingling of HDPE with lesser value plastic resins.

Mixed paper is also unique in that it has the largest quantity of available material among any category with a market value. Though it is the lowest value per ton of any of the valuable materials, its large quantity would suggest it is "low-hanging fruit" for diversion improvements.

Employment Impact

Increasing recycling will create jobs in Michigan. The value of recyclable materials diverted from landfills and incinerators to markets will eventually end up with households through increased employment and profits by waste haulers and recycling processors, and also through purchases of goods and services to support these businesses.

Since very little virgin material (particularly plastics and metals) is extracted in Michigan, we assume all of the revenues from the sale of recyclables can be counted as new household spending. Using RIMS multipliers for Kent County from 2006 (adjusting the jobs multiplier per million dollars by inflation since 2006), we find extracting recycling from the MSW stream would create between 2,085 and 2,619 full time equivalent jobs in Michigan with a total effect of between $317 and $399 million dollars.

EMPLOYMENT AND TOTAL FINANCIAL EFFECT OF INCREASED RECYCLING				
Value Reclaimed	Jobs Multiplier	Jobs Created	Total Effect Multiplier	Total Effect
$293,179,831	7.11	2,085	1.08	$317,425,804
$368,276,066	7.11	2,619	1.08	$398,732,497

We estimate total material value of Michigan MSW disposed in landfills and incinerators of as much as $368 million. If all of this material was recovered and sold to the market it would have an estimated total economic impact of up to $399 million.

Recommendations

Efforts to increase the recycling rate in Michigan should first focus on the 42% of materials that have market value, which would include all standard recyclable commodities but glass, plus textiles.

We argue that doubling the recycling rate itself is an arbitrary goal, albeit a worthwhile motivational tool. A potentially better metric would be the percentage of material of value in the waste stream, with a goal of reducing this to zero.

Keeping to the stated goal of doubling the Michigan recycling rate to 30%, our findings do provide a rough outline for how that might be best achieved. In total, the state must increase the quantity of diverted material by approximately 1.5 million tons per year through a combination of recovery and source reduction.

1. **Aggressively promote efforts to increase recovery of corrugated cardboard, prioritizing commercial audiences.** This is an ideal opportunity and should be considered "low-hanging fruit." Corrugated cardboard is among the state's highest volume materials. It is perhaps the easiest material to recycle, and boasts a net recycling value of $55 per ton, the highest return among high-volume material. The market for the material is well-developed and not likely to experience any significant technological or market upheavals in the foreseeable future.

2. **Support efforts to increase availability and usage of conventional recycling programs with a goal to increase recovery of non-corrugated paper products, metal, and high-value plastic resins HDPE and PET.** As demonstrated in the economic analysis section, there are a limited number of recyclable commodities that can be recycled without subsidy, and fewer still in high demand. Efforts to increase recycling in Michigan should prioritize diverting materials of value from the waste stream.

3. **Through recovery or source reduction, decrease the quantity of electronic waste disposed of in Michigan landfills by half.** As a percentage of MSW, Michigan disposes twice the amount of electronic waste as any of its neighboring states. This would represent a dramatic improvement, considering that the state currently recycles just 9% of electronic waste. A landfill ban could potentially achieve this.

4. **Promote source reduction and diversion of food waste.** Food waste is the most prevalent material found in Michigan MSW. It is a prime candidate for source reduction, which could be achieved through commercial efficiencies or consumer behavior change. As an alternative, feeding the hungry is a universally positive diversion opportunity. Composting, agriculture and renewable energy also offer diversion opportunities for consideration.

5. **Promote source reduction of low-value plastic resins.** Michigan recycles 5% of plastic volumes currently, and it seems likely that the highest concentration of that is occurring with high-value, easy-to-recycle materials such as PET and HDPE. Low-value resins are notoriously difficult to recycle due to logistical and financial challenges, which limits the potential

effectiveness of efforts to improve recycling of those commodities. From a quantity standpoint, if the state were to quadruple its plastic recycling performance it would only increase the state's recycling rate by a few percentage points.

Strategies intended to promote packaging efficiency, reusable products and other source reduction tactics could have a more noticeable impact on Michigan's MSW characterization and recycling rate.

As an alternative, the state might pursue game-changing market development activities.

6. **Initiate efforts to increase recycling channels for textiles and promote availability of textile recycling.** Though a minor impact in terms of aggregate recycling rate, this would have a significant impact on the total value of materials recovered. This opportunity deserves greater attention than what it is currently receiving. There is also clear potential for improvement: Michigan's textile recycling rate (9%) is half that of Illinois (20%).

7. **Educate the public on the financial difficulties of recycling and waste diversion.** The majority of MSW disposed in Michigan landfills and incinerators has no market value as an unprocessed commodity.

8. **Pursue opportunities for further study highlighted in this report.**

    - Performance of yard waste ban in context of high-concentration of non-banned materials that would be classified as yard waste.

    - Recovery rate of deposited containers in context of discrepancies suggested in this report between number of deposited containers being disposed and recovered.

    - Repeat characterization study within three to five years. The results reported in this study represent a baseline, the state's first derived from field study and verifiable commodity prices. A repeat study will allow for the visualization of improvements over time, both in recycling performance and in economic conditions. That is when the full value of this activity will be realized, and a timely opportunity given groundswell of efforts to increase recycling in Michigan in the near future.

1-1: INTRODUCTION

The economically practical diversion of otherwise useful solid waste from landfills and incinerators is a universal environmental concern in the state. Recycling is a ubiquitous entry point for sustainability initiatives across all scales, from homes and commercial offices to communities and industry. Even private enterprises that profit from landfill volumes recognize the value of diversion and are actively engaged in developing programs to monetize such efforts. The environmental and economic value of recycling in Michigan has been well documented and consistently affirmed.

However, there is limited data available on the composition of solid waste for decision makers to evaluate the impact of recycling programs or the feasibility of public or private investments in new or expanded capacity. In West Michigan, administrators of recycling and composting programs are seeking waste characterization data to enhance educational programming and promotions to consumers and commercial enterprises, for evaluation, and for strategic decision making. It could prove critical in providing a business case support for strategic growth and access to capital, particularly for those in emerging fields such as composting and electronics recycling. In Muskegon, such data would help inform feasibility for a major potential public infrastructure investment.

In general, local and state decision makers require a characterization benchmark to determine the value of potential new and expanded recycling streams, performance of programs, and the environmental and economic costs of solid waste. Private-industry sustainability professionals and recyclers desire this knowledge to better communicate and support the value of landfill avoidance efforts. It is particularly relevant at this time given the Snyder administration's stated goal of increasing the recycling rate to 30% by 2016, as characterization data would help inform investments toward that goal.

A statewide waste characterization study has never been performed in Michigan using statistically significant waste sorts at landfills, transfer stations and/or incinerators. Nor has a regional study been performed in West Michigan. Further, existing estimates concerning the potential economic value of materials currently being landfilled or incinerated are not based on characterization or actual market values of recycled commodities. There is opportunity to provide decision-makers and recycling advocates a more accurate value.

The Michigan Municipal Solid Waste Characterization and Valuation Study performed statistically significant waste sorts at sites regionally and statewide, and through this provided an economic valuation for divergence in terms of real material value, job creation, and other positive economic and environmental impacts.

The following details the results of that initiative according to its five objectives:

- Determine composition of Michigan MSW now being disposed of in landfills and incinerators
- Compare the composition of Michigan's MSW to the MSW waste of other Midwest states
- Complete an economic analysis of MSW composition
- Complete an assessment of hazardous waste concerns for electronic materials sent to landfill
- Complete an evaluation of West Michigan composition and local concerns

1-2 DEFINITIONS

Confidence intervals – The lower and upper confidence intervals indicate the likelihood that the population mean falls close to the sample mean as defined by the standard. For comparison with other studies, and in accordance with industry standards, the lower and upper bounds throughout this report have been calculated at a 90 percent level of confidence. The 90 percent confidence intervals define the upper and lower bounds for which we can be 90 percent confident that the particular material category's mean value will fall. If the confidence intervals are "wide" for a material category, it means there was greater variability of that material between samples.

Municipal Solid Waste – more commonly known as trash or garbage, consists of everyday items we use and then throw away, such as product packaging, yard waste, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. This comes from our homes, schools, hospitals, and businesses. In its annual solid waste report the MDEQ refers to this waste stream as Municipal and Commercial Waste. For purposes of this study, we will treat the two terms as synonyms. Abbreviated as MSW.

Mean – The mean is calculated as the average composition of each material category (or primary material category) expressed as a percentage of the total amount of material within that sample set.

MSW Characterization – evaluation of the composition and quantity of material in MSW.

Standard Deviation – measure of dispersion in a frequency distribution, equal to the square root of the mean of the squares of the deviations from the arithmetic mean of the distribution.

Z Score – a statistical measurement of a score's relationship to the mean in a group of scores. A Z-score of 0 means the score is the same as the mean. A Z-score can be positive or negative, indicating whether it is above or below the mean and by how many standard deviations.

1-3 MICHIGAN MUNICIPAL SOLID WASTE

Michigan landfills report received volume to MDEQ on annual basis. Based on these regulatory fillings there were 7,475,259 tons of MSW landfilled during the 2013-2014 fiscal year that came from Michigan. Between the Kent County Waste to Energy Facility in Grand Rapids and the Detroit Renewable Power facility in Detroit there were about 1,386,982 tons of MSW incinerated during 2014 (reported as 182,482 tons per year and 3,300 tons per day, respectively).

The landfill estimates omit incinerator ash (including it would double count that material as available for recycling), MSW imported from other states (it would be difficult to screen for recyclables and likely already has been), and MSW exported to other states (the number is not available). The two incinerators do not process out-of-state MSW.

Between these two sources we estimate the state generates 8,862,241 tons of MSW available for screening for recycling. MDEQ has previously published an estimate of 8,026,443 tons of landfilled and incinerated MSW, which is the number that appears in the 2015 Michigan Recycling Index report. In the valuation analysis in Section 4 we use an aggregate of these two numbers.

TABLE 1-1
MICHIGAN LANDFILL SOLID WASTE DISPOSAL SUMMARY

Waste Type	Municipal Solid Waste	Incinerator Ash	Industrial Waste	Construction & Demolition	Total
By Volume in Cubic Yards	22,425,777	44,825	9,413,457	4,510,264	36,394,323
Est. by Weight in Tons	7,475,259	14,942	3,137,819	1,503,421	12,131,441
% of Total	66%	0.1%	23%	11%	---

Source: MDEQ Solid Waste Annual Report for FY 2014

Michigan landfills report volumes received in cubic yards. To aid in comparing other states' waste to Michigan's, the MDEQ uses a simple conversion of 3 cubic yards equals 1 ton of waste. For the purposes of simplicity and consistency we have followed this precedent.

TABLE 1-2
MICHIGAN MUNICIPAL SOLID WASTE DISPOSED ORIGIN
(by weight in tons)

Incinerator	Landfill	Total
1,386,982	7,475,259	8,862,241

As will be highlighted in the characterization and valuation discussions later in this report, it is important to note that approximately 16% of Michigan's MSW is processed through incineration, as that does impact projections for the amount of available material to be recycled. At both facilities, ferrous metals are reclaimed from incinerator ash in significant volumes.

1-4 STUDY DESIGN

The project consisted of two major research tasks: characterization and valuation. The characterization included waste sorts at eight sites throughout Michigan, six of those split between four West Michigan counties, and two further afield in Northern and Southeast Michigan. Civil engineering firm Fishbeck, Thompson, Carr & Huber was contracted to develop a sorting protocol and safety guidelines, which would be based primarily on the methodology detailed in the professional standard ASTM D5231-92 (2008) Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste.

MDEQ personnel consulted on applicable regulations for municipal solid waste, while the WMSBF Waste Task Force provided guidance on various process decisions. The protocol can be found after the report in Appendix B. Multiple amendments were made to the protocol in field as questions and concerns emerged. These are also documented in Appendix B.

Sort Size and Selection

Per the standard, a governing component was used to determine the number of random samples necessary to achieve the desired precision level. This is described further in Appendix A. Due to its historical and demographic consistency, corrugated cardboard was selected as the governing component, requiring 10 samples per site.

At the beginning of each sorting day three to 10 compactor trucks were chosen via a random number generator. For instance, if the goal for the day was to sort three trucks and the number generator pulled 1, 7, and 15, then the first, seventh and fifteenth trucks would be sampled. One sorting sample of approximately 300 lbs was taken from each vehicle selected. Samples were taken via front loader, selected from a quadrant of the load pile by a coin-flip methodology that varied slightly as a function of load size.

Qualifying vehicles were compactor trucks serving residential or commercial route customers. Drivers were queried by research staff on the communities they served and the type of load. Site staff recorded truck weights. Detailed truck information can be found in Appendix A.

Host sites were volunteered from representative operators on the WMSBF Solid Waste Task Force.

Seasonality and Timing

Characterization studies of similar states have concluded that seasonal differences in the composition of the MSW stream are not statistically significant. Historically, the most seasonably variable material in the MSW stream is yard waste, and because Michigan has comprehensive yard waste collection and diversion programs in place, backed by a ban on certain yard wastes such as yard clippings, the extent of seasonal differences in the MSW composition is estimated to be minimal. As a result, all sampling and sorting was conducted in the summer of 2015, as opposed to collecting data at various times throughout the year.

In scheduling the sorts, we were careful to avoid days in which waste composition or volume was likely to deviate from typical occurrence. All sorts were done on non-holiday weekdays. One sort occurred mid-week during a week that included a holiday (Ottawa Farms: Memorial Day). The table below depicts the schedule and quantities of mixed municipal solid waste sorted at each of the host sites.

TABLE 1-3:
WASTE SORT LOCATION INFORMATION, SCHEDULE AND WEIGHT

Host Site	Location	Operator	Urban/Rural	Sort Days	Weight Sorted(lbs)
South Kent Landfill	Byron Center	Kent County DPW	Mixed	6/3 - 6/4	3,167.23
North Kent Transfer Station	Rockford	Kent County DPW	Mixed	6/25 - 6/26	2,295.20
Waste to Energy Facility	Grand Rapids	Kent County DPW	Urban	6/9	3,088.90
Elk Run Landfill	Onaway	Republic Services	Rural	6/11	2,108.40
Central Sanitary Landfill	Pierson	Republic Services	Rural	6/23 - 6/24	2,262.90
Muskegon County Solid Waste Management	Ravenna	Muskegon County	Mixed	5/20 - 5/21	2,886.21
Oakland Heights Development	Auburn Hills	Republic Services	Mixed	6/16	3,039.75
Ottawa County Farms	Coopersville	Republic Services	Mixed	5/27	1,785.40

Sorting Methodology

Sample loads were sorted by hand into 22 different categories (Table 1-4), weighed and returned to the waste stream. All sorting occurred within the tipping area of the landfill, incinerator or transfer station. Scavenging rules and impracticality prevented recycling of sampled materials.

Sorting categories were defined in context of waste diversion potential through recycling and composting. As such, material definitions are not universally consistent with waste data provided in other studies. For instance, the U.S. Environmental Protection Agency and certain state reports would classify soiled napkins as paper. Given that this material is not recycled as a paper product through any recycler in Michigan, but could be composted, we have classified it as "Other Organic." A handful of other such variations exist, and are discussed further in Section 2.

When calculating its MSW disposal reports, the EPA distinguishes between material and product, which allows for a neater classification of problem materials. Those reports are generated from market data and regulatory filings, not in-field waste sorts. The ASTM standard for waste sorts does not distinguish between materials and products.

Several adjustments were made to category definitions and the sorting process in the field as unanticipated situations emerged. The vast majority of these concerned the discovery of materials that challenged existing definitions. Some of the more prominent examples included cigarette butts, dirt, house plants, and textiles. Two categories were added on the second day of the first sort: textiles and soil.

Sorter Staffing

Waste sort teams were comprised of students and recent graduates from WMSBF member colleges and universities. Six research fellows were hired for a two-month period from May to June 2015. This core group was supplemented by day laborers, host-site employees and WMSBF staff members as available and necessary. Research fellows also supported WMSBF project supervisors with logistical preparations. Staff from FTCH was also on-site for four of the eight sort events.

All sorters and supervisors received a safety orientation for the project protocol, and another orientation for each individual site. No volunteers were used.

TABLE 1-4: MATERIAL CATEGORY DEFINITIONS	
Paper	
Mixed	Paper that would be included in residential "mixed mail", magazines/catalogs, phonebooks, office paper, glossy paper, and boxboard (uncoated box board primarily used for boxes) such as cereal boxes.
Newsprint	Printed ground wood newsprint.
Corrugated	Cardboard with a wavy core and not contaminated with other materials such as wax or plastic coating.
Plastic	
Plastic (#3,4,5,7)	Any plastic with the 3, 4, 5 or 7 # label that includes everything except packaging. Miscellaneous plastic that could not be excluded from the above categories on visual inspection.
Plastic Bags	Plastic bags, grocery bags, garbage bags and other film plastic in bag form, but not stretch wrapping and shrink wrap.
Plastic Packaging (#2-7)	Any non-foam plastic with 2,3,4,5, 6 or 7 # label that was used as product packaging.
PET Beverage (#1)	Clear and colored plastic beverage containers composed of polyethylene terephthalate. Key point: Look for the label "1" on the bottom.
Polystyrene foam	#6 plastic foam, packaging or otherwise
Metals	
Ferrous	All other ferrous metals not containing aluminum such as iron or steel Examples: clothes hangers, sheet metal products, pipes, metal scraps.
Aluminum	Any non-ferrous metal containing the element aluminum that does not include a Michigan deposit.
Organic	
Food Waste	Food preparation waste, food scraps, spoiled food, kitchen wastes, liquid food wastes, waste parts from butchered animals.
Yard Waste	Woody and non-woody plant material, plus loose dirt and gravel. Examples: grass, leaves, weeds, cut flowers, twigs, brush, fine mix, and branches
Soil	A black or dark brown material typically consisting of a mixture of organic remains, clay, and rock particles. For the purposes of this study, fill dirt only.
Wood	Treated and untreated lumber and other wood products
Other Organics	Any organic material not classified by any other category, including cotton balls, soiled paper, hair, kitty litter, paperboard egg cartons, compostable plastics, house plants, dead animals not killed for food, etc.
Other Wastes	
Textiles	Clothing, bedding, curtains, blankets, other cloth material
Bulk Items	Examples: Large pieces of furniture, bed frames, fitness equipment, and mattresses
Other Inorganics	Any other inorganic material that could not be placed into any other sort category.
Glass	Any glass or glass container that is not a MI Deposit.
MI Deposits	Beer, soft drinks, wine coolers, canned cocktails labeled with the MI Deposit on the back worth $0.10 per deposit in Michigan.
Household Hazardous	Products characterized as toxic, corrosive, flammable, ignitable, radioactive, poisonous, or reactive. (e.g. solvents, pesticides, antifreeze, batteries)
Electronics	Products or appliances with electric cord or battery power source Examples: Toasters, Hairdryers, Laptops, Computer Monitors, Televisions, Printers, cell phones, DVD Players, "White Goods," etc.

Data Analysis

Findings from each site were entered into a statistical model defined by the standard and refined by FTCH. The model calculates the mean and the 90% confidence intervals for individual material categories for each sorting event and in the aggregate.

The mean represents the mathematical average or average percent of material composing the MSW stream by weight. The confidence interval is an expression of accuracy. It provides the upper and lower limits of the "actual" mean for all the MSW received at the participating facility based upon the sorting and sampling observations of the sampled materials. For example, the 90% confidence interval represents that there is a 90% level of confidence that the true population mean falls within the upper and lower bounds of the confidence interval. The 90% confidence interval is the generally accepted industry standard for solid waste composition studies. In general, the more samples that are sorted, the narrower the confidence interval becomes for a given level of confidence. Given our sample sizes, narrower confidence intervals indicate less variability in the data.

The statewide composition is a function of the means of the eight sites. Adjustments were not made to manipulate the data according to demographic differences, such as weighting the sites by population or their percentage contributions to total Michigan MSW. A transcription error caused one sample to be omitted from statewide calculations (South Kent Sample 7).

There are several factors that may influence the actual potential for diversion:

- By definition, all MSW is contaminated from a recycling perspective. We have assumed that all recyclable materials would be diverted in a clean and dry state. It is reasonable to assume that if this material is diverted its value would be impacted by contamination to the same extent or more as material currently being recycled.
- Though we have tried to separate food waste from its packaging, and vice versa, this could not be done with precision in the field. There exists the possibility that weights for recyclable packaging may be overstated slightly by the presence of material that would be washed away if the product were recycled.
- In limited instances, packaging was sorted into food waste when it would have been impractical to separate the two in field, such as unopened canned goods. In these situations, packaging weights would have been understated, while food waste was overstated.
- Materials were sorted by their ability to be recycled in the state that they were disposed. Items containing recyclable material requiring significant disassembly to be recycled were classified as Non-Recyclable Inorganic Waste, or Bulk Items, whichever was appropriate.
- Fine soil mixes and dirt proved the most challenging material to classify. With the exception of loads containing obvious fill dirt, which was classified as Soil, and dirt from the landfill, which was excluded, it was not possible to identify the origin of dirt and dirt-like material. Given that it most often occurred in conjunction with Yard Waste, it was most often included in that category, but this was unfortunately not done in a consistent manner. As such, this may have overstated weights for Yard Waste.
- Coffee grounds were classified as Other Organic through a decision in the field, as opposed to Food Waste.

1-5 PHOTO REFERENCE

2-1 COMPOSITION RESULTS

The first objective of this study was to provide an estimate of the statewide aggregate mixed municipal solid waste composition for Michigan. These results are detailed in the following table:

TABLE 2-1:
MICHIGAN STATEWIDE AGGREGATE COMPOSITION
(mean % by weight)

		Conf Int. (90%)				Conf Int. (90%)	
Material	Mean	Lower	Upper	Material	Mean	Lower	Upper
Paper				Other Wastes			
Mixed	12.07%	10.98%	13.16%	Textiles	3.65%	2.98%	4.32%
Newsprint	1.22%	0.93%	1.50%	Bulk Items	1.20%	0.33%	2.06%
Corrugated	8.42%	7.17%	9.67%	Other Inorganics	14.65%	12.64%	16.67%
Subtotal Paper	21.71%	19.08%	24.33%	*Subtotal Other Wastes*	19.50%	15.95%	23.05%
Plastic				Organic			
Plastic (#3,4,5,7)	4.10%	3.44%	4.75%	Food Waste	13.57%	11.97%	15.17%
Plastic Bags	2.77%	2.45%	3.10%	Yard Waste	5.00%	3.59%	6.41%
Plastic Packaging (#2-5,7)	5.50%	4.92%	6.08%	Soil	2.36%	0.63%	4.09%
PET Beverage (#1)	0.94%	0.82%	1.05%	Wood	5.19%	3.73%	6.65%
Polystyrene	0.71%	0.61%	0.81%	Other Organics	9.05%	8.00%	10.11%
Subtotal Plastic	14.02%	12.24%	15.79%	*Subtotal Organic*	35.17%	27.92%	42.43%
Metals				MI Deposits	0.29%	0.21%	0.37%
Ferrous	3.32%	2.70%	3.94%				
Aluminum	0.43%	0.34%	0.51%	Household Hazardous	0.93%	0.49%	1.36%
Subtotal Metals	3.75%	3.04%	4.45%				
				Electronics	2.49%	1.53%	3.46%
Glass	2.15%	1.75%	2.56%				

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Composition tables for each of the eight host sites can be found in Appendix A.

The figures below show the major category composition for mixed municipal solid waste in Michigan.

FIGURE 2-1
Michigan Municipal Solid Waste Composition
(mean % by weight)

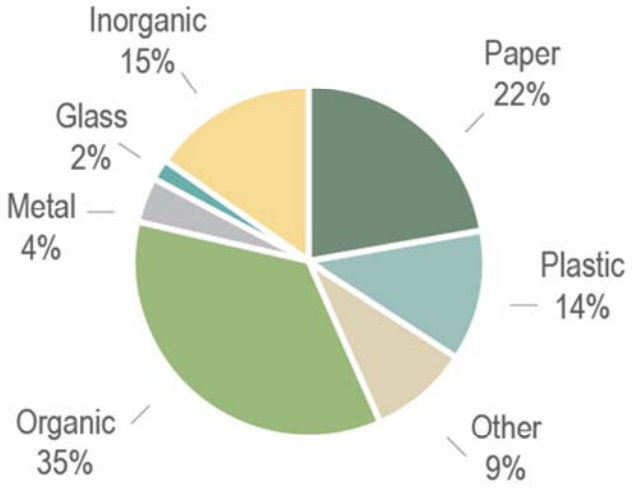


FIGURE 2-2
Top Materials in Michigan MSW Composition
(mean % by weight - 5% or greater)

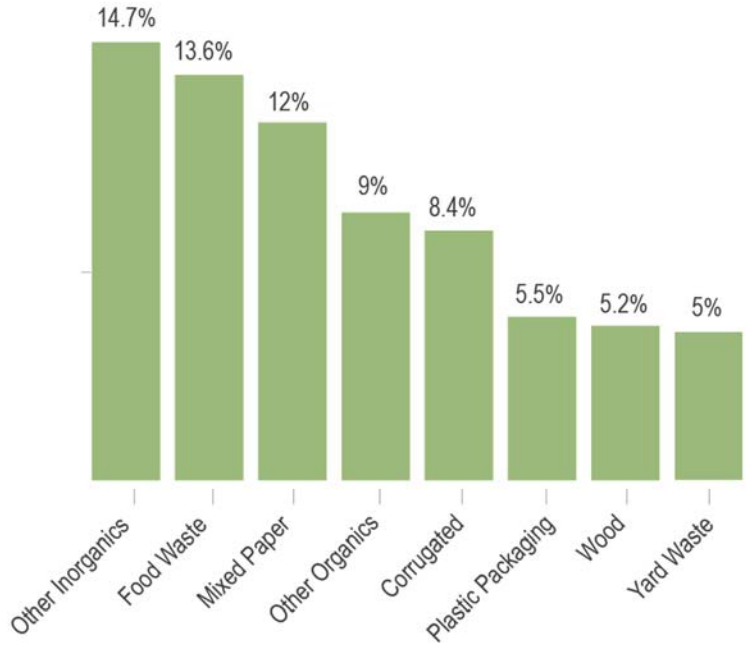


FIGURE 2-1
Michigan Municipal Solid Waste Composition
(mean % by weight)

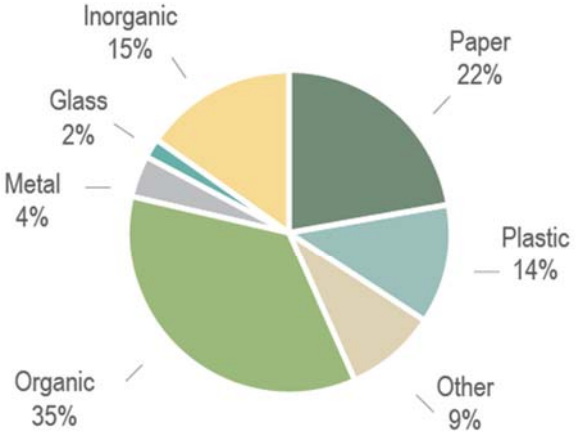


FIGURE 2-3
Plastics in Michigan MSW Composition
(mean % by weight)

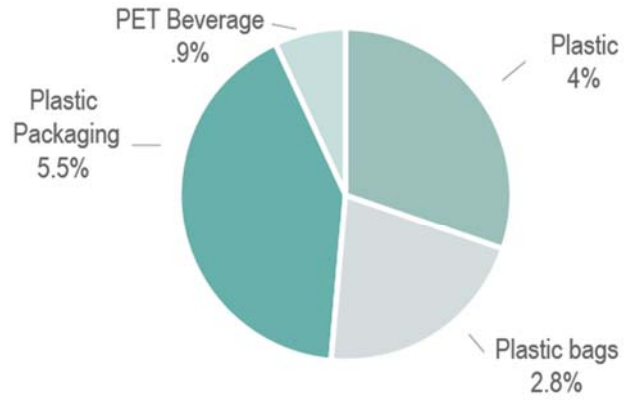


FIGURE 2-4
Paper in Michigan MSW Composition
(mean % by weight)

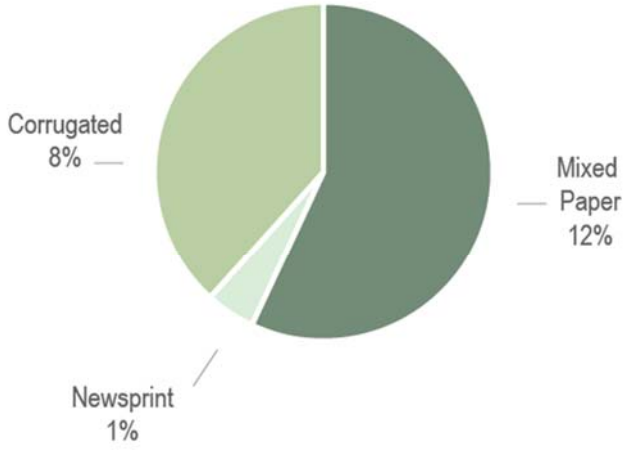
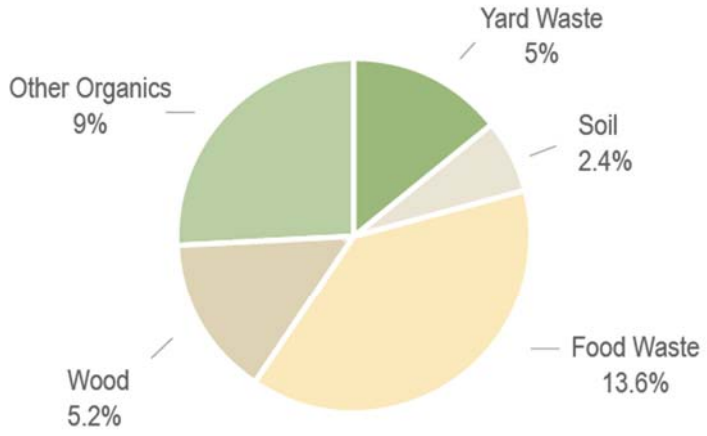


FIGURE 2-5
Organics in Michigan MSW Composition
(mean % by weight)



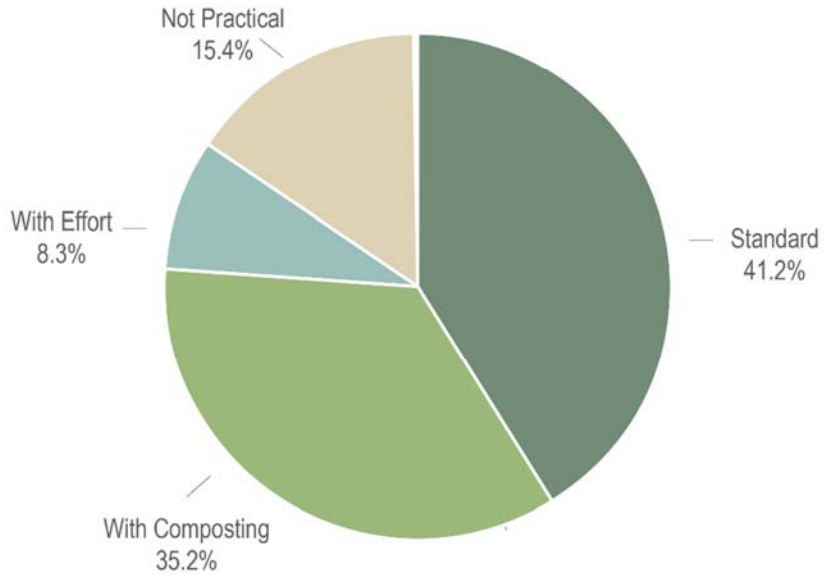
2-2 COMPOSITION FINDINGS

Several valuable insights were revealed through the composition analysis. Perhaps most importantly, it became clear that the Snyder Administration's goal of doubling the recycling rate is attainable with sufficient time and resources. Most material currently being disposed of through landfills and incinerators could be recycled or composted in most metropolitan communities without great difficulty. As shown in Figure 2-6, a plurality of material can be recycled through any commonly available recycling service (glass, paper, metal, most plastic). An additional 35% could be composted, including compostable paper, food waste, soil, wood and yard waste. With some effort, most other materials could be recycled in many Michigan communities, including textiles, bulk items/furniture, soil, and household hazardous waste.

FIGURE 2-6

Michigan MSW Material by Ease of Recycling

(mean % by weight)



Only 15.4% of Michigan waste is impractical or extremely difficult to recycle, including those materials that require special effort for disassembly and that lack opportunities for recycling: polystyrene foam and miscellaneous inorganic waste. Polystyrene foam will be discussed in greater depth in Section 5. A portion of inorganic waste could be recycled through extraordinary disassembly, or niche services such as Terracycle, which allows consumers to mail-in miscellaneous consumer products and packaging, which we do not believe are reasonable expectations for the average consumer or business.

Considerations: Yard Waste

Given the state's landfill ban on yard clippings, we had not expected to find that it represented 5% of Michigan MSW. This is particularly alarming when taken in context of the Michigan Recycling Index, which would suggest that less yard waste was being recycled than was being disposed (422,103 tons of yard waste disposed vs. 378,000 tons organic waste recycled), but the results are deceptive.

This study should not be used to validate or invalidate arguments for or against the state's landfill ban. While there were certainly banned wastes observed in sort samples, these were generally considered in de minimis. The majority of material classified as yard waste would not have fit the definition of a banned waste under the law. Among other material, this would have included fine soil mixes and dirt that were difficult to distinguish from plant material. Obvious fill dirt was counted in a separate category after experiencing larger than expected volumes during the first sort event, a change made out of consideration for how a large percentage of yard waste would be perceived in context of the yard clippings ban.

As it was well understood that yard waste would not have an impact on the economic value of recyclable material, limited adjustments were made to the study methodology to create a consistent and usable protocol regarding the measurement of yard waste. An evaluation on the effectiveness of the ban or state of yard waste diversion was not an objective of this project. It is an opportunity for further study.

Considerations: Ferrous Metal Reclaimed from Incinerator Ash

Approximately 16% of Michigan's MSW is processed through the state's two waste-to-energy facilities. Ferrous metals are reclaimed from incinerator ash in significant volumes between the two some 39,000 tons at Detroit Renewable Power and 3,153 tons at Kent County Waste to Energy. These quantities are in line with our composition expectations for the quantity of ferrous metal that would be found in MSW material disposed of at Michigan incinerators.

Given this, it becomes necessary to define what constitutes disposal of Michigan MSW. For the purposes of determining characterization we have chosen to count all materials that arrive on the tipping floor as part of composition and quantity, which is consistent to MDEQ regulatory definitions and facility scavenging rules. Regardless, these quantities would not have a meaningful impact on the statewide composition, though it could have a meaningful impact on valuation, which will be discussed in Section 4.

Considerations: Deposit Containers

For our purposes, we have separated beverage containers redeemable for a $0.10 deposit-return in Michigan from the containers' material composition (aluminum, glass, plastic). This is discussed further in Section 5.

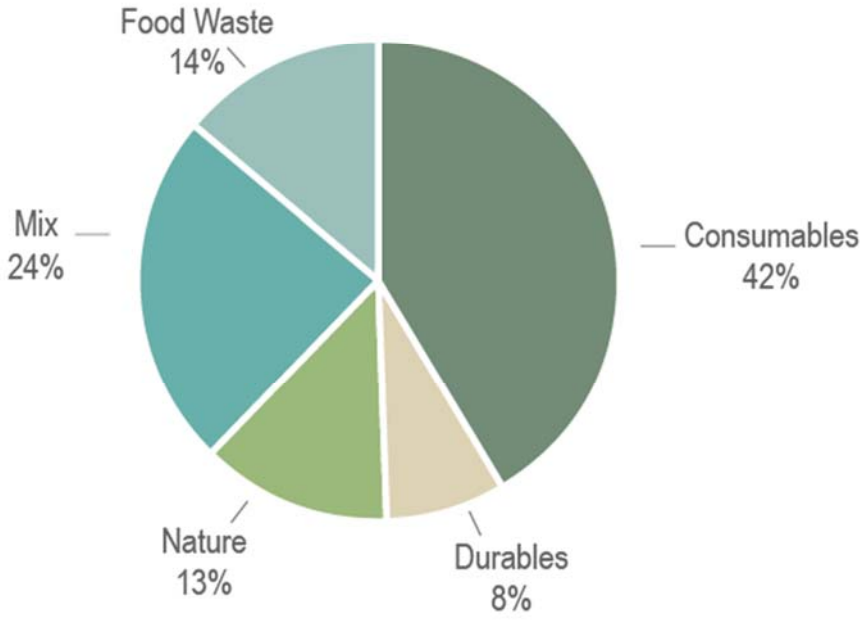
Consumables and Non-Durable Product Materials

The majority of disposed MSW material is generated from single or limited-use product purchases and activities. The figure below describes the composition of disposed MSW generated by product.

Our methodology did not allow us to define this with the same level of precision found in EPA MSW estimates, as several material categories contained a mix of durable and nondurable goods. Results are consistent with recent EPA estimates that 50.5% of MSW generation is from nondurable goods, containers and packaging, plus 14.5% from food waste.

Strategies intended to promote packaging efficiency and reusable products could have a noteworthy impact on Michigan's MSW characterization and recycling rate.

FIGURE 2-7
Michigan MSW Generation by Product
(mean % by weight)



Commercial and Residential Composition

The following tables define composition of statewide MSW disposed by commercial or residential generation. Study samples were split approximately evenly between commercial (29), residential (26) and mixed (24) route loads. As the sample size was much smaller for these populations than that of the statewide composition, the information should not be deemed as equally reliable.

TABLE 2-2:
COMPOSITION OF COMMERCIAL MSW DISPOSED (mean % by weight)

		Conf Int. (90%)				Conf Int. (90%)	
Material	Mean	Lower	Upper	Material	Mean	Lower	Upper
Paper				Other Wastes			
Mixed	12.47%	10.49%	14.45%	Textiles	3.80%	2.54%	5.07%
Newsprint	1.04%	0.72%	1.36%	Bulk Items	0.17%	-0.12%	0.46%
Corrugated	10.48%	8.13%	12.83%	Other Inorganics	14.27%	10.66%	17.87%
Subtotal Paper	23.99%	19.34%	28.64%	*Subtotal Other Wastes*	18.24%	13.08%	23.4%
Plastic				Organic			
Plastic (#3,4,5,7)	4.42%	3.51%	5.33%	Food Waste	14.35%	11.27%	17.43%
Plastic Bags	3.16%	2.65%	3.66%	Yard Waste	5.34%	3.38%	7.30%
Plastic Packaging (#2-5,7)	5.44%	4.64%	6.23%	Soil	2.02%	0.24%	3.81%
PET Beverage (#1)	1.04%	0.81%	1.26%	Wood	3.58%	1.95%	5.22%
Polystyrene	0.68%	0.52%	0.84%	Other Organics	9.71%	7.90%	11.52%
Subtotal Plastic	14.74%	12.13%	17.32%	*Subtotal Organic*	35.00%	24.74%	45.28%
Metals				MI Deposits	0.26%	0.17%	0.34%
Ferrous	3.54%	2.54%	4.55%				
Aluminum	0.40%	0.24%	0.56%	Household Hazardous	0.59%	0.13%	1.05%
Subtotal Metals	3.94%	2.78%	5.11%				
				Electronics	1.74%	1.07%	2.40%
Glass	1.50%	1.04%	1.97%				

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

TABLE 2-3:
COMPOSITION OF RESIDENTIAL MSW DISPOSED (mean % by weight)

		Conf Int. (90%)				Conf Int. (90%)	
Material	Mean	Lower	Upper	Material	Mean	Lower	Upper
Paper				Other Wastes			
Mixed	13.05%	11.12%	14.98%	Textiles	3.98%	2.65%	5.30%
Newsprint	1.28%	0.92%	1.63%	Bulk Items	1.33%	-0.65%	3.32%
Corrugated	5.78%	4.36%	7.21%	Other Inorganics	13.27%	10.99%	15.56%
Subtotal Paper	20.11%	16.40%	23.82%	*Subtotal Other Wastes*	18.58%	12.99%	24.18%
Plastic				Organic			
Plastic (#3,4,5,7)	3.14%	2.47%	3.81%	Food Waste	16.89%	14.02%	19.76%
Plastic Bags	3.19%	2.62%	3.76%	Yard Waste	5.11%	2.87%	7.35%
Plastic Packaging (#2-5,7)	6.48%	5.39%	7.56%	Soil	3.26%	-1.54%	8.06%
PET Beverage (#1)	1.06%	0.83%	1.30%	Wood	2.87%	1.83%	3.91%
Polystyrene	0.80%	0.63%	0.97%	Other Organics	10.22%	8.38%	12.06%
Subtotal Plastic	14.67%	11.94%	17.40%	*Subtotal Organic*	38.35%	25.56%	51.14%
Metals				MI Deposits	0.39%	0.20%	0.58%
Ferrous	2.55%	1.87%	3.22%				
Aluminum	0.44%	0.33%	0.54%	Household Hazardous	0.49%	0.06%	0.91%
Subtotal Metals	2.99%	2.20%	3.76%				
				Electronics	1.70%	1.13%	2.27%
Glass	2.72%	1.80%	3.64%				

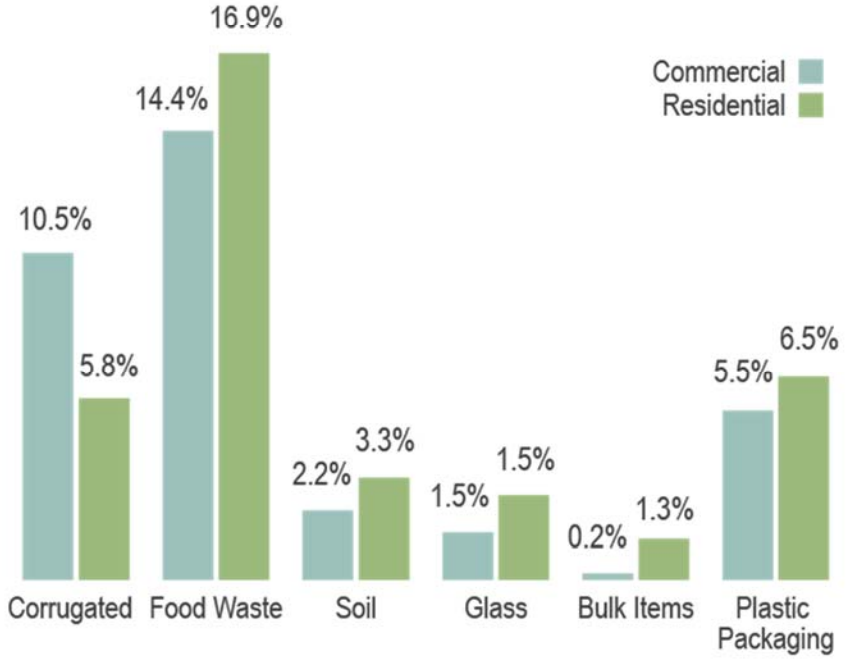
Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

To ascertain statistically significant differences between the specific material types we calculated the variances between the two and flagged any with a deviation of more than 0.5. This is shown in Figure 2-8.

For the most part the results fit common-sense expectations for differences between commercial and residential waste. Residential routes had a higher composition of food waste, soil, glass, bulk items and plastic packaging. Commercial routes had a higher composition of corrugated cardboard.

Of those, the variance for corrugated cardboard is by far the highest, and also the most noteworthy item in this data set. Across all audiences corrugated cardboard represents 8.4% of MSW disposed in the state. After mixed paper, it is the largest concentration of material that has market value – but it has much lower quantities among residential users, nearly half of what is found on commercial routes. Targeting the business sector for specific improvements in corrugated cardboard diversion could be prove worthwhile, more so than any other material.

FIGURE 2-8
Michigan MSW Material Disposed Notable Variances
Commerical vs. Residential
(by weight)



2-3 CONTEXT WITH MICHIGAN RECYCLING INDEX

The Michigan Recycling Index published in spring 2015 by Michigan Recycling Coalition and MDEQ provides an opportunity for further context of statewide MSW characterization. Given the voluntary nature of the MRI and the lack of confidence its authors exhibit in its data, these projections should be taken with a grain of salt.

The table below reconciles the characterization of statewide MSW detailed in this report with the estimated quantities of MSW diverted detailed in the MRI. For the purpose of consistency total MSW disposed is the quantity reported in the MRI.

TABLE 2-4:
QUANTITIES OF MICHIGAN MSW DISPOSED VS. RECOVERED
(tons in 000s)

	Paper	Metal	Plastic	Glass	Textiles	Organics	Electronics	Other	Total MSW
Disposed Tons	1,833	316	1,208	181	308	2,006	235	1,937	8,026
Recycled Tons	444	172	73	188	29	378	24	102	1,413
Total	2,277	488	1,282	369	338	2,384	259	2,039	9,439
Rate	20%	35%	6%	5%	9%	16%	16%	5%	15%

No adjustments were made to account for differences in approach for metals reclaimed from incinerators and in counting deposited beverage containers. Quantities were not sufficient to meaningfully impact the result.

This table is not presented to prove the 15% Michigan MSW recycling rate reported in the MRI and previously estimated by MDEQ. It serves only to quantify recycling performance in individual material categories, based on the published results of the MRI. Some understanding of the characterization of MSW recovered is necessary if we are to make conclusions or recommendations on improvements using MSW disposal data.

This Michigan MSW disposal characterization report is designed to help provide understanding of MSW contents, not data on recycling performance. Further information on recycled quantities is necessary to calculate a recycling rate, which has some value in context of national metrics and in comparison with other states. Recycling program performance could be measured by performing additional characterization studies in the future, allowing for changes in composition and quantities to be tracked over time.

3-1 COMPARISON WITH OTHER GREAT LAKES STATES

Michigan is the last of the Great Lakes states to conduct a field study on MSW disposal characterization. In order to quantify potential differences between the state's characterization and that of its neighboring states we have reviewed characterization studies for Illinois (2015), Minnesota (2013), Indiana (2012), Wisconsin (2009) and Ohio (2004). We have also included data from the US EPA's most recent MSW characterization report from 2012.

All of the statewide studies followed similar methodologies from a sorting standpoint, but differed slightly by category definition and significantly in scope. Care was taken to ensure standard definitions of material disposed, which resulted in reclassification of several materials in other reports. As such the values shown in the below tables will not precisely align with the category values found in the reports themselves. The below tables show a comparison of MSW disposal composition by weight for the six Great Lakes states.

FIGURE 3-1

Between States Comparison MSW Disposed (by mean% of weight)

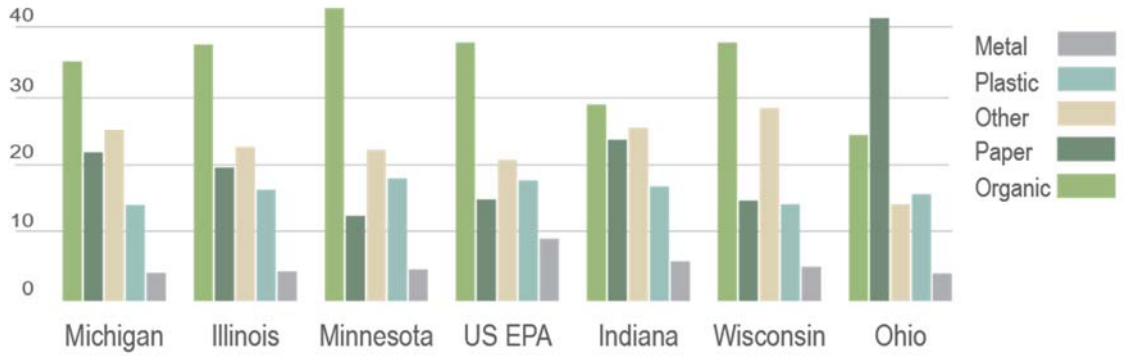


TABLE 3-1:
BETWEEN-STATE COMPARISON MSW DISPOSED CATEGORIES
(mean % by weight)

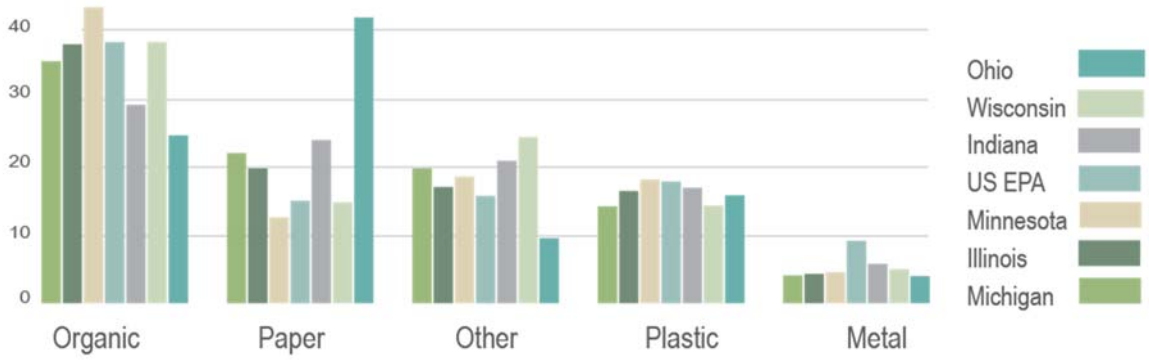
Material	Michigan 2015	Illinois 2015	Minnesota 2013	USEPA 2012	Indiana 2012	Wisconsin 2009	Ohio 2004
Organic	35.2%	37.7%	43.1%	38.0%	28.9%	38%	24.3%
Paper	21.7%	19.5%	12.4%	14.8%	23.6%	14.6%	41.6%
Other	19.5%	16.8%	18.3%	15.5%	20.6%	24%	9.4%
Plastic	14.0%	16.2%	17.9%	17.6%	16.7%	14.1%	15.6%
Metal	4.0%	4.2%	4.5%	9.0%	5.7%	4.9%	3.9%
Electronics	2.5%	1.4%	1.2%	NR	1.3%	2.4%	NR
Glass	2.2%	3.5%	2.2%	5.1%	3.0%	1.7%	4.7%
HHW	0.9%	0.8%	0.4%	NR	0.6%	0.3%	NR

At first glance, there are not any tell-tale differences between the Michigan characterization and others produced in the past decade, with the exception of Indiana, which appears to be an outlier due to the low percentage of organic material in its waste stream. The scope of this study did not allow for a thorough review of recycling programs in other states. However, the Illinois characterization did address recovery/recycling performance, estimating 37.8% diversion, which was believed to be a significant improvement for the state, though difficult to reliability quantify for lack of reliable baseline data. In its SCORE program annual report, a separate document, Minnesota claims a 68% diversion rate.

The composition differences between Michigan (15% recycling rate) and Illinois/Minnesota (38%/68%) are subtle, enough so that one might consider whether the state is performing as poorly as commonly believed. Figure 3-2 shows the same data with the columns and rows reversed.

FIGURE 3-2

Between States Category Comparison MSW Disposed (by mean% of weight)



Note the following:

- Michigan has a higher percentage of paper material disposed than the high-performing states. Paper is generally believed to be one of the more efficient materials to recycle, so it would be reasonable to assume that improvements would be most achievable in this category, and that high-performing state programs would have a lower percentage of this material than low-performing programs.
- Michigan has a lower percentage of plastic than all of the Great Lakes states. Plastic is generally believed to be more difficult to recycle, so it would be reasonable to assume that high-performing programs would have a higher percentage of material in this category, compared to lower percentages of materials less difficult to recycle.
- Minnesota is the only Great Lakes state with a lower percentage of paper than plastic. It is also the highest performing state, with a stated recycling rate of 68%.
- Michigan has a lower percentage of organic material. Organics are the most plentiful waste and not particularly easy to recycle, so it would be reasonable to assume that a high-performing state would have a higher percentage of material in this category.

The 2013 Minnesota study benefitted from comparison with a 2000 statewide study. The results were as predicted above:

TABLE 3-2: MINNESOTA 2000 COMPARED TO 2013 STATEWIDE WASTE CHARACTERIZATION RESULTS		
Material	2000	2013
Paper	34.3%	24.5%
Plastic	11.4%	17.9%
Organics	25.7%	31.0%

Likewise, the 2015 Illinois study benefitted from comparison with a 2008 statewide study.

TABLE 3-3: ILLINOIS 2008 COMPARED TO 2015 STATEWIDE WASTE CHARACTERIZATION RESULTS		
Material	2008	2015
Paper	26%	23%
Plastic	14.4%	16.2%
Organics	22.2%	27.9.%

In both cases, the percentage of paper decreased as the percentage of plastic and organics increased. There does exist the possibility that the changes in composition exhibited may also be due to industry developments unrelated to recycling performance. This is demonstrated by the Ohio MSW disposal composition. The oldest of the group, it contains by far the highest percentage of paper products. The decline in paper use over the past 15 years is common knowledge.

Regardless, the characteristics common to Illinois and Minnesota do appear to represent the ideal composition of MSW disposed for a high-recycling-performance state in the Great Lakes. A high-performing state has a lower percentage of paper products.

The U.S. EPA MSW disposed composition estimate aligns with the Michigan and Great Lakes studies in most categories, with a stark difference for metal. It is twice that of nearly every state report. We do not have an explanation for why this would occur.

All of the statewide studies followed similar methodologies from a sorting standpoint, but differed slightly by category definition and significantly in scope. This study included more facilities than many of its peers, but the fewest total samples. For instance, the Minnesota study sampled 30 vehicles each from six facilities. The Indiana study, of comparable scale to this project, sampled 20 vehicles each from four facilities. The Illinois study also characterized recovered/recycled MSW in its study, while Wisconsin sampled industrial and construction waste streams.

For budgetary and logistical reasons, this study included fewer material categories than most of its peers. It does not suffer in comparison, with one exception that will be discussed in Section 4.

4-1 MATERIAL VALUATION AND ECONOMIC IMPACT

Changing the rate of recycling in Michigan would have many economic effects, including changes in recycling markets and municipal budgets. Recycling rates also affect landfill capacity and real estate values and health outcomes for people living near landfills and incinerators. We consider each of these impacts below.

Quantities

In Table 4-1 we use the results of the MSW Characterization sorts that are discussed in detail in Section 2, and the two respective total MSW disposed estimates from the MDEQ Solid Waste Annual Report (Estimate 1) and Michigan Recycling Index (Estimate 2).

TABLE 4-1:
AVAILABLE WEIGHT BY MATERIAL TYPE IN TONS

Material	Estimate 1 8,862,241	Estimate 2 8,026,443	Average Estimate
Mixed Paper	1,069,672	968,690	1,019,181
Newsprint	108,119	97,537	102,828
Corrugated	746,201	676,137	711,169
Plastic (#3,4,5,7)	363,352	328,768	346,060
Plastic Bags	245,484	222,465	233,975
Plastic Packaging (#2-5,7)	487,423	441,404	464,414
PET Beverage (#1)	83,305	75,075	79,190
MI Deposit	25,700	23,469	24,585
Polystyrene	62,922	56,916	59,919
Yard Waste	443,112	401,093	422,103
Soil	209,149	189,554	199,351
Food Waste	1,202,606	1,089,391	1,145,999
Wood	459,950	416,545	438,248
Other Organics	802,033	726,591	764,312
Ferrous	294,226	266,465	280,346
Aluminum	38,108	34,157	36,132
Glass	190,538	172,702	181,620
Other Inorganics	1,298,318	1,176,256	1,237,287
Textiles	323,472	292,960	308,216
Bulk Items	106,347	95,970	101,158
Electronics	220,670	199,998	210,334
Household Hazardous	82,419	74,298	78,358

4-2 MATERIAL VALUE

A primary benefit of increased recycling is the economic value found from reclaiming these resources and selling them to the market. We have collected commodity prices for each of our composition categories and calculated the value of the material currently being disposed.

Our process for defining material value is simple and straight-forward: What will the market pay for a ton of the material in Michigan?

The Kent County Department of Public Works (KC) provided data on the prices it received for bulk recyclables from June 2007 through April 2015. Given the categories used in the MSW characterization process, we use price data for PET plastic (#1), HDPE plastic (#2), mixed plastics (#3 through #7), plastic bags, mixed paper, newspaper, corrugated (cardboard), scrap/mixed metals, and glass. Aluminum sales by Kent County were infrequent and significantly below market prices, so we use aluminum price data provided by the Resource Recovery and Recycling Authority of Southwest Oakland County (RRRASOC). The prices per ton were computed by dividing their total revenues for each month by the total tons sold in that month.

Representatives from Michigan recycling and processing firms confirmed the prices used were near competitive market rates for bulk recyclable materials. In particular, they confirmed Kent County's prices received were in line with the rates they received for similar materials, and with national prices including those from reputable sources such as *PPI Pulp and Paper Week*'s *Official Board Markets* (also called "The Yellow Sheet"), *Iron Age*, and the *Scrap Price Bulletin*.

HDPE Plastic and Plastic Packaging

As discussed in Section 3, in order to sort the minimum number of samples necessary with the labor budget available, this study limited its material categories to 20, later expanding it to 22. These decisions were made before the price survey was fully complete, and it later became apparent that at least one additional material should have been sorted separately.

Waste sort staff members combined #2 high-density polyethylene (HDPE) plastics into the plastic packaging category, which included non-beverage containers and films and wrap from a variety of types of plastics. The high-value of HDPE made this decision very meaningful in the valuation of MSW. To reconcile this we estimated the proportion of each type of plastic in this sort category using recent estimates from the Indiana and Minnesota Characterization Studies. The two states had about 8.47% of their MSW made of these materials, with 0.54% being PET plastic, 1.32% HDPE, and 6.62% of other types of plastics. The current study found 8.27% of Michigan MSW made of these materials, where the proportional amounts are about 0.52% PET plastic, 1.28% HDPE, and 6.46% other. We estimate the value of materials in this category at the weighted average of these materials.

No Value for Electronics, EPS Foam and Organics

Prices for electronics (including appliances and white goods), polystyrene (EPS foam), and organic/compostable and inorganic/non-compostable materials were all valued at zero based on historical data gathered from the representatives of relevant local companies.

A local electronics recycler analyzed the complete list of electronics and appliances gathered by the waste characterization staff. Some proportion of the materials was recyclable (such as power cords), but the materials had a sufficiently low market value that the recycler indicated it would not be profitable to process them. While electronics such as computers, monitors, and printers have value for e-waste recyclers, little of this material was found in this study. This result is consistent with the findings of other states, which will be discussed further in Section 5.

Similarly, while polystyrene may have some value once densified, the value is low enough that we assume it to be zero. WMSBF member companies that trade in recycled EPS foam confirmed this to be the case.

A representative from a composting service also confirmed that there is a zero market value for unprocessed compostable materials.

Deposit Containers

Waste characterization staff sorted all Michigan deposit containers together. They estimated, post-sort, that 40% of the weight was glass, 40% was aluminum, and 20% was PET plastic. We estimate the value of materials in this category at the weighted average of these materials.

Textiles

Textiles were also sorted by waste characterization staff. They estimated 80% of these materials were in good enough condition that they would donate them to a local non-profit. Increased donations to these non-profits add value to the local economy through clothing sales, sales tax receipts by local and state governments, employment opportunities, and support these non-profits provide through pursuit of their missions. While we do not have a good estimate of these values, we use $100 per ton, the price given by Trans-Americas Trading Company on its website.

This price was validated by a representative from a local non-profit who processes donated textiles. Market prices for recyclable materials are notoriously volatile, and predicting their movements is difficult. We provide the interquartile range (the 25th and 75th percentiles) of the prices paid to Kent County for each material for the last year (May 2014 through April 2015). All prices and their sources are reported in Table 3 (note that "KC: weighted average" uses HDPE price quartiles of 665.11 and 1074.745, based on data from RRRASOC).

TABLE 4-2:
ESTIMATED MATERIAL PRICES AND DATA SOURCES

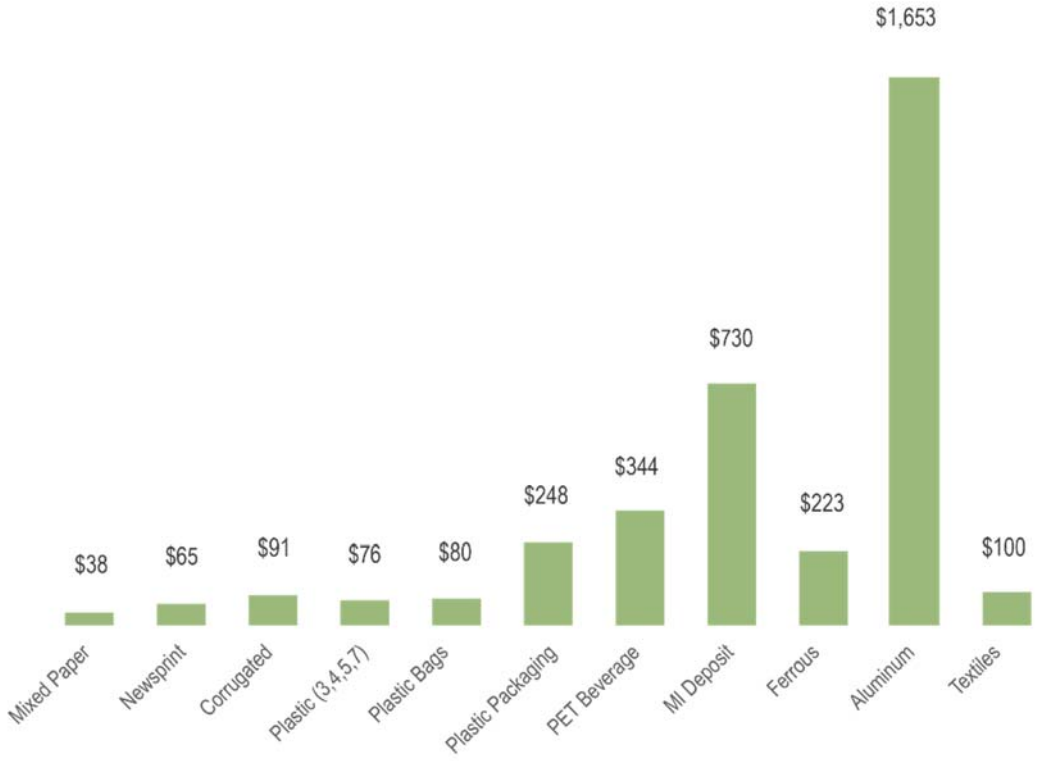
Material	Data Source	Low Price	High Price
Mixed Paper	KC: mixed paper	$37.51	$38.06
Newsprint	KC: newspaper	$61.18	$64.87
Corrugated	KC: corrugated	$79.11	$90.87
Plastic (#3,4,5,7)	KC: plastic 3-7	$54.22	$76.19
Plastic Bags	KC: plastic bags	$30.00	$80.00
Plastic Packaging (#2-5,7)	KC: weighted average	$163.49	$248.23
PET Beverage (#1)	KC: PET plastic	$281.59	$343.78
MI Deposit	KC: alum/PET/glass	$671.17	$729.76
Polystyrene	Local company	0.00	0.00
Yard Waste	Local company	0.00	0.00
Soil	Local company	0.00	0.00
Food Waste	Local company	0.00	0.00
Wood	Local company	0.00	0.00
Other Organics	Local company	0.00	0.00
Ferrous	KC: scrap metal	$147.50	$222.50
Aluminum	RRRASOC: aluminum	$1537.13	$1652.50
Glass	KC: glass	0.00	0.00
Other Inorganics	N/A	0.00	0.00
Textiles	Company website	$100.00	$100.00
Bulk Items	N/A	0.00	0.00
Electronics	Local company	0.00	0.00
Household Hazardous	N/A	0.00	0.00

We estimate the value of recyclables currently disposed of in Michigan landfills and incinerators by multiplying the mean of the two estimates of the available MSW, the percent of each type in the waste stream, and the price of a ton of each material. To account for the contamination of recycled materials and handling in the materials processing facilities we multiply this number by 0.9 for all materials except textiles. Textiles would presumably be collected as a separate stream, and so we multiply it by 0.8, the proportion of those materials waste characterization staff estimated was of donation-level quality.

FIGURE 4-1

Market Value of MSW Commodities Disposed

($ per ton)



An increase in recyclable materials would also increase the total amount of material available in the market. This increase in supply would likely push down the per-ton market price of these materials.

We estimate the change in market price given a change in quantity using an "elasticity" estimate for this relationship defined by economist Karen Palmer and co. (Palmer, Sigman, and Wells, 1996.) We compute the change in quantity comparing the maximum possible increase in recyclable materials in Michigan against the national market size in 2013 (EPA 2015). The market values of the available recyclables are provided in Table 4-3.

TABLE 4-3: MARKET VALUE OF AVAILABLE RECYCLABLES						
Material	Available Quantity	Quality Adjustment	Adj. Low Price	Adj. High Price	Low Price Total Value	High Price Total Value
Mixed Paper	1,019,181	0.9	$33.90	$34.40	$31,098,212	$31,556,184
Newsprint	102,828	0.9	$60.86	$64.54	$5,632,700	$5,972,444
Corrugated	711,169	0.9	$78.23	$89.85	$50,072,698	$57,511,714
Plastic (#3,4,5,7)	346,060	0.9	$42.96	$60.37	$13,379,666	$18,803,449
Plastic Bags	233,975	0.9	$25.79	$68.77	$5,430,458	$14,481,222
Plastic Packaging (#2-5,7)	464,414	0.9	$117.93	$179.06	$49,291,787	$74,841,415
PET Beverage (#1)	79,190	0.9	$237.35	$289.77	$16,916,121	$20,652,352
MI Deposit	24,585	0.9	$622.33	$675.96	$13,769,911	$14,956,569
Polystyrene	59,919	0.9	0.00	0.00	0	0
Yard Waste	422,103	0.9	0.00	0.00	0	0
Soil	199,351	0.9	0.00	0.00	0	0
Food Waste	1,145,999	0.9	0.00	0.00	0	0
Wood	438,248	0.9	0.00	0.00	0	0
Other Organics	764,312	0.9	0.00	0.00	0	0
Ferrous	280,346	0.9	$143.46	$216.40	$36,195,945	$54,600,663
Aluminum	36,132	0.9	$1437.16	$1545.02	$46,735,061	$50,242,782
Glass	181,620	0.9	0.00	0.00	0	0
Other Inorganics	1,237,287	0.9	0.00	0.00	0	0
Textiles	308,216	0.8	$100.00	$100.00	$24,657,272	$24,657,272
Bulk Items	101,158	0.9	0.00	0.00	0	0
Electronics	210,334	0.9	0.00	0.00	0	0
Household Hazardous	78,358	0.9	0.00	0.00	0	0
TOTAL:	8,444,784				$293,179,831	$368,276,066

Thus, we estimate there is between $293 million and $368 million in available recyclable materials currently being disposed of in incinerators and landfills in Michigan.

For comparison, the 2015 Illinois MSW characterization study estimated the value of that state's landfilled materials at over $360 Million.

Implications

First, we should note that the value of ferrous metals may be overstated by $7 million to $12 million. The ferrous metal reclaimed from incinerator ash in Grand Rapids and Detroit is by definition available to be reclaimed from MSW disposed through diversion efforts. However, the diversion of this material from MSW disposed would not be a net-gain for recovered material in the state, as increases in diversion of this material would represent a corresponding decrease in its reclamation from incinerator ash.

We have not made an adjustment to the available material value based on incinerator ash reclamation, or for that matter, other salvage or reclamation activities that may occur after materials arrive at a landfill, incinerator or transfer station that we may not be aware of. We do take this into consideration as part of the economic impact projection.

Also it should be noted that the material value of deposited containers is significantly less than the value of the deposits themselves. This will be discussed further in Section 5.

Finally, it should be highlighted that only half of the 22 categories analyzed in the characterization have any material value to the market. These are presented in Figure 4-3 below.

Due largely to the presence of HDPE plastic, plastic packaging would offer the most aggregate material value to the state. This is followed by corrugated cardboard, ferrous metal, aluminum and textiles, then all other materials.

FIGURE 4-2
Total Value of Michigan MSW Material Disposed ($)

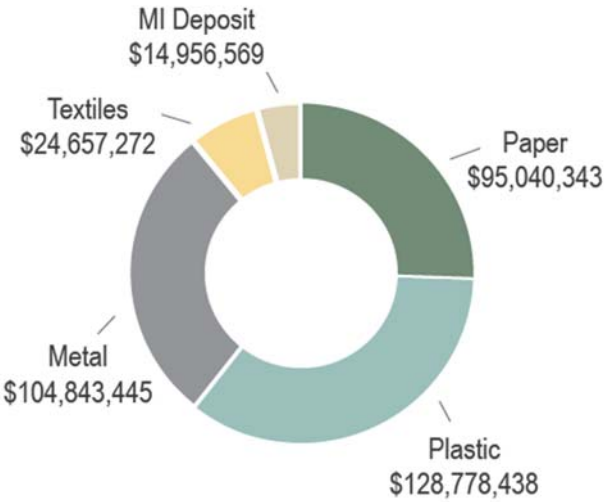
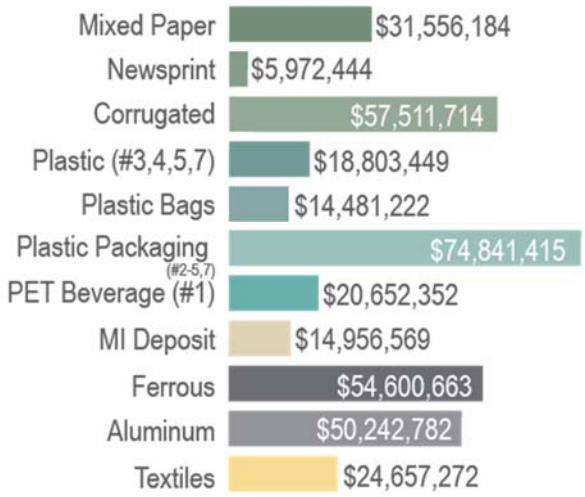
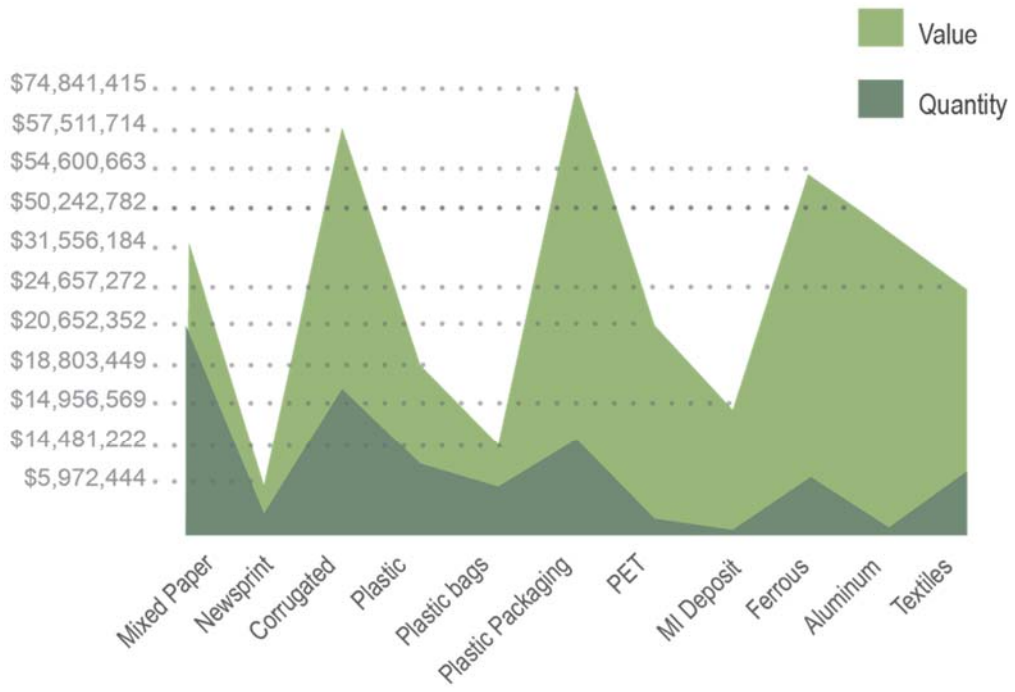


FIGURE 4-3
Total Value of Michigan MSW Commodities Disposed ($)



Total material value is not the best method to evaluate opportunity for diversion improvements. For instance, aluminum represents 13.5% of the available material value with a high-price estimate of $50.2 million. Yet it is only 0.43% of the aggregate statewide composition of MSW disposed. Figure 4-4 expresses these discrepancies below.

FIGURE 4-4
Total Value vs Total Quantity



Viewed in this way, we see that one material exemplifies a high-value, high-quantity scenario: corrugated cardboard. Though not as prominent, plastic packaging does offer a similar opportunity, though it is likely overstated due to the comingling of HDPE in the category definition. Ferrous metal and textiles also show good value for the quantity of material available.

Mixed paper is unique in that it has the largest quantity of available material among any category with a market value. Though it is the lowest value per ton of any of the valuable materials, its large quantity would suggest it is "low-hanging fruit" for diversion improvements.

4-3 OPERATING COSTS

To fully understand the potential economic impact of increased recycling we must also consider the cost savings inherent in diverting materials from the landfill or incinerator. Using our estimates of non-ash landfill and incinerator tonnage, the data show that about 15.69% of Michigan MSW is incinerated each year while the remaining 84.31% is landfilled. Each of these types of facilities has its own operating costs, and increased recycling would avoid these costs.

Landfills

Two approaches to valuing the financial costs of landfilling material are computing the marginal cost (adding tonnage to a currently operating facility) and computing the average cost of landfilling (the net present value of the average cost per ton added to a facility). People and companies dispose of MSW over time and across geography, so it is not possible to say any particular facility opened because of the failure to recycle materials. Regardless, this material fills facilities and causes the expansion of existing landfills and creation of new facilities over time. Given the ongoing cost of closing old facilities, opening new ones, and operating and expanding existing ones across the state, we use the average cost approach over computing the cost of adding additional tons to an existing landfill.

The cost of landfill construction and maintenance differs considerably across site characteristics (see Duffy 2015 and Eilrich, Doeksen, and VanFleet 2002). We do not know the geography, regulatory environment, or features of future landfills, and so use multiple cost estimates. The literature provides multiple estimates of landfill construction costs. Scholarly research suggests an average price of $36.58 per ton over the lifetime of a landfill (adjusted from the 2002 value of $27.80 per ton to 2014 dollars using the Bureau of Labor Statistics' Consumer Price Index's (CPI-U) inflation adjustment of 1.316). Available literature also provides a thorough analysis of construction costs under different assumptions and estimates an average cost of $26.36 per ton.

We do not use in our calculations a third available estimate of the cost of landfilling from a local facility. Over 2013 and 2014 Kent County spent $7,574,543 on landfilling MSW in the South Kent Landfill. During this time the South Kent Landfill processed 511,092 tons of MSW for an average cost of $14.82 per ton. These costs do not include initial bond or startup costs, the gas-to-energy plant, outreach and education, the household hazardous waste program, maintenance of any closed landfills, solid waste planning activities, or any legacy costs (preparing for closing and maintenance of the site). This value represents the cost of adding tons of MSW to an existing facility, which is substantially below the average cost we are trying to capture. Instead, we use the tipping fee currently set for the facility, which is intended to capture some of these other costs. The 2015 tipping fee is $36.10 per ton, a fee which is intended to represent the total average cost of a ton of MSW to the county.

Thus, we have identified three estimates of the cost of a ton of MSW placed into a landfill, $36.58, $26.36, and $36.10, which average to $33.01 per ton. This estimate also omits the possible cost of an extreme outcome, such as when a closed landfill becomes a Superfund Cleanup site.

Incinerators

There are currently two waste incinerators operating in Michigan, the Waste-To-Energy facility in Kent County and the Greater Detroit Resource Recovery Facility. During 2013 and 2014 the MSW incineration facility in Kent County handled 371,803 tons of MSW at a total cost of $39,304,961.

The facility produced 204,438 Mwh of electricty, worth approximately $50 per Mwh, for an estimated total revenue of about $10,221,900. This leaves a net cost of $29,083,061, or $78.22 per ton of MSW processed. As previously discussed, incineration also isolates ferrous metals which can be resold, which are omitted in this analysis because we need to compute the cost of incineration independent of the value of reclaimed recyclables, as increased recycling would remove those materials from the MSW stream before it arrived at the incinerator. This resulted in operating costs of about $78.22 per ton of MSW. We did not have access to any recent documentation of the operating costs and volumes of the other incinerator in Michigan for comparison purposes.

Material Recovery Facilities

The Material Recovery Facility in Kent County processed 62,538 tons of material at a cost of $6,260,514 (which includes bond payments) during 2013 and 2014 for gross average operating cost of approximately $100.11 per ton. This is a modern, single-stream facility that sorts out a wide variety of recyclable materials.

While it may be possible for a multi-stream facility or a facility that extracts a narrow range of materials to sort recyclables at a lower cost, the movement seems to be toward single-stream processing. We do not net out the revenues from the recyclable materials, as those are computed separately from the per-ton processing cost in our analysis.

4-4 INDIRECT EFFECTS

People differ in their willingness to value non-bugetary costs when valuing projects, and increasing recycling is no exception. In this section we examine a variety of other issues which may be of interest to policymakers and the public.

Landfill Capacity

Another benefit of increased recycling is that it would increase the lifespan of existing landfills. According to MDEQ Michigan has 495,809,471 cubic yards of remaining, approved landfill capacity as of the end of the 2013-2014 fiscal year. If MSW is created at the same rate as during that year, Michigan currently has enough total capacity for about 26 more years. Removing all recyclable materials of value would reduce MSW by nearly 40%, substantially extending the lifespan of existing, approved landfill capacity. Interviews with industry professionals indicated that some facilities have additional land available that has not been developed but could be added to their existing facilities.

This issue is more complicated than simply extending the lifespan of total statewide landfill capacity. MSW is spread across landfills with between 1 year and 556 years of remaining capacity at current rates. While it has been many years since a new landfill has been opened in Michigan, facilities will be expanded, closed, and new ones opened over time. Reducing the MSW stream by diverting additional recyclables would increase the average across the state, but would reduce the need to expand existing facilities and open new facilities over time.

Real Estate Values

A study analyzing housing prices near landfills showed that high volume landfills (500 tons per day or more) reduce adjacent housing values by 12.9% and that rate decreases 5.9% per mile, while lower volume landfills decrease adjacent housing values by 2.5% on average, decreasing at 1.2% per mile (Ready, 2005).

Given the uncertain nature of future landfills, we take the average of these numbers: 7.7 for adjacent houses decreasing at 3.5% per mile. To simplify the analysis we assume the effect ends after two miles and that the effect radiates from a single point. We note that this set of assumptions biases the estimate of damages toward zero.

Landfills are likely to be built in rural areas rather than urban areas. According to the US Census and the American Community Survey (2009-2013), Michigan has about 47.5 people per square mile in rural areas, an average house size of 2.1 people, and an average house price of $121,700. This results in about $2,752,738 in house values for every square mile of rural Michigan property (which includes small towns of with fewer than 10,000 people).

A one-mile radius circle around a point contains 3.14 square miles of property (about $8,643,597 in value) while the second mile-wide ring around that contains an additional 9.43 square miles (about $25,958,319 in value). If we estimate the loss in value of homes in the first ring at the average of the adjacent value and the one mile ring (7.7 and 4.2%; 6%), and homes in the second mile ring at the average of those two values (4.2 and 0.7%; 2.5%) the total decrease in housing values would be about $518,616 and $648,958 for a total of $1,167,574.

According to MDEQ solid waste reports, the median landfill in Michigan disposed of 459,660 cubic yards (153,220 tons) during 2013-2014. Assuming the construction of a single landfill of moderate size handling the additional MSW caused by non-recycling would result in a real estate loss of about $7.62 per ton of MSW processed.

We estimate the benefit of increased recycling on real estate near an incinerator at zero, as the two incinerators in Michigan are likely to stay in business even if there is a reduction in waste volumes, and a decrease in volume will have little impact on the visual impact, odor, or psychological effects of living near the facility.

When weighting the real estate loss of $7.62 per ton for landfills by the 84.31 percent of materials sent to landfills (as opposed to incineration) this adds an additional social cost of $6.50 per ton.

Environmental Effects: Greenhouse Gases

The EPA's Waste Reduction Model (WaRM) calculates the outcomes of various waste management techniques in terms of their carbon dioxide equivalent ($MTCO_2E$) across many common materials. The online WaRM calculator provided the net effect of landfilling or incineration of materials against recycling, with results listed in Table 4-4. We use the baseline assumptions from the calculator, including use of the national average for landfill-gas extraction (since landfills differ across the state) and travel distances of 20 miles.

The table below computes the carbon dioxide improvement from recycling versus landfilling or incinerating for each type of material. We then weigh the improvements in tons of carbon dioxide by type of disposal, assuming 15.69% of materials are incinerated rather than landfilled, and multiply by the June 2015 auction price in the Regional Greenhouse Gas Initiative of $5.50 per ton.

TABLE 4-4:
VALUE OF MTCO2E, RECYCLING AND COMPOSTING AGAINST LANDFILLING OR INCINERATION

Material	EPA Category	Emissions Vs Landfill	Emissions Vs Incinerator	Cost per ton CO2	Cost Savings per ton
Mixed Paper	Mixed Paper (residential)	-3.873	-3.042	$5.5	$20.58
Newsprint	Newspaper	-2.024	-2.196	$5.5	$11.28
Corrugated	Corrugated	-3.566	-2.635	$5.5	$18.81
Plastic (#3,4,5,7)	Mixed Plastics	-1.071	-2.283	$5.5	$6.94
Plastic Bags	Mixed Plastics	-1.071	-2.283	$5.5	$6.94
Plastic Packaging (#2-5,7)	Mixed Plastics	-1.071	-2.283	$5.5	$6.94
PET Beverage (#1)	PET	-1.17	-2.371	$5.5	$7.47
MI Deposit	Aluminum	-9.147	-9.161	$5.5	$50.32
Polystyrene	N/A	N/A	N/A	$5.5	N/A
Yard Waste	**	$0.641	$0.031	$5.5	-3.00
Soil	N/A	N/A	N/A	$5.5	N/A
Food Waste	Food Waste	-0.866	-0.032	$5.5	4.04
Wood	N/A	N/A	N/A	$5.5	N/A
Other Organics	N/A	N/A	N/A	$5.5	N/A
Ferrous	Mixed metals	-4.415	-3.387	$5.5	$23.40
Aluminum	Aluminum	-9.147	-9.161	$5.5	$50.32
Glass	Glass	-0.315	-0.322	$5.5	1.74
Other Inorganics	N/A	N/A	N/A	$5.5	N/A
Textiles	N/A	N/A	N/A	$5.5	N/A
Bulk Items	N/A	N/A	N/A	$5.5	N/A
Electronics	N/A	N/A	N/A	$5.5	N/A
Household Hazardous	N/A	N/A	N/A	$5.5	N/A

Environmental Effects and Health Effects

Tables 4-5a and 4-5b contain a variety of estimates of the environmental and health impacts of MSW. These results vary widely by the pollutants included and the specific setting of the facility. We do not know the conditions of a particular new facility and so use the average of the high and low estimates from each study cited. Note that in each case some value has been given to carbon dioxide so they would not be added to the damage estimates from Table 4-4.

TABLE 4-5A:
TOTAL ENVIRONMENTAL AND HEALTH EFFECTS, 2014 DOLLARS (METHOD 1)

Facility	Author	Year	Low	High	Avg of High and Low
Landfill	Schall	1992	$3.11	$18.19	$10.65
	CSERGE	1993	$1.17	$18.84	$10.01
	Powell and Brisson	1994	$2.06	$8.23	$5.15
	Enosh	1996	$8.36	N/A	$8.36
	EMC	1996	$3.86	N/A	$3.86
	Miranda and Hale	1997	$3.11	$16.93	$10.02
	EU	2000	$7.72	$56.61	$32.17
	ENOMIA	2002	$9.66	$13.11	$11.39
	Dijkgraaf and Vollebergh	2003	$27.02	N/A	$27.02
	Average				$13.18
Incinerated	Tellus	1992	$1.29	$6.43	$3.86
	CSERGE	1993	$7.42	$25.47	$16.45
	Powell and Brisson	1994	-4.05	$8.11	$2.03
	ECON	1995	$36.03	$220.01	$128.02
	ECON	1996e	$1.67	N/A	$1.67
	Enosh	1996	$12.98	N/A	$12.98
	EMC	1996	$2.12	N/A	$2.12
	Miranda and Hale	1997	$6.65	$40.53	$23.59
	Rabl et al.	1998a	$15.83	N/A	$15.83
	ExternE	1998	$19.3	$118.37	$68.84
	EU	2000	-11.58	$159.54	$73.98
	EUNOMIA	2002	$37.81	$58.99	$48.40
	Dijkgraaf and Vollebergh	2003	$22.61	N/A	$22.61
	Average				$32.34

TABLE 4-5B: TOTAL ENVIRONMENTAL AND HEALTH EFFECTS, 2014 DOLLARS (METHOD 2)		
	Type	Damages per US ton of MSW
Landfill	No energy recovery	$11.77
	Electricity recovery replacing coal and oil	$10.03
Incinerator	Electricity recovery replacing coal and oil	$14.62
	Electricity and heat recovery replacing coal and oil	$12.05

The average values from these two sources are $13.18 per ton of MSW in landfilling and $32.34 per ton of MSW in incinerators or, net of other energy sources, $10.90 per ton of MSW in landfilling and $13.34 per ton of MSW in incinerators, weighted by the percent of MSW that is landfilled or recycled this yields an average environmental impact of $11.28. Given our goal of assessing total social cost we use Method 2, which accounts for the other energy sources displaced.

4-5 TOTAL IMPACT

The impact of increasing recycling varies depending on the materials diverted from the MSW stream, where it is sent for processing, and what non-budgetary impacts are included.

The budgetary costs of one ton of recyclables placed in the MSW stream for landfilling or recycling is:

$$Cost_{Landfill} * ProportionMSW_{Landfill} + Cost_{Incinerate} * ProportionMSW_{Incinerate}$$

Or

$$\$33.01/ton * 0.8531 + 78.22/ton * 0.1569$$

This yields an average operating cost of disposing of MSW of $40.43 per ton of MSW.

The real estate loss of $7.62 per ton for landfills (weighted by the 85.31% of materials sent to landfills) adds an additional social cost of $6.50 per ton, for a total processing cost of $46.93. Adding in environmental and health effects, weighted by the percent of materials sent to landfills versus incinerators yields an additional average cost of $11.28 per ton of MSW. Adding together the operations cost of landfills and incinerators, the impact on property values, and other environmental and health effects yields a total social cost of $58.21 per ton of MSW.

With this approach one would not include the cost of carbon dioxide computed in Table 4-3 above, as that has already been incorporated in these estimates.

While recycling materials saves on these costs, it must be processed. The total cost of sending the material to a MRF is the gross cost of processing ($100.11 per ton of MSW) net of the revenues from selling the recycled materials. Returning to the adjusted value per ton of recyclable, we see that it matters which types of recyclable materials are removed from the waste stream.

Using the values computed above we can compare the cost of landfilling and incineration against the cost of recycling, such as from removing a ton PET plastic from the MSW stream into recycling. In the first approach this ton of materials avoids the cost of landfilling and incinerating the materials, the associated impact on real estate values, and the social values while capturing the revenues from resale of the material.

This total benefit is measured aganst the cost of MRF sorting in table 4-5. Here we see a per-ton metric for the net impact of recycling each type of material. For the case of PET plastic, diverting one ton of material out of the MSW stream into recycling yields a gain between $191.64 and $247.87 in total social benefits per ton. For mixed paper the values range from a loss of $7.99 to a gain of $1.81 in total social benefits per ton.

TABLE 4-6: MRF COST NET OF RECYCLING BENEFITS ($)								
	Benefit Measures		Material Price		Lowest Benefit	Highest Benefit	Recycling Value, Net MRF	
Material	Ops+RE+RSZ	Ops+RE+CO2	Low	High	+Low Price	+High Price	Low	High
Mixed Paper	$58.21	$67.51	$33.90	$34.40	$92.12	$101.92	-7.99	$1.81
Newsprint	$58.21	$58.21	$60.86	$64.54	$119.07	$122.75	$18.96	$22.64
Corrugated	$58.21	$65.74	$78.23	$89.85	$136.45	$155.59	$36.34	$55.48
Plastic (#3,4,5,7)	$58.21	$53.87	$42.96	$60.37	$96.83	$118.59	-3.28	$18.48
Plastic Bags	$58.21	$53.87	$25.79	$68.77	$79.65	$126.98	-20.46	26.87
Plastic Packaging (#2-5,7)	$58.21	$53.87	$117.93	$179.06	$171.80	$237.27	$71.69	$137.16
PET Beverage (#1)	$58.21	$54.40	$237.35	$289.77	$291.75	$347.98	$191.64	$247.87
MI Deposit	$58.21	$97.25	$622.33	$675.96	$680.55	$773.21	$580.44	$673.10
Polystyrene	$58.21	$46.93	0.00	0.00	$46.93	$58.21	-53.18	-41.90
Yard Waste	$58.21	$43.93	0.00	0.00	$43.93	$58.21	-56.18	-41.90
Soil	$58.21	$46.93	0.00	0.00	$46.93	$58.21	-53.18	-41.90
Food Waste	$58.21	$50.97	0.00	0.00	$50.97	$58.21	-49.14	-41.90
Wood	$58.21	$46.93	0.00	0.00	$46.93	$58.21	-53.18	-41.90
Other Organics	$58.21	$46.93	0.00	0.00	$46.93	$58.21	-53.18	-41.90
Ferrous	$58.21	$70.33	$143.46	$216.40	$201.67	$286.73	$101.56	$186.62
Aluminum	$58.21	$97.25	$1,437.16	$1,545.02	$1,495.37	$1,642.28	$1,395.26	$1,542.17
Glass	$58.21	$48.67	0.00	0.00	$48.67	$58.21	-51.44	-41.90
Other Inorganics	$58.21	$46.93	0.00	0.00	$46.93	$58.21	-53.18	-41.90
Textiles	$58.21	$46.93	$100.00	100.00	$146.93	$158.21	$46.82	$58.10
Bulk Items	$58.21	$46.93	0.00	0.00	$46.93	$58.21	-53.18	-41.90
Electronics	$58.21	$46.93	0.00	0.00	$46.93	$58.21	-53.18	-41.90
Household Hazardous	$58.21	$46.93	0.00	0.00	$46.93	$58.21	-53.18	-41.90

4-6 EMPLOYMENT IMPACT

Increasing recycling will create jobs in Michigan. The value of recyclable materials diverted from landfills and incinerators to markets will eventually end up with households through increased employment and profits by waste haulers and recycling processors, and also through purchases of goods and services to support these businesses.

Since very little virgin material (particularly plastics and metals) is extracted in Michigan, we assume all of the revenues from the sale of recyclables can be counted as new household spending. Using RIMS multipliers for Kent County from 2006 (adjusting the jobs multiplier per million dollars by inflation since 2006), we find extracting recycling from the MSW stream would create between 2,085 and 2,619 full time equivalent jobs in Michigan with a total effect of between $317 and $399 million dollars.

See Table 4-7 for details.

TABLE 4-7:
EMPLOYMENT AND TOTAL FINANCIAL EFFECT
OF INCREASED RECYCLING

Value Reclaimed	Jobs Multiplier	Jobs Created	Total Effect Multiplier	Total Effect
$293,179,831	7.11	2,085	1.08	$317,425,804
$368,276,066	7.11	2,619	1.08	$398,732,497

5-1 SUMMARY FINDINGS AND CONCLUSIONS

In the preceding sections we have accomplished the primary objectives of this study, which was to provide information and analysis on the composition of municipal solid waste currently landfilled and incinerated in Michigan, and the economic value of this material. Its findings are derived entirely from field studies, verifiable market prices for recycled commodities, and peer-reviewed academic studies.

As detailed in Section 4, we estimate total material value of Michigan MSW disposed in landfills and incinerators of as much as $368 million. If all of this material was recovered and sold to the market it would have an estimated total economic impact of up to $399 million.

In Table 5-1 we have summarized our findings for material composition and valuation, as well as the net recycling value per ton after accounting for indirect benefits and processing costs. Together this data quantifies characterization of Michigan MSW disposed in landfills and incinerators by aggregate commodity value and as a net impact for recyclers and recycling communities.

TABLE 5-1:
MICHIGAN STATEWIDE COMPOSITION (by weight), AVAILABLE MATERIAL VALUATION
($ in millions) AND NET RECYCLING VALUE ($ per ton)

Material	Comp.	Value	Net	Material	Comp.	Value	Net
Paper				Other Wastes			
Mixed	12.07%	$31.6m	$1.81	Textiles	3.65%	$24.7m	$58.10
Newsprint	1.22%	$6.0m	$22.64	Bulk Items	1.20%	0	-41.90
Corrugated	8.42%	$58m	$55.48	Other Inorganics	14.65%	0	-41.90
Subtotal Paper	21.71%	$95.6m	---	*Subtotal Other Wastes*	19.50%	$24.7m	---
Plastic				Organic			
Plastic (#3,4,5,7)	4.10%	$18.9m	$18.48	Food Waste	13.57%	0	-41.90
Plastic Bags	2.77%	$14.5m	$26.87	Yard Waste	5.00%	0	-41.90
Plastic Packaging (#2-5,7)	5.50%	$74.8m	$137.16	Soil	2.36%	0	-41.90
PET Beverage (#1)	0.94%	$20.6m	$247.87	Wood	5.19%	0	-41.90
Polystyrene	0.71%	0	-41.90	Other Organics	9.05%	0	-41.90
Subtotal Plastic	14.02%	$128.8m	---	*Subtotal Organic*	35.17%	0	---
Metals				MI Deposits	0.29%	$15m	$673.10
Ferrous	3.32%	$54.6m	$186.62				
Aluminum	0.43%	$50.2m	$1542.17	Household Hazardous	0.93%	0	-41.90
Subtotal Metals	3.75%	$104.8m	---				
				Electronics	2.49%	0	-41.90
Glass	2.15%	0	---				

Composition: Mean percentage of available material by weight.
Material Value: Aggregate value of available material according to verifiable commodity prices.
Net Recycling Value: High estimate of value per ton plus indirect benefits, minus processing costs.

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Ideally, efforts to promote recycling or composting improvements would prioritize those with the highest composition and net recycling value.

While there is an environmental or social case for promoting recovery of all MSW materials, there is no economic value in recovering many materials. For many products the cost of processing exceeds both the material value and indirect benefits of recycling or composting. Economic impact would not be the motivation for increasing diversion of these materials.

Further, we should highlight emphatically that the material values used in this report are volatile and prone to change. At the time we conducted our research commodity prices were experiencing sharp declines. The situation will hopefully improve over time.

In the following pages we will highlight some final points and then make recommendations on potential responses to this study. An additional regional characterization for West Michigan can then be found in Section 6.

5-2 ELECTRONIC WASTE

One of the secondary objectives of this study was an evaluation of electronic waste in Michigan MSW disposed in landfills and incinerators. This was a particular interest of certain WMSBF Waste Task Force members, and of relevance to legislative and regulatory discussions currently underway in Michigan.

Electronic waste, or e-waste, is one of the most complex streams in MSW, as it is immensely diverse and contains both hazardous and valuable materials. The EPA determined that in 2012 the United States created 3.4 million tons of e-waste. It also estimated that only 29% of the e-waste generated in 2012 was recycled, leaving 71% to end up in landfills and incinerators. The growth of the category makes this especially pertinent: 2014 was an all-time high for electronics sales revenue.

We have defined e-waste as electronic items that are nearing or have reached the end of their usable life, and which have been discarded by a consumer or business. Electronic items are any product requiring a power source, which may or may not include circuitry. Examples include, but are not limited to, computers and computer accessories, televisions, hard copy devices, mobile units, and entertainment systems.

It had been our expectation that we would encounter a certain composition of electronic material that would have significant relevance to current regulatory and legislative conversations. We did not.

TABLE 5-3:
ELECTRONIC MATERIAL FOUND IN MICHIGAN MSW SAMPLES

Advertising Button	Controller	Nintendo Game-boy	Smoke detectors (3)
Air compressor	Cords (36)	Outlet	Solar lights (2)
Alarm clocks (3)	Digital blood pressure monitor	Pencil sharpener	Space heater
Bag of cords	Disk Drive	Phone jack	Speakers (5)
Battery pack	Drill	Plugs (6)	Spotlight
Boat motor	Elec. Toothbrush (2)	Portable CD player	TV CRT (2)
Boom box	Face exfoliator	Power board	TV non CRT (2)
Calculator (4)	Fans (4)	Power converter	Thermostat
Calculator clipboard	Flashlights (6)	Power source	Toaster
Camera	Hair dryer	Power strips (2)	Toy bear
Car CD adapter	Treadmill parts	Printers (2)	Toy car
Car chargers (3)	Industrial fan	Pumps (3)	Toy doll
Car lighter	Iron	Radio	Toys misc. (10)
Chargers misc. (7)	Lamps (4)	Razor	Toy tablet
Christmas Lights (5)	Leaf blowers (2)	Remote controls (5)	Transmitter
Circuit boards (3)	Light bulbs (21)	Roll of Cord	Vacuum parts
Coaxial cable	Light Switches (2)	Routers (2)	Vacuums (3)
Coffee makers (2)	Lights (3)	Satellite dish	VCR/DVD Player
Computer keyboard (4)	Microphone	Satellite receiver	Wrist watch
Computer mice (3)	Mixer	Slow cooker (2)	

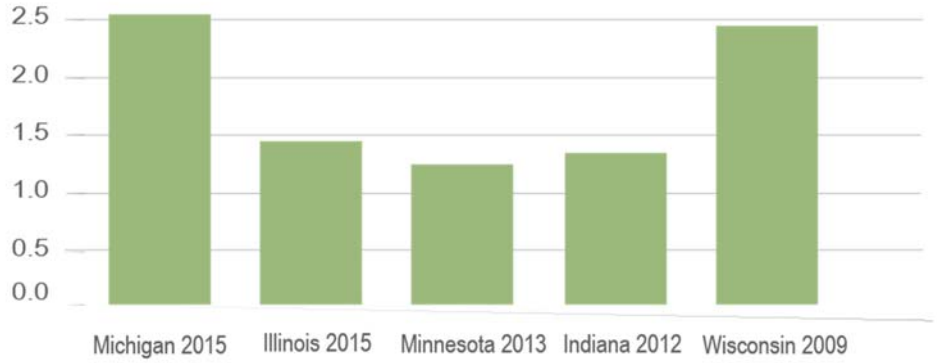
Electronic waste represents an estimated 2.5% of Michigan MSW disposed in landfills and incinerators. We expected to find predominantly problem materials such as cathode-ray tube televisions and high-value consumer and office equipment such as computers, laptops and cell phones. The material sampled was much more diverse, and much more mundane, ranging from small appliances to happy-meal toys. A full account of materials can be found in Table 5-2.

High-value products were encountered, but comingled with low-value products to such a degree that it made the category worthless in aggregate. Problem materials were also encountered, and under the same circumstances. Thus, based on our findings, there is no evidence to support that electronic waste represents a particularly valuable or hazardous factor in Michigan MSW characterization. The composition findings are consistent with that of other states, as demonstrated in Table 5-3.

TABLE 5-2:
BETWEEN-STATE COMPARISON OF ELECTRONIC WASTE

	Illinois	Indiana	Minnesota	Wisconsin
TVs/Monitors	0.4%	0.5%	0%	0.6%
Other Computer/Electronic	0.1%	0.1%	1.2%	0.6%
Small appliances	0.5%	0.7%	0%	0.8%
White goods	0.4%	0%	0%	0.4%
Total	1.4%	1.3%	1.2%	2.4%

FIGURE 5-1
Between States Comparison Electronic Waste Disposed (by mean% of weight)



Though electronic waste of the sort most prominently discussed was not encountered in significant quantities during this project, it is nonetheless a priority concern, and electronic waste in general is a much larger percentage of the MSW composition in Michigan than in other Great Lakes states or nationally, as shown in Figure 5-1, so there is opportunity for improvement.

Hazardous Waste Concerns

The primary concern for allowing electronic waste into landfills and incinerators is potential negative impacts from toxic and hazardous components.

The most prominent issues regarding the hazardous components of e-waste include the lead in cathode ray tube (CRT) televisions and monitors, the metals on printed circuit boards, and mercury in screens, lamps and switches. The tube or glass funnel in a CRT monitor uses a leaded glass and one tube can contain approximately 1 to 3 kg of lead. Printed circuit boards, which are found in the majority of electronic items, use a lead and tin mix in their solder, cadmium and beryllium in contacts and occasionally have mercury in switches. Mercury is also commonly found in fluorescent lamps of laptop screens and some batteries.

The first attempts to quantify the hazardous impact of e-waste in the landfill were a series of experiments using the U.S. EPA Toxicity Characteristic Leaching Procedure (TCLP). The TCLP is a laboratory experiment that is used to determine whether a solid waste is hazardous from the leaching of hazardous pollutants. While household wastes are exempt from the categorization of hazardous waste, scientists were still interested in testing electronics using this method.

In 1999 an academic study found that on average the leachable lead concentration for a CRT was 18.5 mg/l, well above the 5 mg/l regulatory limit. In 2004 the laboratory group did a similar study using the TCLP and a modified TCLP to test the leachable lead concentration in other electronics items including computers, computer accessories, VCRs, printers, and cell phones and found that all items surpassed the regulatory limit in at least one test. The researchers that used the TCLP admitted that they did not represent landfill conditions and since then others have attempted to determine the potential for hazardous leachate in environments closer to that of a landfill, with mixed results.

Whether or not e-waste will significantly impact landfill leachate, it is still necessary to begin to quantify the amount of hazardous material being deposited in landfills and incinerators via e-waste. For our study, we had intended to quantify the hazardous impact laptop screens and CRT monitors using information from Table 5-3. These materials were not found in large enough quantities to make any calculations meaningful.

TABLE 5-4:
AMOUNT OF LEAD AND MERCURY FOUND IN COMMON ELECTRONIC COMPONENTS

Material	Commonly Found in	Quantity
Mercury	Laptop Screen	.12mg - 50mg per laptop
Lead	CRT Monitor	.4 - 3kg per monitor

Source: Global Knowledge Partnerships in e-Waste Recycling

TABLE 5-5:
HAZARDOUS SUBSTANCES COMMONLY FOUND IN ELECTRONIC EQUIPMENT

Substance	Occurrence in e-waste
Halogenated compounds:	
- PCB (polychlorinated biphenyls)	Condensers, Transformers
- TBBA (tetrabromo-bisphenol-A)	Fire retardants for plastics (thermoplastic components, cable insulation)
- PBB (polybrominated biphenyls)	Flame retardants
- PBDE (polybrominated diphenyl ethers)	Flame retardants
- Chlorofluorocarbon (CFC)	Cooling unit, Insulation foam
- PVC (polyvinyl chloride)	Cable insulation
Heavy metals and other metals:	
- Arsenic	Small quantities in the form of gallium arsenide within light emitting diodes
- Barium	Getters in CRT
- Beryllium	Power supply boxes which contain silicon controlled rectifiers and x-ray lenses
- Cadmium	Rechargeable NiCd-batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines (printer drums)
- Chromium VI	Data tapes, floppy-disks
- Lead	CRT screens, batteries, printed wiring boards
- Lithium	Li-batteries
- Mercury	Fluorescent lamps that provide backlighting in LCDs, in some alkaline batteries and mercury wetted switches
- Nickel	Rechargeable NiCd-batteries or NiMH-batteries, electron gun in CRT
- Rare Earth elements (Yttrium, Europium)	Fluorescent layer (CRT-screen)
- Selenium	Older photocopying-machines (photo drums)
- Zinc sulphide	Interior of CRT screens, mixed with rare earth metals
Others:	
- Toner Dust	Toner cartridges for laser printers / copiers
Radio-active substances:	
- Americium	Medical equipment, fire detectors, active sensing element in smoke detectors

Source: Global Knowledge Partnerships in e-Waste Recycling

E-Waste Material Value

The secondary concern for allowing electronic materials into landfills is the loss of the resources and corresponding potential for economic gain. Although our study suggested that the material encountered had little economic value, more promising estimates do exist. The Institute of Scrap Recycling Industry estimates that electronics recycling has contributed $20.6 billion to the US economy and employs more than 45,000 full-time employees.

Currently, there are 26 electronics recycling companies that are registered with the MDEQ. Businesses and consumers bring electronics to local recycling facilities that disassemble them into commodities which can be sold. Some materials are sold to be directly recycled like scrap ferrous metal, scrap plastic, and certain kinds of glass.

Other commodities such as whole laptops, power supplies, circuit and motherboards, batteries, RAM, processors, disk drive, and hard drives are more valuable when sold intact to companies that can either reuse them or specialize in the recycling of that commodity.

In some cases, usable or refurbished electronics, particularly computers, are shipped overseas in order to provide access to digital resources to people in developing nations who could not afford new products. Computers and computer parts are the most valuable commodities for electronics recyclers. Table 5-6 describe the composition of three common types of electronics and Table 5-7 shows a range of prices for those commodities.

This material did not appear in significant enough quantities to track.

TABLE 5-6: COMPOSITION OF COMMON ELECTRONIC MATERIALS		
Desktop Computer	Weight in g	Percent of Total
Power Supply	1,330	10.90%
CD Drive	500	4.10%
A-Drive	510	4.18%
Hard Drive	500	4.10%
PWBW	900	7.38%
Mix wiring/Cord	960	7.86%
Scrap Steel	7,000	57.38%
Plastic	500	4.10%
Printer		
Toner Cartridge	70	1.07%
Mix wiring	200	3.06%
PWB	660	10.11%
Plastic Steel Mix	3,000	45.94%
Steel	1,300	19.91%
Plastic	1,300	19.91%
CRT Monitor		
Mixed Wiring and Cords	460	3.32%
PWB	1,300	9.39%
Deflection Coil	580	4.19%
Thick Wire	100	0.72%
CRT Screen	8,500	61.42%
Plastic Casing	1,900	13.73%
Mix metal	1,000	7.23%
Source: Global Knowledge Partnerships in e-Waste Recycling		

TABLE 5-7:
PRICES FOR ELECTRONIC COMMODITIES

Description	Price in US Dollars/Lbs
AC Adapter	$0.10 - $0.34
CDs/Floppy Disk	$0.05
Cell phones	$3.50 - $5.50
Gold Memory RAM	$10 - $11
Mother Boards	$1.10 - $3.50
Hard Drives	$0.70 - $1
Landline phone	$0.10
Keyboard/Mouse	$0.04 - $0.07
Li-Ion Battery	$0.75 - $1.65
Complete laptop	$0.80
Mixed Computer Wire	$0.60
Power Supplies	$0.10 - $0.38
CPU Processors	$26 - $35
Servers	$0.10 - $0.35
Printer/Copier	$0.07

(Source: Various internet sources. National estimates that are generally higher than an electronics recycler would likely see in Michigan.)

Landfill Ban Context

In 2008 the State of Michigan enacted an addition to the Natural Resources and Environmental Protection Act of 1994 that outlined requirements for television and computer manufacturers to support recycling efforts for their products. The law took effect in 2010, making Michigan one of 23 states which have passed consumer responsibility laws that address the recycling of televisions, computers, or other electronic items.

Computer and television manufacturers have slightly different requirements: Computer manufacturers only need take back computers that they manufactured, while television manufacturers must take back any brand of television. Television manufacturers also have a non-binding target to collect 60% of the number of televisions sold the previous year. Both are permitted to collaborate in groups or to contract a third party to meet the take-back requirements In 2014, 78 television and computer manufacturing companies registered with the Michigan MDEQ. Manufacturers reported collecting 12,920 tons of material, while the Michigan Recycling Index estimated 24,000 tons in total were recycled.

Recently, many manufacturers have reduced funding for these programs in Michigan, forcing collectors and recyclers of CRT televisions and computer monitors, who had previously received subsidies from the manufacturers, to either stop collecting the material or require customers to pay a fee to have their CRT recycled. There was an expectation that this study would encounter a significant number of CRT televisions. These were found, but it did not represent a noteworthy portion of e-waste or MSW.

To help address this issue and related concerns, there is discussion of a landfill ban for some types of e-waste in Michigan. Some 12 states currently have bans on the incineration or landfill of certain electronic items. In Michigan, the only items related to electronics that are currently banned from landfills and incineration facilities are appliances containing refrigerants and lead acid batteries.

Illinois addressed electronic waste concerns with a landfill ban of certain materials in 2011, similar to regulations currently under consideration in Michigan. The impact of that legislation can be measured through the 2009 and 2015 MSW characterization studies. Though the overall amount of electronic waste is consistent between the two years, there are subtle differences in the material categories targeted by the law.

TABLE 5-8:
ILLINOIS ELECTRONIC WASTE AS PERCENTAGE OF MSW

	2015	2009
Televisions	0.2	0
Computer Monitors	0.1	0.2
Computer Equipment/Peripherals	0.2	0.2
Electronic Equipment	0.5	1.0
White goods	0.4	0
Total	1.4	1.4

5-3 DEPOSIT CONTAINERS

In total, 522 deposit containers were encountered during the waste sorts. The total weight of this material was 56.28 pounds. The total weight of sorted samples was 20,634 pounds. From this we can calculate the deposit value of these unredeemed containers via two potential methods, one using the quantity of cans sampled per ton, and one using composition by weight.

TABLE: 5-9
CALCULATED DEPOSIT VALUE OF BEVERAGE CONTAINERS IN MSW DISPOSED AT LANDFILLS AND INCINERATORS

Method 1		Method 2	
Est. Containers per Ton MSW	50.6	Weight per container (lbs)	0.107816092
Total MSW	8,862,241	Est. Total Wt. Deposit	49,170,000
Total Containers	448,429,394	Total Containers	456,054,371
Deposit Value	$44,842,939	Deposit Value	$45,605,437

The two methods produce similar results in a range of $44.8 million to $45.6 million. According to the Michigan Department of Treasury, in 2013, the latest year for which data was available at the time of this study, Michigan retailers collected $368.3 million in bottle deposits. Some 94.5% of those deposits were redeemed, leaving approximately $21.5 million unredeemed.

Allowing for variance between 2013 deposit data and 2015 MSW data, and keeping in mind that our study was not designed to test recovery rates of deposited containers or the effectiveness of the bottle deposit law, our findings suggest an inconsistency between the amount of deposited containers being disposed of in Michigan landfills and incinerators, and the amount that should be available for disposal. Our findings suggest that there is more than double the number of deposited beverage containers in Michigan MSW than what deposit statistics suggest there should be.

This could possibly be explained by differences between 2013 and 2015 expectations, as 2013 represented a 20-year low for both deposits collected and redeemed, though unredeemed deposits that year were the highest since 2000. Further research is merited.

Regardless of explanation, deposit containers are meaningless to the composition of MSW disposed (0.29%), but somewhat meaningful to the total value of available material ($15 million), albeit less than the value of the unredeemed deposits.

Despite the unexpected number, deposit containers were still a de minimis, or insignificant, quantity at all sites.

5-4 EXPANDED POLYSTYRENE FOAM

A secondary impact of the project was to estimate the potential impact on the waste stream of replacing expanded polystyrene foam packaging with compostable alternatives derived from organic material.

Though EPS foam, commonly associated with the Styrofoam brand, is a key concern for sustainability-minded consumers and businesses, it was not a significant percentage of MSW composition by weight, less than 1%.

As an unscientific measure of volume we calculated the number of bins of material sorted throughout the project, as shown in Table 5-10. While EPS did represent a larger percentage of bins, it was very near the minimum number of bins that would be found for materials that occurred in all samples sorted. EPS is not a significant factor in the MSW waste stream.

EPS was also not a factor in the material value of MSW disposed. Interviews with WMSBF Task Force members that process EPS foam indicated that it was done strictly as a value-added service for customers. Densified foam was reported to have some value, but ultimately the material is not profitable to recycle under current conditions, and it is extremely difficult to locate recyclers interested in processing the material. As such, EPS is the only category that we have defined as not recyclable or compostable in our findings apart from the Other Inorganics category created specifically for materials that could not be recycled, composted or otherwise diverted.

Compostable packaging is represented in the Other Organic category during the waste sorts. We did not track the quantity of this material specifically, but empirical observations suggest it would be a very small quantity in context of aggregate MSW by weight or volume.

EPS foam may have much greater relevance to the waste streams of individual consumers and businesses, and there are certainly sound environmental reasons for reducing its use in favor in practice or in favor of alternatives. It has little relevance in the context of aggregate statewide MSW composition.

TABLE 5-10: QUANTITY OF BINS SORTED BY MATERIAL		
Categories:	Bins	% of Total Bins
Corrugated	202	9.43%
Other Inorganic/Non-Combustibles	191	8.91%
Mixed Paper	186	8.68%
Plastic Packaging	183	8.54%
Plastic	138	6.44%
Other Organics/Combustibles	127	5.93%
Plastic Bags	107	4.99%
Food Waste	100	4.67%
Wood	93	4.34%
Ferrous	86	4.01%
Polystryrene	*82*	*3.83%*
Textiles	81	3.78%
PET Beverage	76	3.55%
Aluminum	74	3.45%
Newsprint	71	3.31%
Glass	71	3.31%
Yard Waste	70	3.27%
Electronics	70	3.27%
MI Deposit	69	3.22%
Household Hazardous Waste	45	2.10%
Soil	21	0.98%
Minimum 79 bins for material found in all sample (1 bin for each of 79 samples).		

5-5 ILLINOIS RECYCLING RATE IMPROVEMENTS

Before discussing recommendations for improving MSW recovery rates in Michigan, we conclude our findings with two graphs appropriated from the 2015 Illinois MSW characterization study detailing changes in recovery rates between 2008 and 2014. A thorough examination of recycling programs in other states was not an objective of this study, so we do not have a great deal of insight into what is presented in Table 5-6 and Figures 5-3 and 5-4 below.

We can highlight that from 2008 to 2014 Illinois increased its statewide recycling rate from 19.1% to 37.3% through the activities and improvements detailed below, which includes some notable differences and surprising similarities to Michigan. The report did indicate that changes in data collection may account for some of the improvements, especially for Construction and Demolition Waste, but it serves as a meaningful baseline nonetheless.

Table 5-11: Comparison of 2014 and 2008 Illinois Recovery/Diversion Rates

	2008 Recovery Tons	2014 Recovery Tons	2008 Recovery %	2014 Recovery %	Recovery Difference
Paper	1,790,500	2,087,200	33.3%	43.5%	10.2%
Beverage Containers	2,100	2,400	6.1%	6.5%	0.4%
Plastic	131,500	167,700	6.2%	8.1%	1.9%
Glass	120,500	140,500	21.7%	25.3%	3.6%
Metal	147,400	666,700	16.6%	57.4%	40.8%
Organics	516,400	560,700	14.0%	14.3%	0.2%
Inorganics	518,000	645,400	59.0%	57.4%	40.8%
Textiles	21,900	141,100	2.0%	19.0%	17.0%
HHW	120,400	108,000	65.2%	62.3%	-2.8%
C&D	241,300	2,714,600	5.9%	56.9%	51.1%
Total*	3,610,000	7,234,300	19.1%	37.3%	18.3%

*Numbers rounded to nearest 100 tons

Note that:

- Illinois demonstrated no marked improvement in recycling of plastic in general, and its current plastic recycling rate is identical to that of Michigan. It did demonstrate an enormous increase in HDPE, the highest value plastic commodity, represented within the plastic packaging category in our study.
- Illinois improved paper in general, and corrugated cardboard and boxboard specifically. Its paper recycling rate is more than twice that of Michigan. It increased its corrugated cardboard recycling rate to over 50% recovery.
- Illinois increased its textile recycling rate to nearly 20%. Michigan recovers just 9% of its textiles.
- Illinois increased is metal recycling rate dramatically to more than 50%. Michigan recovers 35% of its metal from MSW.

FIGURE 5-2
Comparison of 2014 and 2008 Illinois
Recovery/Diversion Rates

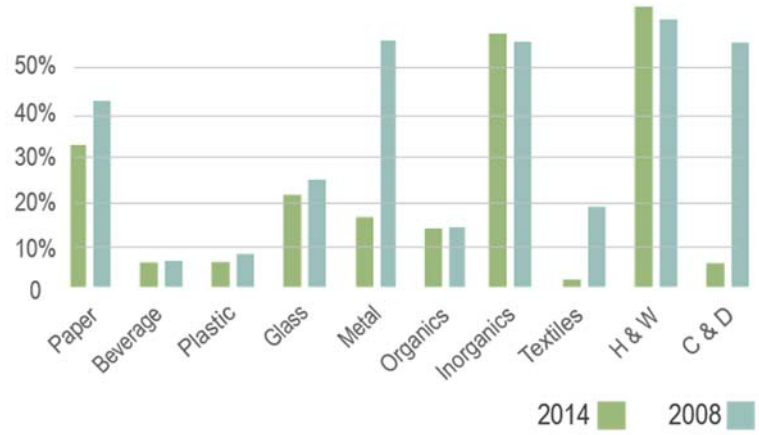
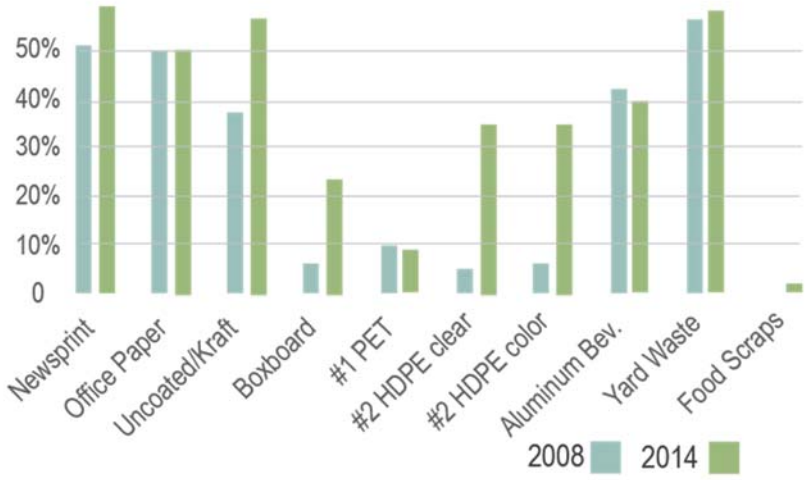


FIGURE 5-3
Comparison of 2014 and 2008 Illinois
Recovery/Diversion Commodity Materials



RECOMMENDATIONS

Efforts to increase the recycling rate in Michigan should first focus on the 42% of materials that have market value, which would include all standard recyclable commodities but glass, plus textiles.

We argue that doubling the recycling rate itself is an arbitrary goal, albeit a worthwhile motivational tool. A potentially better metric would be the percentage of material of value in the waste stream, with a goal of reducing this to zero.

Keeping to the stated goal of doubling the Michigan recycling rate to 30%, our findings do provide a rough outline for how that might be best achieved. In total, the state must increase the quantity of diverted material by approximately 1.5 million tons per year through a combination of recovery and source reduction.

1. **Aggressively promote efforts to increase recovery of corrugated cardboard, prioritizing commercial audiences.** This is an ideal opportunity and should be considered "low-hanging fruit." Corrugated cardboard is among the state's highest volume materials. It is perhaps the easiest material to recycle, and boasts a net recycling value of $55 per ton, the highest return among high-volume material. The market for the material is well-developed and not likely to experience any significant technological or market upheavals in the foreseeable future.

2. **Support efforts to increase availability and usage of conventional recycling programs with a goal to increase recovery of non-corrugated paper products, metal, and high-value plastic resins HDPE and PET.** As demonstrated in the economic analysis section, there are a limited number of recyclable commodities that can be recycled without subsidy, and fewer still in high demand. Efforts to increase recycling in Michigan should prioritize diverting materials of value from the waste stream.

3. **Through recovery or source reduction, decrease the quantity of electronic waste disposed of in Michigan landfills by half.** As a percentage of MSW, Michigan disposes twice the amount of electronic waste as any of its neighboring states. This would represent a dramatic improvement, considering that the state currently recycles just 9% of electronic waste. A landfill ban could potentially achieve this.

4. **Promote source reduction and diversion of food waste.** Food waste is the most prevalent material found in Michigan MSW. It is a prime candidate for source reduction, which could be achieved through commercial efficiencies or consumer behavior change. As an alternative, feeding the hungry is a universally positive diversion opportunity. Composting, agriculture and renewable energy also offer diversion opportunities for consideration.

5. **Promote source reduction of low-value plastic resins.** Michigan recycles 5% of plastic volumes currently, and it seems likely that the highest concentration of that is occurring with high-value, easy-to-recycle materials such as PET and HDPE. Low-value resins are notoriously difficult to recycle due to logistical and financial challenges, which limits the potential

effectiveness of efforts to improve recycling of those commodities. From a quantity standpoint, if the state were to quadruple its plastic recycling performance it would only increase the state's recycling rate by a few percentage points.

Strategies intended to promote packaging efficiency, reusable products and other source reduction tactics could have a more noticeable impact on Michigan's MSW characterization and recycling rate.

As an alternative, the state might pursue game-changing market development activities.

6. **Initiate efforts to increase recycling channels for textiles and promote availability of textile recycling.** Though a minor impact in terms of aggregate recycling rate, this would have a significant impact on the total value of materials recovered. This opportunity deserves greater attention than what it is currently receiving. There is also clear potential for improvement: Michigan's textile recycling rate (9%) is half that of Illinois (20%).

7. **Educate the public on the financial difficulties of recycling and waste diversion.** The majority of MSW disposed in Michigan landfills and incinerators has no market value as an unprocessed commodity.

8. **Pursue opportunities for further study highlighted in this report.**

    - Performance of yard waste ban in context of high-concentration of non-banned materials that would be classified as yard waste.

    - Recovery rate of deposited containers in context of discrepancies suggested in this report between the number of deposited containers being disposed and recovered.

    - Repeat characterization study within three to five years. The results reported in this study represent a baseline, the state's first derived from field study and verifiable commodity prices. A repeat study will allow for the visualization of improvements over time, both in recycling performance and in economic conditions. That is when the full value of this activity will be realized, and a timely opportunity given groundswell of efforts to increase recycling in Michigan in the near future.

6-1 WEST MICHIGAN CHARACTERIZATION REPORT

Though a statewide resource, this project was driven by West Michigan stakeholders, and focused a disproportionate amount of its efforts on the seven-county West Michigan Prosperity Region. The following pages highlight regional composition and valuation findings.

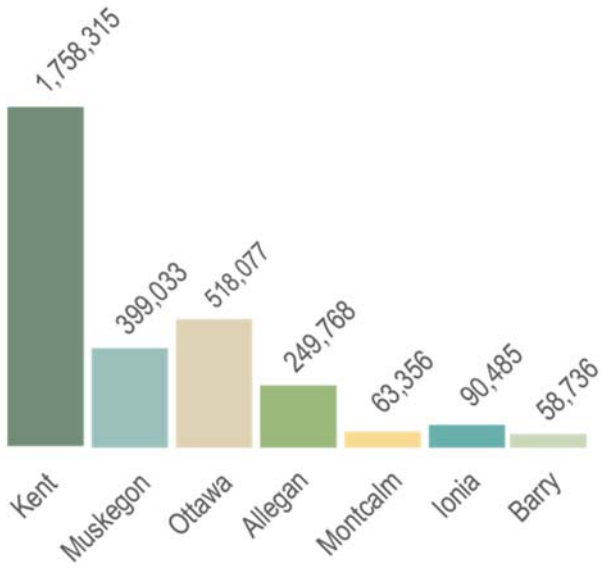
West Michigan Municipal Solid Waste

The seven-county region generated 1,046,013 tons of municipal solid waste in 2014, which was disposed of between 18 different facilities throughout Michigan. Approximately 97% of that was processed locally.

The region is a net importer of MSW from other parts of the state, but as that material would not likely be available to local recyclers and composters, it is not relevant to this study. However, in this section there is a distinction between MSW disposed and generated. We reason that only MSW generated locally can be recycled or composted locally.

The quantity of West Michigan MSW is described in Figure and Table 6-1.

FIGURE 6-1
Total MSW Disposed in West Michigan
by Volume in Cubic Yards



Our study included sites in four counties: Kent, Muskegon, Ottawa, and Montcalm. Sites sampled in Kent County represented 93% of MSW generated in the county, and 86% in Muskegon County. This allowed us to quantify the composition separately for the two counties. The other five counties are represented in the West Michigan characterization.

TABLE 6-1:
WEST MICHIGAN COUNTY MUNICIPAL SOLID WASTE BY VOLUME (in cubic yards)

	Kent	Muskegon	Ottawa	Allegan	Montcalm	Ionia	Barry	Six-County Area
South Kent	708,126	0	35,389	66,379	0	647	12,824	823,365
Kent County WTE	547,446							547,446
Autumn Hills	109,897	55,758	243,808	93,787	9,441	9,634	85	522,410
Ottawa Farms	49,380	187,429	236,696	31,255	409	7		505,176
Central Sanitary	330,567				26,513	20,972		378,052
Muskegon County		156,116	2,184					158,300
CES Landfill	10,769			1,106	21	28,987	44,046	84,929
Granger Wood				2,911	6,719	26,822	1,633	38,085
Brent Run				29,710				29,710
Pitsch Ionia	2,090				17,768	2,243	61	22,165
SE Berrien				18,726				18,726
C&C				3,408			67	3,475
Venice Park					2,385	107		2,492
Orchard Hill				2,465			20	2,485
Granger Gr River				2		1,048		1,050
Northern Oaks					100			100
Vienna Junction	40							40
Westside				19		18		37
Total	1,758,315	399,303	518,077	249,768	63,356	90,485	58,736	3,138,040
Total Surveyed	1,635,519	343,545	274,269	97,634	26,922	21,626	12,824	2,399,515
Surveyed	0.93	0.86	0.53	0.39	0.43	0.24	0.22	0.77

3 cubic yard = 1 ton for municipal & commercial waste (MCW)

Source: 2014 MDEQ Solid Waste Annual Report, Kent County

Estimated waste composition for Muskegon and Kent Counties, and the West Michigan Regional Prosperity District, are in Table 6-2.

We sampled 54 vehicles from West Michigan, 14 vehicles from Muskegon County and 27 from Kent County.

A Muskegon County Landfill vehicle was omitted from the county calculations as it identified itself as originating from Cutlerville in Kent County. Given that the Muskegon County Landfill did not receive any MSW from Kent in 2014, this did not seem likely to be accurate. Presumably the vehicle actually originated in Coopersville or a like-sounding community. The data is included in the West Michigan calculations, as we are confident it originated in West Michigan.

An earlier version of this data was calculated using a methodology that weighted the landfill compositions against the amount of waste they receive from each community. This seemed to best follow the methodology used to calculate the state MSW. However, when examining outliers for each of the local compositions, it became apparent that they were being skewed by site-specific outliers that were not representative of the vehicles that had originated in the local communities.

Using the same methodology as described in Section 4, we also have estimated the value of MSW generated in West Michigan that is currently being disposed in landfills and incinerators.

Further, to identify notable variances between Kent and Muskegon county variances and the rest of the state, we calculated variance and Z Scores for each material. Material categories with a Z score greater than +/- 0.5 were flagged.

TABLE 6-2
COMPOSITION OF DISPOSED MSW GENERATED LOCALLY
(mean % by weight)

	Muskegon County	Kent County	West Michigan	Michigan
Material		(%)		
Paper				
Mixed	10.55%	12.00%	11.36%	12.07%
Newsprint	2.22%	0.99%	1.32%	1.22%
Corrugated	8.93%	8.56%	7.98%	8.42%
Subtotal Paper	21.7%	21.55%	20.66%	21.71%
Plastic				
Plastic (#3,4,5,7)	4.70%	3.52%	4.32%	4.10%
Plastic Bags	4.04%	2.23%	2.74%	2.77%
Plastic Packaging (#2-5,7)	4.70%	5.51%	5.14%	5.50%
PET Beverage (#1)	1.06%	0.91%	0.95%	0.94%
Polystyrene	0.71%	0.70%	0.72%	0.71%
Subtotal Plastic	14.51%	12.87%	13.87%	14.02%
Metals				
Ferrous	3.59%	3.17%	3.59%	3.32%
Aluminum	0.62%	0.44%	0.48%	0.43%
Subtotal Metals	4.21%	3.61%	4.07%	3.75%
Other Wastes				
Textiles	5.11%	2.20%	3.77%	3.65%
Bulk Items	0.73%	0.83%	0.70%	1.20%
Other Inorganics	11.84%	18.37%	15.36%	14.65%
Subtotal Other Wastes	17.68%	21.40%	19.83%	19.50%
Organic				
Food Waste	12.30%	12.62%	12.61%	13.57%
Yard Waste	1.33%	5.62%	4.42%	5.00%
Soil	1.88%	1.88%	3.37%	2.36%
Wood	6.83%	6.48%	6.15%	5.19%
Other Organics	9.65%	8.80%	8.46%	9.05%
Subtotal Organics	31.99%	35.40%	35.01%	35.17%
MI Deposits	0.27%	0.30%	0.27%	0.29%
Glass	1.59%	2.86%	2.34%	2.15%
Household Hazardous	2.10%	0.72%	0.87%	0.93%
Electronics	5.24%	1.31%	3.07%	2.49%
Vehicles Sampled	14	27	54	78

TABLE 6-3:
COMPOSITION OF DISPOSED MSW GENERATED IN WEST MICHIGAN
(mean % by weight)

			Conf Int. (90%)					Conf Int. (90%)	
Material	Mean	Stdev	Lower	Upper	Material	Mean	Stdev	Lower	Upper
Paper					Other Wastes				
Mixed	11.36%	5.54	10.10%	12.62%	Textiles	3.77%	3.95	2.87%	4.67%
Newsprint	1.32%	1.65	0.95%	1.70%	Bulk Items	0.70%	2.01	0.24%	1.16%
Corrugated	7.98%	6.34	6.53%	9.42%	Other Inorganics	15.36%	11.02	12.85%	17.87%
Subtotal Paper	20.66%		17.58%	23.74%	*Subtotal Other Wastes*	19.83%		15.96%	23.70%
Plastic					Organic				
Plastic (#3,4,5,7)	4.32%	3.81	3.45%	5.18%	Food Waste	12.61%	8.85	10.60%	14.63%
Plastic Bags	2.74%	1.85	2.32%	3.16%	Yard Waste	4.42%	7.64	2.68%	6.16%
Plastic Packaging (#2-5,7)	5.14%	2.85	4.49%	5.79%	Soil	3.37%	10.88	0.89%	5.84%
PET Beverage (#1)	0.95%	0.58	0.82%	1.09%	Wood	6.15%	8.83	4.14%	8.16%
Polystyrene	0.72%	0.51	0.61%	0.84%	Other Organics	8.46%	5.33	7.25%	9.68%
Subtotal Plastic	13.87%		11.69%	16.06%	*Subtotal Organic*	35.01%		25.56%	44.47%
Metals					MI Deposits	0.27%	0.41	0.18%	0.36%
Ferrous	3.59%	3.61	2.77%	4.41%					
Aluminum	0.48%	0.54	0.36%	0.61%	Household Hazardous	0.87%	2.38	0.32%	1.41%
Subtotal Metals	4.07%		3.13%	5.02%					
					Electronics	3.07%	6	1.71	4.44
Glass	2.34%	2.56	1.76	2.93					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are not calculated independently.

FIGURE 6-2
Composition of W. Michigan MSW Disposed
(mean % by weight

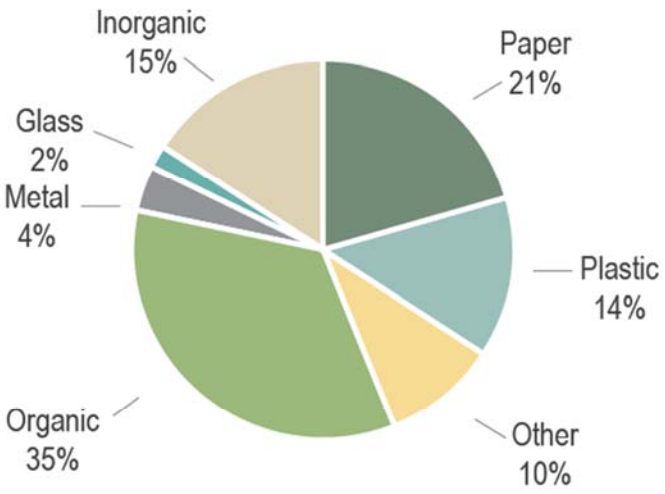


FIGURE 6-3
Plastics in W. Michigan MSW Composition
(mean % by weight)

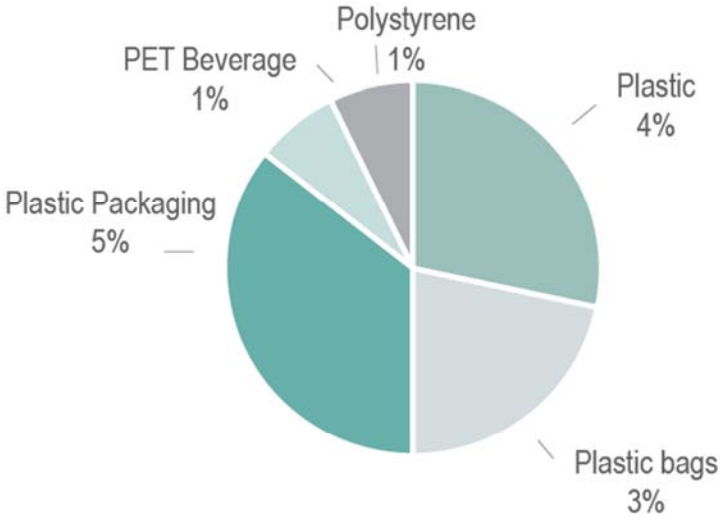


FIGURE 6-4
Paper in W. Michigan MSW Composition
(mean % by weight)

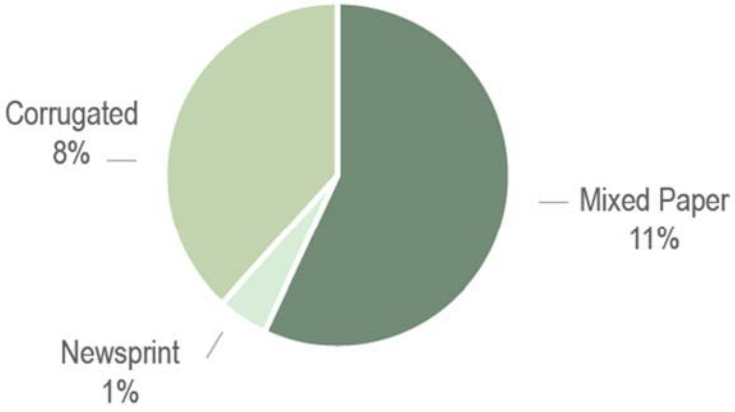


FIGURE 6-5
Organics in W.Michigan MSW Composition
(mean % by weight)

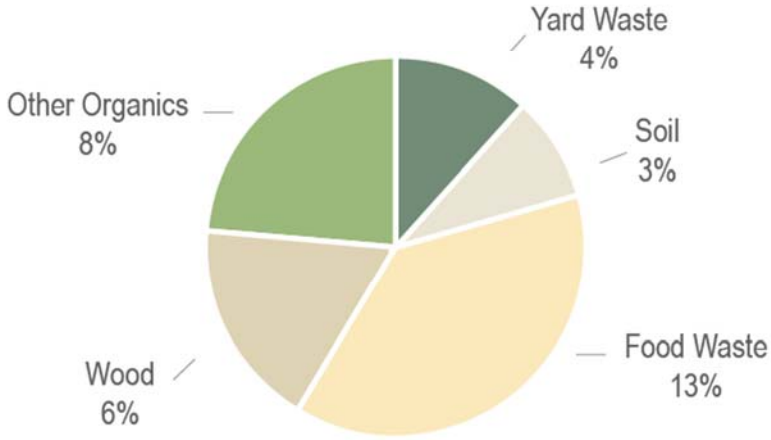
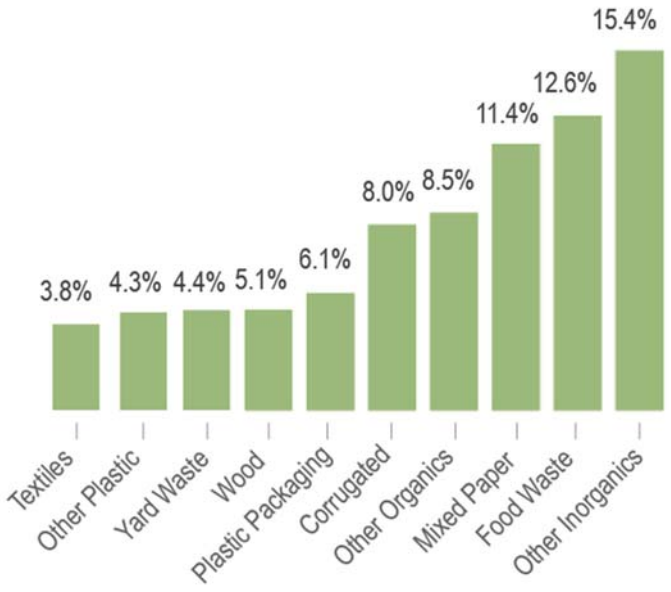


FIGURE 6-6
Top Materials in W. Michigan MSW Composition
(mean % by weight - 5% or greater)



West Michigan disposes of an estimated $52 million of recyclable MSW materials in landfills and incinerators each year. That total does include approximately 3,150 tons of ferrous metal that is reclaimed from incinerator ash.

FIGURE 6-7
Total Value in W. Michigan MSW Disposed
(mean % by weight)

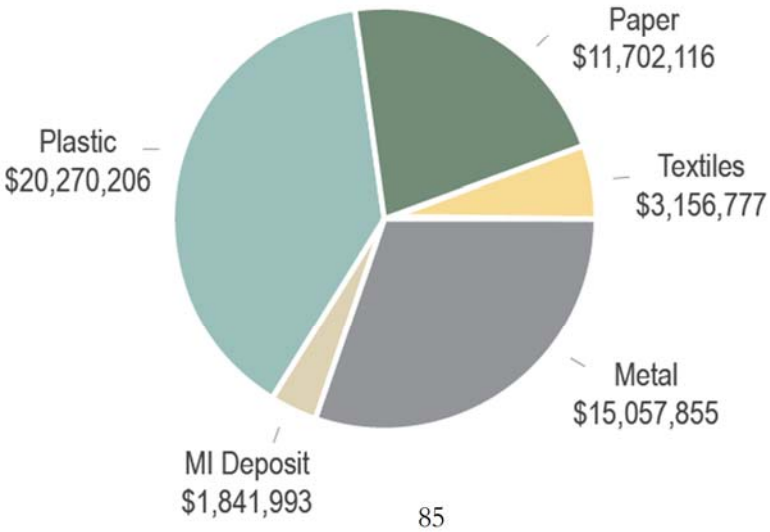


TABLE 6-4:
WEST MICHIGAN COMPOSITION (mean % by weight), AVAILABLE MATERIAL (tons) AND AVAILABLE MATERIAL VALUATION ($ in 000s)

Material	Comp.	Available Material	Value	Material	Comp.	Available Material	Value
Paper				Other Wastes			
Mixed	11.36%	118,833	$4,070,508	Textiles	3.77%	39,460	$3,156,777
Newsprint	1.32%	13,841	$808,080	Bulk Items	0.70%	7,295	0
Corrugated	7.98%	83,435	$6,823,528	Other Inorganics	15.36%	160,675	0
Subtotal Paper	20.66%	216,109	$11,702,115	*Subtotal Other Wastes*	19.83%	207,430	$3,156,777
Plastic				Organic			
Plastic (#3,4,5,7)	4.32%	45,153	$3,096,167	Food Waste	12.61%	131,929	0
Plastic Bags	2.74%	28,704	$2,066,689	Yard Waste	4.42%	46,213	0
Plastic Packaging (#2-5,7)	5.14%	53,797	$12,018,620	Soil	3.37%	35,199	0
PET Beverage (#1)	0.95%	9,983	$3,088,730	Wood	6.15%	64,321	0
Polystyrene	0.72%	7,562	0	Other Organics	8.46%	88,511	0
Subtotal Plastic	13.87%	145,199	$20,270,206	*Subtotal Organic*	35.01%	366,173	0
Metals				MI Deposits	0.27%	2,805	$1,841,993
Ferrous*	3.59%	37,539	$7,517,282				
Aluminum	0.48%	5,070	$7,540,572	Household Hazardous	0.87%	9,050	0
Subtotal Metals	4.07%	42,609	$15,057,854				
				Electronics	3.07%	32,146	0
Glass	2.34%	24,492	0				

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding.

6-2 KENT COUNTY CHARACTERIZATION

Kent County generated 586,105 tons of MSW that was disposed of in landfills and incinerators in 2014, split between seven sites in the West Michigan area. The vast majority of that is disposed of at the South Kent landfill in Byron Center and the Kent County Waste to Energy Facility in Grand Rapids. We sampled 27 vehicles from Kent County.

TABLE 6-5:
KENT COUNTY MSW BY SITE DISPOSED

	% of MSW
South Kent	40%
Kent WTE	31%
Central Sanitary	18%
Autumn Hills	6%
Ottawa Farms	3%
CES Landfill	0.6%
Pitsch Ionia	0.1%

Source: MDEQ Solid Waste Annual Report for FY 2014

No material categories varied significantly from that of the statewide composition.

FIGURE 6-8
Composition of Kent County MSW Disposed
(mean % by weight)

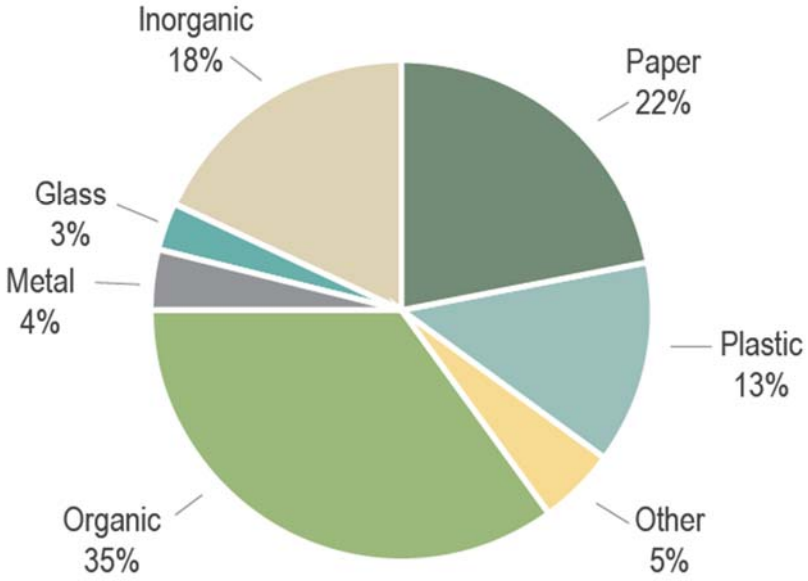
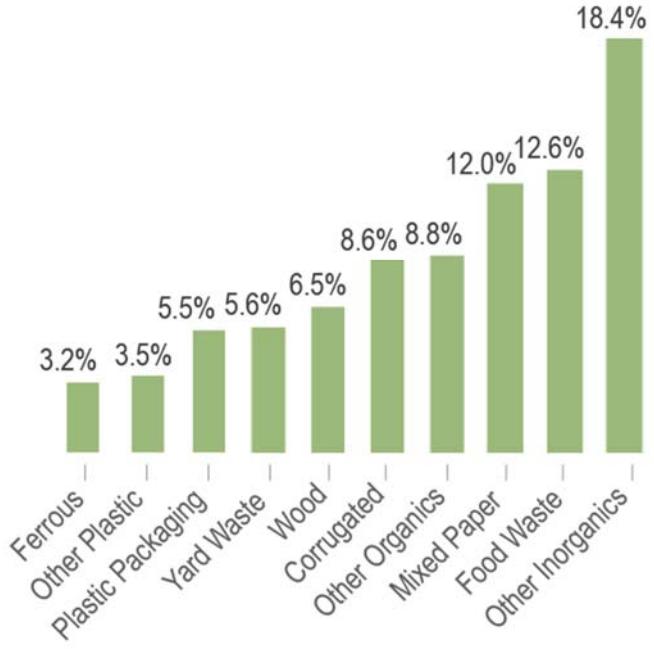


TABLE 6-6:
COMPOSITION OF DISPOSED MSW GENERATED IN KENT COUNTY
(mean % by weight)

			Conf Int. (90%)					Conf Int. (90%)	
Material	Mean	Stdev	Lower	Upper	Material	Mean	Stdev	Lower	Upper
Paper					Other Wastes				
Mixed	12.00%	5.65	10.15%	13.86%	Textiles	2.20%	1.63	1.66%	2.73%
Newsprint	0.99%	0.97	0.67%	1.31%	Bulk Items	0.83%	2.46	0.02%	1.63%
Corrugated	8.56%	6.02	6.58%	10.54%	Other Inorganics	18.37%	13.93	13.79%	22.94%
Subtotal Paper	21.55%	--	17.40%	25.71%	*Subtotal Other Wastes*	21.40%	--	15.47%	27.30%
Plastic					Organic				
Plastic (#3,4,5,7)	3.52%	2.59	2.67%	4.37%	Food Waste	12.62%	8.23	9.92%	15.32%
Plastic Bags	2.23%	1.22	1.83%	2.63%	Yard Waste	5.62%	7.64	3.11%	8.12%
Plastic Packaging (#2-5,7)	5.51%	3.02	4.52%	6.50%	Soil	1.88%	4.65	0.35%	3.40%
PET Beverage (#1)	0.91%	0.51	0.75%	1.08%	Wood	6.48%	11.14	2.82%	10.13%
Polystyrene	0.70%	0.52	0.53%	0.87%	Other Organics	8.80%	5.39	7.03%	10.57%
Subtotal Plastic	12.87%	--	10.30%	15.45%	*Subtotal Organic*	35.40%	--	23.23%	47.54%
Metals					MI Deposits	0.30%	0.54	0.12%	0.47%
Ferrous	3.17%	3.80	1.93%	4.42%					
Aluminum	0.44%	0.43	0.29%	0.58%	Household Hazardous	0.72%	1.55	0.21%	1.23%
Subtotal Metals	3.61%	--	2.22%	5.00%					
					Electronics	1.31%	1.52	0.81%	1.81%
Glass	2.86%	3.22	1.81%	3.92%					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are not calculated independently.

FIGURE 6-9
Top 10 Materials in Kent County Composition
(mean % by weight - 5% or greater)



Kent County disposes of an estimated $27.8 million of recyclable MSW materials in landfills and incinerators each year. That total does include approximately 3,150 tons of ferrous metal that is reclaimed from incinerator ash.

FIGURE 6-10
Total Value Kent County MSW Disposed
(mean % by weight)

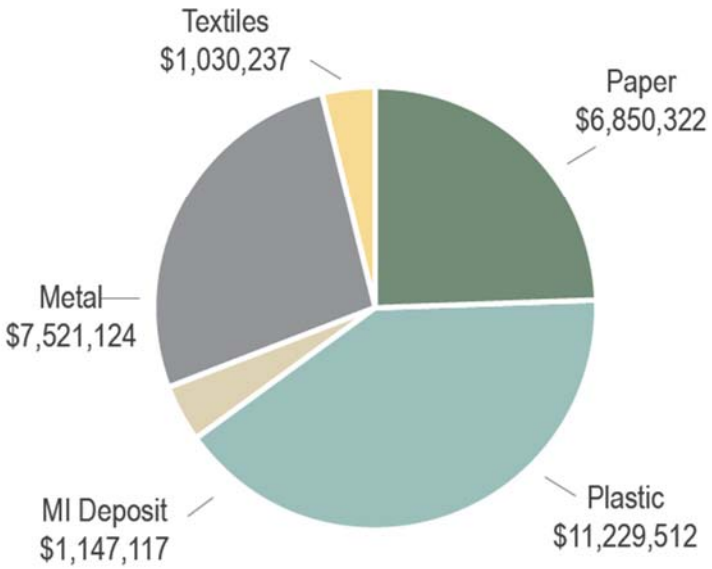


TABLE 6-7:
KENT COUNTY COMPOSITION (by weight), AVAILABLE MATERIAL (tons)
AND AVAILABLE MATERIAL VALUATION ($ in thousands)

Material	Comp.	Material	Value	Material	Comp.	Material	Value
Paper				Other Wastes			
Mixed	12.00%	70,346	$2,409,625	Textiles	2.20%	12,878	$1,030,237
Newsprint	0.99%	5,794	$338,298	Bulk Items	0.83%	4,853	0
Corrugated	8.56%	50,162	$4,102,400	Other Inorganics	18.37%	107,648	0
Subtotal Paper	21.55%	126,302	$6,850,322	*Subtotal Other Wastes*	21.40%	125,379	$1,030,237
Plastic				Organic			
Plastic (#3,4,5,7)	3.52%	20,637	$1,415,067	Food Waste	12.62%	73,963	0
Plastic Bags	2.23%	13,079	$941,679	Yard Waste	5.62%	32,911	0
Plastic Packaging (#2-5,7)	5.51%	32,289	$7,213,587	Soil	1.88%	10,994	0
PET Beverage (#1)	0.91%	5,363	$1,659,179	Wood	6.48%	37,960	0
Polystyrene	0.70%	4,104	0	Other Organics	8.80%	51,564	0
Subtotal Plastic	12.87%	75,472	$11,229,512	*Subtotal Organic*	*35.40%*	207,392	0
Metals			0	MI Deposits	0.30%	1,747	$1,147,117
Ferrous*	3.17%	18,593	$3,723,327				
Aluminum	0.44%	2,554	$3,797,796	Household Hazardous	0.72%	4,207	0
Subtotal Metals	3.61%	21,147	$7,521,124				
				Electronics	1.31%	7,671	0
Glass	2.86%	16,785	0				

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding.

6-3 MUSKEGON COUNTY COMPOSITION

Muskegon County generated 133,101 tons of MSW that was disposed of in landfills in 2014, split between three sites in the West Michigan area. Some 61% of MSW is processed outside of the county at private sector landfills in Ottawa County. The balance is processed at the Muskegon County Landfill in Ravenna. We sampled 14 vehicles from Muskegon.

TABLE 6-8:
MUSKEGON COUNTY
MSW BY SITE DISPOSED

	% of MSW
Ottawa Farms	47%
Muskegon County	39%
Autumn Hills	14%

Source: MDEQ Solid Waste Annual Report for FY 2014

Figure 6-11 and Table 6-9 detail the composition of MSW sampled from Muskegon County.

FIGURE 6-11
Composition of Muskegon Co MSW Disposed
(mean % by weight)

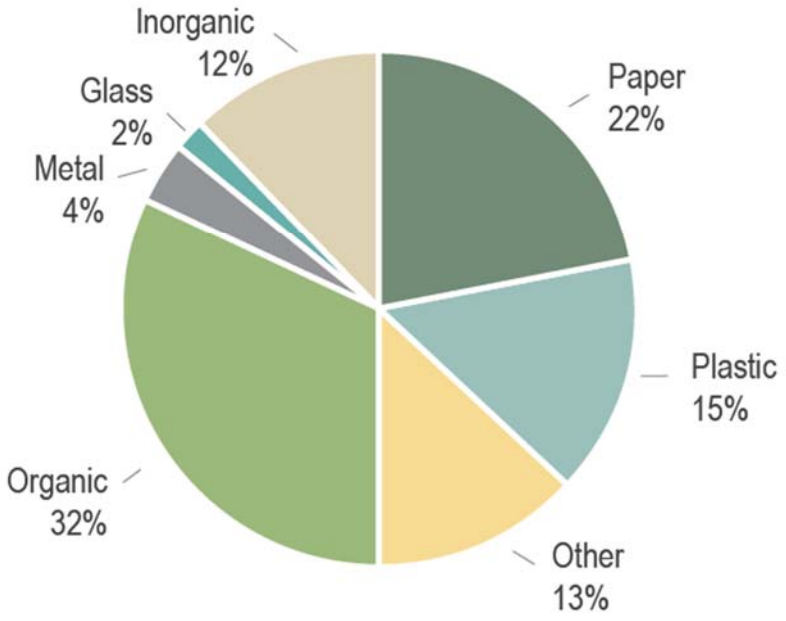
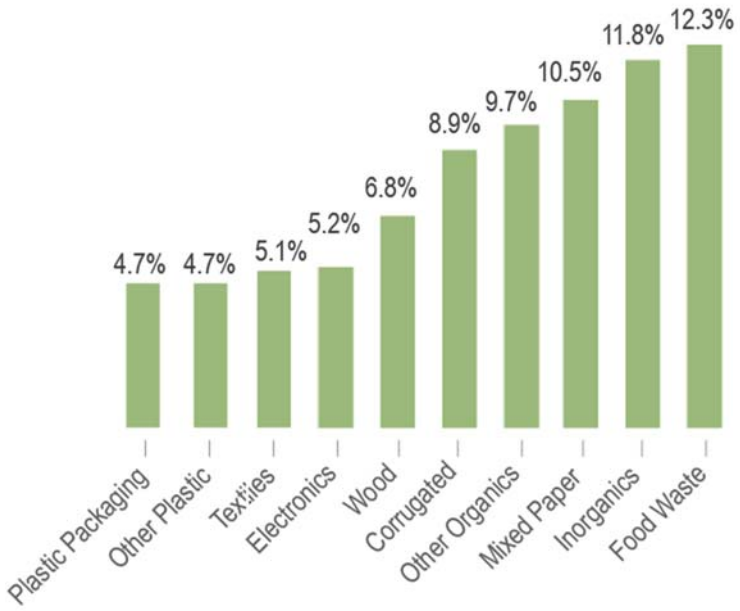


TABLE 6-9:
COMPOSITION OF DISPOSED MSW GENERATED IN MUSKEGON COUNTY
(mean % by weight)

			Conf Int. (90%)					Conf Int. (90%)	
Material	Mean	Stdev	Lower	Upper	Material	Mean	Stdev	Lower	Upper
Paper					Other Wastes				
Mixed	10.55%	4.36	8.48%	12.61%	Textiles	5.11%	5.05	2.72%	7.50%
Newsprint	2.22%	2.62	0.98%	3.46%	Bulk Items	0.73%	1.85	-0.15%	1.61%
Corrugated	8.93%	8.33	4.99%	12.87%	Other Inorganics	11.84%	5.15	9.41%	14.28%
Subtotal Paper	21.70%		14.45%	28.94%	*Subtotal Other Wastes*	17.68%		11.98%	23.39%
Plastic					Organic				
Plastic (#3,4,5,7)	4.70%	2.72	3.41%	5.99%	Food Waste	12.30%	7.56	8.72%	15.88%
Plastic Bags	4.04%	2.28	2.96%	5.12%	Yard Waste	1.33%	2.85	-0.02%	2.68%
Plastic Packaging (#2-5,7)	4.70%	3.81	2.90%	6.50%	Soil	1.88%	3.03	0.45%	3.32%
PET Beverage (#1)	1.06%	0.58	0.78%	1.33%	Wood	6.83%	5.91	4.03%	9.62%
Polystyrene	0.71%	0.41	0.51%	0.90%	Other Organics	9.65%	5.61	7.00%	12.31%
Subtotal Plastic	15.21%		10.56%	19.84%	*Subtotal Organic*	31.99%		20.18%	43.81%
Metals					MI Deposits	0.27%	0.23	0.16%	0.38%
Ferrous*	3.59%	2.5	2.41%	4.77%					
Aluminum	0.62%	0.58	0.34%	0.89%	Household Hazardous	2.10%	4.04	0.19%	4.02%
Subtotal Metals	4.21%		2.75%	5.66%					
					Electronics	5.24%	9.88	0.57%	9.92%
Glass	1.59%	1.90	0.69	2.49					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are not calculated independently.

FIGURE 6-12
Top 10 Materials in Muskegon County Composition
(mean % by weight - 5% or greater)



Muskegon County disposes of an estimated $7.2 million of recyclable MSW materials in landfills and incinerators each year.

FIGURE 6-13
Total Value Muskegon County MSW Disposed
(mean % by weight)

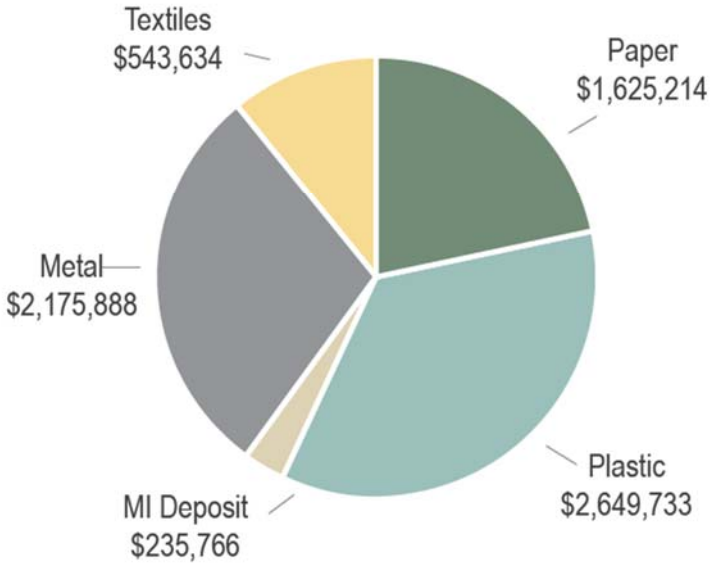


TABLE 6-10:
MUSKEGON COUNTY COMPOSITION (mean % by weight), AVAILABLE MATERIAL (tons)
AND AVAILABLE MATERIAL VALUATION ($ in thousands)

Material	Comp.	Material	Value	Material	Comp.	Material	Value
Paper				Other Wastes			
Mixed	10.55%	14,040	$480,926	Textiles	5.11%	6,795	$543,634
Newsprint	2.22%	2,950	$172,240	Bulk Items	0.73%	970	0
Corrugated	8.93%	11,886	$972,048	Other Inorganics	11.84%	15,766	0
Subtotal Paper	21.70%	28,876	$1,625,214	*Subtotal Other Wastes*	17.68%	23,531	$543,634
Plastic				Organic			
Plastic (#3,4,5,7)	4.70%	6,261	$429,310	Food Waste	12.30%	16,375	0
Plastic Bags	4.04%	5,381	$387,399	Yard Waste	1.33%	1,776	0
Plastic Packaging (#2-5,7)	4.70%	6,255	$1,397,501	Soil	1.88%	2,505	0
PET Beverage (#1)	1.06%	1,408	$435,523	Wood	6.83%	9,085	0
Polystyrene	0.71%	944	0	Other Organics	9.65%	12,850	0
Subtotal Plastic	15.21%	20,249	$2,649,733	*Subtotal Organic*	31.99%	42,591	0
Metals				MI Deposits	0.27%	359	$235,766
Ferrous*	3.59%	4,781	$957,365				
Aluminum	0.62%	819	$1,218,523	Household Hazardous	2.10%	2,801	0
Subtotal Metals	4.21%	5,600	$2,175,888				
				Electronics	5.24%	6,981	0
Glass	1.59%	2,114	0				

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding.

Four material categories stand out as statistically unique in Muskegon County's MSW composition according to the Z score test described in the local composition methodology. There is no obvious commonality between the materials to suggest why these outliers are unique to Muskegon.

TABLE 6-11
MUSKEGON COUNTY VARIANCES
(of mean % by weight)

Material	Muskegon	Michigan	Z Score
Newsprint	2.22%	1.22%	0.67
Plastic Bags	4.04%	2.77%	0.73
Household Hazardous	2.10%	0.93%	0.54
Electronics	5.24%	2.49%	0.51

We have not focused on site-specific findings thus far in this report, but given that there is a local interest in the composition of the Muskegon County landfill, a brief discussion seems prudent.

Of the 10 vehicles sampled, eight indicated they were from communities in Muskegon County, one contained a load mixed with material from Ottawa and Muskegon counties, and one was recorded as originating in Kent County. The Kent vehicle was omitted from the Muskegon and Kent calculations as this appeared to be an error. The facility received no waste from Kent in 2014. That vehicle was also the most noteworthy outlier of the entire project: 73% of the sample was soil.

TABLE 6-12:
COMPOSITION OF MSW DISPOSED AT MUSKEGON COUNTY LANDFILL
(mean % by weight)

			Conf Int. (90%)					Conf Int. (90%)	
Material	Mean	Stdev	Lower	Upper	Material	Mean	Stdev	Lower	Upper
Paper					Other Wastes				
Mixed	8.90%	5.29	5.83%	11.96%	Textiles	4.97%	5.63	1.71%	8.24%
Newsprint	2.40%	2.97	0.68%	4.12%	Bulk Items	1.02%	2.15	-0.23%	2.27%
Corrugated	7.35%	7.98	2.73%	11.98%	Other Inorganics	12.17%	5.32	9.09%	15.26%
Subtotal Paper	18.65%	--	9.24%	28.06%	*Subtotal Other Wastes*	18.16%	--	10.57%	25.77%
Plastic					Organic				
Plastic (#3,4,5,7)	4.84%	3.18	2.99%	6.68%	Food Waste	11.33%	8.94	6.14%	16.51%
Plastic Bags	3.52%	2.13	2.28%	4.75%	Yard Waste	0.89%	1.45	0.05%	1.73%
Plastic Packaging (#2-5,7)	3.39%	2.28	2.07%	4.71%	Soil	9.24%	22.59	-3.86%	22.34%
PET Beverage (#1)	0.92%	0.62	0.57%	1.28%	Wood	6.90%	7.11	2.77%	11.02%
Polystyrene	0.61%	0.45	0.35%	0.87%	Other Organics	9.05%	5.69	5.75%	12.35%
Subtotal Plastic	13.28%	--	8.66%	18.29%	*Subtotal Organic*	37.41%	--	10.85%	63.95%
Metals					MI Deposits	0.26%	0.25	0.12%	0.41%
Ferrous	3.81%	2.86	2.15%	5.47%					
Aluminum	0.58%	0.62	0.23%	0.94%	Household Hazardous	1.03%	2.10	-0.18%	2.25%
Subtotal Metals	4.39%	--	2.38%	6.41%					
					Electronics	5.72%	11.68	-1.05%	12.49%
Glass	1.10%	0.87	0.59%	1.60%					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Using the Z score methodology (<0.5+/-), six material categories were flagged as statistically unique, a larger number of outliers than at any other site. This may be partially due to sampling error, as this was the first facility sorted, and several protocol changes were made throughout the course of the first day of sorting.

The soil outlier can be explained by the unusual sample containing 73% soil. The electronics outlier can also be explained by an unusual load, with one sample containing 39% electronic material.

TABLE 6-13
MUSKEGON COUNTY LANDFILL VARIANCES

Material	Muskegon County Landfill	Michigan	Z Score
Mixed Paper	8.90	12.07	-.055
Newsprint	2.40	1.22	0.79
Plastic Packaging	3.39	5.50	-0.68
Yard Waste	0.89	5.00	-0.55
Soil	9.24	2.36	0.75
Electronics	5.72	2.49	0.63

For the purposes of this study, a Z score of +/-0.5 was considered a statistically significant difference from the mean of all sites surveyed.

BIBLIOGRAPHY

Abramowitz, Harvey and Yu Sun (2012) Municipal Solid Waste Characterization Study for Indiana. Hammond, IN: Purdue University Calumet.

About Compostables: Materials: Compostable Plastic. (n.d.). Retrieved March 12, 2015, from http://worldcentric.org/about-compostables/materials/plastics

Ackerman, Frank, Dmitri Cavander, John Stutz, and Brian Zuckerman (1995) Preliminary Analysis: the costs and benefits of bottle bills, a draft report to U.S. Environmental Protection Agency, Office of Solid Waste. EPA Contract No. 68-W3-0008. Tellus Institute.

Analysis of CRT Televisions and Monitor Recycling in U.S. Households. (2014, April). National Center for Electronics Recycling. Retrieved from http://www.electronicsrecycling.org/public/ContentPage.aspx?pageid=158

Basel Action Network and Silicon Valley Toxics Coalition. (2002). Exporting Harm: The High-Tech Trashing of Asia.

Basel Action Network (BAN). (n.d.). Retrieved March 6, 2015, from http://www.ban.org/

Brown, D., L., & Rosen, C., J. (2009). Backyard composting guide. Retrieved March 30, 2015, from http://www.extension.umn.edu/garden/yard-garden/soils/backyard-composting-guide/

Burns and McDonnell Engineering Company, Inc. (2013) 2013 Statewide Waste Characterization. Project No. 73536. St. Paul, Minnesota: Minnesota Pollution Control Agency.

Buzby, J., C., Wells, H., Farah, & Hyman, J. (2014). The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States (No. EIB - 121). USDA.

CleanEnergy (n.d.) Greater Detroit RRF (Resource Recovery Facility); Fundamentals of Renewable Energy Case Study, www.cleanerergyactionproject.com.

CDM Smith. (March 2015). Illinois Commodity/Waste Generation and Characterization Study

City of Grand Rapids. (n.d.). Frequently Asked Questions. Retrieved March 27, 2015, from http://grcity.us/community-development/Code-Compliance-Division/Pages/Frequently-Asked-Questions.aspx

Detroit Renewable Power (2015) www.detroitrenewablepower.com. Last accessed August 10, 2015.

Duan, H. T., Miller, R., Gregory, J., & Kirchain, R. (2015, December). Quantitative Characterization of

Domestic and Transboundary Flows of Used Electronics Analysis of Generation, Collection, and Export in the United States. StEP.

Duffy, Daniel P. (2015) Landfill Economics Parts 1-3. Available from: http://foresternetwork.com/daily/waste/landfill-management/landfill-economics/

Electronics Industry Revenues to Reach All-Time High in 2014, Projects CEA's Semi-Annual Sa - CEA. (n.d.). Retrieved February 19, 2015, from http://www.ce.org/News/News-Releases/Press-Releases/2014/Consumer-Electronics-Industry-Revenues-to-Reach-Al.aspx

Electronics Scrap Price in United States, China, India & UK - Scrap Price & Charts. (n.d.). Retrieved March 10, 2015, from http://www.scrapmonster.com/scrap-prices/category/Electronics-Scrap/2/1/1

Eilrich, Fred C., Gerald A. Doeksen, and Herb Van Fleet (2002) An economic analysis of landfill costs to demonstrate the economies of size and determine the feasibility of a community owned landfill in rural Oklahoma. Prepared for the Southern Agricultural Economics Association Annual Meeting, 2003.

Engineering Solutions & Design Inc. (April 2014). State of Ohio Waste Characterization Study.

Environmental Protection Agency (2014) User's Guide for WaRM. Available from http://epa.gov/epawaste/conserve/tools/warm/Warm_UsersGuide.html, accessed August, 2015.

Environmental Protection Agency (2015) Advancing sustainable materials management: facts and figures 2013, EPA530-R-15-002.

E-Scrap Prices – Buy Sell Escrap Current Prices – We Pay Cash | We pay CASH for E-Scrap. (n.d.). Retrieved March 10, 2015, from http://www.buysellescrap.com/e-scrap-prices/

Eshet, Tzipi, Ofira Ayalon, and Mordechai Schechter (2005) A critical review of economic valuation studies of externalities from incineration and landfilling. Waste Management and Research. 23: 487-504.

Five Winds International, LP. (2001, October). Toxic and Hazardous Materials in Electronics.

Gibb, T. (2013, November 26). Yard waste ban revisited and rejected by State Senate Committee. Retrieved March 30, 2015, from http://msue.anr.msu.edu/news/yard_waste_ban_revisited_and_rejected_by_state_senate_committee

Heideman, Howard. Internal Memo: 2013 Bottle Deposit Information with percent redeemed for Distribution. Michigan State Treasury, Return Processing Division, to Michigan Legislature. August 26, 2014.

ISRI. (n.d.). Electronic Scrap. Retrieved March 9, 2015, from http://www.isri.org/recycling-industry/commodities-specifications/electronic-scrap#.VP3BWvnF9qU

Kent County Michigan (2015) Annual Budget.

Kent County Michigan Department of Public Works (2012) SWANA 2012 Integrated Solid Waste Management System Excellence Award Application.

Kent County Michigan Department of Public Works (2015) Public_Works. Available at: https://www.accesskent.com/Departments/CountyAdministrator/Performance/Public_Works.pdf

Kiddee, P., Naidu, R., & Wong, M. H. (2013). Metals and polybrominated diphenyl ethers leaching from electronic waste in simulated landfills. Journal of Hazardous Materials, 252-253, 243–249. http://doi.org/10.1016/j.jhazmat.2013.03.015

Kong, D., Shan, J., Iacoboni, M., & Maguin, S. R. (2012). Evaluating greenhouse gas impacts of organic waste management options using life cycle assessment. Waste Management & Research, 30(8), 800–812. http://doi.org/10.1177/0734242X12440479

Kyle, B. (2015, March 19). E-waste broker caught making illegal exports of CRTs to Hong Kong and China. Retrieved March 31, 2015, from http://www.electronicstakeback.com/2015/03/19/e-waste-broker-caught-making-illegal-exports-of-crts-to-hong-kong-and-china/

Laffely, J. (2007, July). Assessing cost implications of applying best e-waste recovery practices in a manual disassembly material recovery facility in Cape Town, South Africa, using process-based cost modelling. École polytechnique fédérale de Lausanne and Swiss Federal Laboratories for Materials Science and Technology, Lausanne / St.Gallen Switzerland.

Li, Y., Richardson, J. B., Mark Bricka, R., Niu, X., Yang, H., Li, L., & Jimenez, A. (2009). Leaching of heavy metals from E-waste in simulated landfill columns. Waste Management, 29(7), 2147–2150. http://doi.org/10.1016/j.wasman.2009.02.005

Mansikkasalo, Anna, Robert Lundmark, and Patrik Soderholm (2014) Market behavior and policy in the recycled paper industry: a critical survey of price elasticity research. Forest Policy and Economics, 38: 17-29.

Michigan Department of Environmental Quality (2015a) Measuring recycling in the state of Michigan, prepared by Resource Recycling Systems and Michigan Recycling Coalition.

Michigan Department of Environmental Quality (2015b) Report of solid waste landfilled in Michigan, October 1, 2013 - September 30, 2014.

Michigan Department of Environmental Quality (2015, February). List of DEQ Registered Composting Facilities. Retrieved March 9, 2015, from http://www.michigan.gov/deq/0,4561,7-135-3312_4123-185537--S,00.html

Michigan DEQ. (n.d.). Landfill Prohibited Materials and Appropriate Disposal Options. Retrieved March 10, 2015, from http://www.michigan.gov/deq/0,4561,7-135-3312_4123-96663--,00.html

Michigan DEQ. (n.d.). Electronic Waste Takeback Program. Retrieved from http://www.michigan.gov/deq/0,4561,7-135-3312_4123-208087--,00.html

Natural Resources and Environmental Protection Act of 1994, MCL Sections 324.17301- 324.1733 (2008)

Palmer, Karen, Hilary Sigman, and Margaret Walls (1996) The cost of reducing municipal solid waste. Discussion paper 96-35, Resources for the Future; Washington, D.C. <PUBLISHED IN JNL ENVIRO ECON & MGT – Science Direct>

Platt, B., Goldstein, N., Coker, C., & Brown, S. (2014, July). State of Composting in the US. Institute for Local Self-Reliance.

Public Sector Consultants (Feb 2013) Improving Recycling Performance in Michigan: Best Practices, Options and Potential Costs.

Orazio, C., & Peterman, P. (2004, November). Brominated Flame Retardants in the Environment. CERC U.S. Geological Survey.

Rabl, Ari, Joseph V. Spadaro, and Assaad Zoughaib. 2008. Environmental impacts and costs of solid waste: a comparison of landfill and incineration. Waste Management and Research, 26: 147-162.
Ready, Richard C. (2005) Do landfills always depress nearby property values? Rural Development Paper No. 27. The Northeast Regional Center for Rural Development; University Park, PA.

Recycling Connections Corporation (June 2010). 2009 Wisconsin State-Wide Waste Characterization Study.

Repetto, Robert, Roger C. Dower, Robin Jenkins, and Jacqueline Geoghegan (1992), Green Fees: How a Tax

Shift Can Work for the Environment and the Economy, Washington, DC: The World Resources Institute.

Scrap Metal prices in USA, Midwest, East Coast, West Coast, South West | SCRAP REGISTER. (n.d.). Retrieved March 10, 2015, from http://www.scrapregister.com/scrap-prices/united-states/260

Spalvins, E., Dubey, B., & Townsend, T. (2008). Impact of Electronic Waste Disposal on Lead Concentrations in Landfill Leachate. Environmental Science & Technology, 42(19), 7452–7458. http://doi.org/10.1021/es8009277

State Legislation – Electronics TakeBack Coalition. (n.d.). Retrieved February 18, 2015, from http://www.electronicstakeback.com/promote-good-laws/state-legislation/

Themelis, Nickolas J. and Charles Mussche (July 9, 2014) 2014 Energy and Economic Value of Municipal Solid Waste, Including Non-Recycled Plastics, Currently Landfilled in the Fifty States, Columbia University Earth Engineering Center.

Townsend, T., G., Musson, S., Jang, Y.-C., & Chung, I.-H. (1999). Characterization of Lead Leachability from Cathode Ray Tubes Using the Toxicity Characteristic Leaching Procedure (No. 99-5). Gainesville, FL: Department of Environmental Engineering Sciences, University of Florida.

Townsend, T., G., Vann, K., Mutha, S., Pearson, B., Jang, Y.-C., Musson, S., & Jordan, A. (2014). RCRA Toxicity Characterization of Computer CPUs and Other Discarded Electronic Devices. Gainesville, FL: Department of Environmental Engineering Sciences, University of Florida.

Trans-Americas Trading Company (n.d.) Frequently Asked Questions. http://www.tranclo.com/recycling-faq.asp. Last accessed August, 2015.

Tsydenova, O., & Bengtsson, M. (2011). Chemical hazards associated with treatment of waste electrical and electronic equipment. Waste Management, 31(1), 45–58. http://doi.org/10.1016/j.wasman.2010.08.014

United States Census Bureau (2010) http://www.census.gov/geo/reference/ua/urban-rural-2010.html, last accessed August, 2015.

United States Government Accountability Office. (2008). ELECTRONIC WASTE: EPA Needs to Better Control Harmful U.S. Exports through Stronger Enforcement and More Comprehensive Regulation (No. GAO-08-1044).

US EPA. (2014). Municipal Solid Waste Generation, Recycling, and Disposal in the United States -Tables and Figures for 2012. Retrieved from
http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2012_msw_dat_tbls.pdf

Van Haaren, R., Themelis, N., & Goldstein, N. (2010, October). The State Of Garbage In America. Biocycle, 51(10), 16.

Vander Kooy, S. (2014, October 23). Why Are Recyclers Being Forced to Charge for CRTs. Retrieved from http://comprenew.org/2014/10/recyclers-forced-charge-crts/

Vee, Arlene. (February 2015). Report on 2013 SCORE Programs: A summary of recycling and waste management in Minnesota.

West Coast Climate and Materials Management Forum. (2011). Reducing Greenhouse Gas Emissions through Recycling and Composting (No. EPA 910-R-11-003). Seattle, WA: US EPA, Region 10.

Yepsen, R. (2015, January). Residential food waste collection in the U.S. Biocycle, 56(1), 10.

APPENDIX A

This section includes:

- MSW Characterization Tables by Site Surveyed
- Sample Sort Record Template
- Example completed sample records
- Complete transcribed record sheets for all 79 vehicles sampled

Composition of MSW Disposed at Muskegon County Landfill
Mean % By Weight

			Conf Int. (90%)					Conf Int. (90%)	
Material	**Mean**	**Stdev**	**Lower**	**Upper**	**Material**	**Mean**	**Stdev**	**Lower**	**Upper**
Paper					**Other Wastes**				
Mixed	8.90%	5.29	5.83%	11.96%	Textiles	4.97%	5.63	1.71%	8.24%
Newsprint	2.40%	2.97	0.68%	4.12%	Bulk Items	1.02%	2.15	-0.23%	2.27%
Corrugated	7.35%	7.98	2.73%	11.98%	Other Inorganics	12.17%	5.32	9.09%	15.26%
Subtotal Paper	**18.65%**		**9.24%**	**28.06%**	***Subtotal Other Wastes***	**18.16%**		**10.57%**	**25.77%**
Plastic					**Organic**				
Plastic (#3,4,5,7)	4.84%	3.18	2.99%	6.68%	Food Waste	11.33%	8.94	6.14%	16.51%
Plastic Bags	3.52%	2.13	2.28%	4.75%	Yard Waste	0.89%	1.45	0.05%	1.73%
Plastic Packaging (#2-5,7)	3.39%	2.28	2.07%	4.71%	Soil	9.24%	22.59	-3.86%	22.34%
PET Beverage (#1)	0.92%	0.62	0.57%	1.28%	Wood	6.90%	7.11	2.77%	11.02%
Polystyrene	0.61%	0.45	0.35%	0.87%	Other Organics	9.05%	5.69	5.75%	12.35%
Subtotal Plastic	**13.28%**		**8.66%**	**18.29%**	***Subtotal Organic***	**37.41%**		**10.85%**	**63.95%**
Metals					**MI Deposits**	**0.26%**	**0.25**	**0.12%**	**0.41%**
Ferrous	3.81%	2.86	2.15%	5.47%					
Aluminum	0.58%	0.62	0.23%	0.94%	**Household Hazardous**	**1.03%**	**2.10**	**-0.18%**	**2.25%**
Subtotal Metals	**4.39%**		**2.38%**	**6.41%**					
					Electronics	**5.72%**	**11.68**	**-1.05%**	**12.49%**
Glass	**1.10%**	**0.87**	**0.59%**	**1.60%**					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Composition of MSW Disposed at Ottawa Farms Landfill
Mean % By Weight

			Conf Int. (90%)					Conf Int. (90%)	
Material	**Mean**	**Stdev**	**Lower**	**Upper**	**Material**	**Mean**	**Stdev**	**Lower**	**Upper**
Paper					**Other Wastes**				
Mixed	9.94%	3.75	7.76%	12.11%	Textiles	6.90%	5.61	3.65%	10.15%
Newsprint	1.00%	1.20	0.31%	1.70%	Bulk Items	0.00%	0.00	0.00%	0.00%
Corrugated	9.47%	8.35	4.63%	14.31%	Other Inorganics	10.31%	5.84	6.93%	13.70%
Subtotal Paper	**20.41%**		**12.7%**	**28.12%**	***Subtotal Other Wastes***	**17.21%**		**10.58%**	**23.85%**
Plastic					**Organic**				
Plastic (#3,4,5,7)	5.83%	6.58	2.01%	9.64%	Food Waste	16.56%	11.70	9.78%	23.34%
Plastic Bags	4.32%	2.32	2.98%	5.67%	Yard Waste	2.81%	4.10	0.43%	5.18%
Plastic Packaging (#2-5,7)	4.53%	1.59	3.60%	5.45%	Soil	0.69%	2.19	-0.58%	1.97%
PET Beverage (#1)	1.08%	0.73	0.66%	1.50%	Wood	6.71%	5.80	3.35%	10.07%
Polystyrene	0.85%	0.55	0.53%	1.16%	Other Organics	8.14%	5.21	5.12%	11.16%
Subtotal Plastic	**16.61%**		**9.78%**	**23.42%**	***Subtotal Organic***	**34.91%**		**18.10%**	**51.72%**
Metals					**MI Deposits**	**0.39%**	**0.52**	**0.09%**	**0.69%**
Ferrous	2.99%	1.86	1.91%	4.07%					
Aluminum	0.37%	0.46	0.10%	0.63%	**Household Hazardous**	**2.20%**	**4.60**	**-0.46%**	**4.87%**
Subtotal Metals	**3.36%**		**2.01%**	**4.70%**					
					Electronics	**2.72%**	**2.91**	**1.03%**	**4.41%**
Glass	**2.19%**	**2.14**	**0.95%**	**3.43%**					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Composition of MSW Disposed at South Kent Landfill
Mean % By Weight

			Conf Int. (90%)					Conf Int. (90%)	
Material	**Mean**	**Stdev**	**Lower**	**Upper**	**Material**	**Mean**	**Stdev**	**Lower**	**Upper**
Paper					**Other Wastes**				
Mixed	9.63%	6.17	6.05%	13.20%	Textiles	2.52%	1.77	1.50%	3.55%
Newsprint	0.75%	0.91	0.22%	1.27%	Bulk Items	0.92%	2.17	-0.34%	2.17%
Corrugated	7.70%	5.06	4.77%	10.63%	Other Inorganics	16.28%	12.59	8.98%	23.57%
Subtotal Paper	**18.08%**		**11.04%**	**25.10%**	***Subtotal Other Wastes***	**19.72%**		**10.14%**	**29.29%**
Plastic					**Organic**				
Plastic (#3,4,5,7)	4.41%	3.10	2.62%	6.21%	Food Waste	10.35%	9.27	4.98%	15.73%
Plastic Bags	1.35%	0.95	0.80%	1.90%	Yard Waste	6.93%	11.60	0.21%	13.66%
Plastic Packaging (#2-5,7)	4.04%	2.25	2.74%	5.35%	Soil	3.60%	6.36	-0.09%	7.28%
PET Beverage (#1)	0.67%	0.46	0.40%	0.94%	Wood	11.05%	16.55	1.46%	20.65%
Polystyrene	0.48%	0.46	0.22%	0.75%	Other Organics	5.08%	4.01	2.76%	7.41%
Subtotal Plastic	**10.95%**		**6.78%**	**15.15%**	***Subtotal Organic***	**37.01%**		**9.32%**	**64.73%**
Metals					**MI Deposits**	**0.22%**	**0.25**	**0.07%**	**0.36%**
Ferrous	6.64%	5.83	3.26%	10.02%					
Aluminum	0.61%	0.77	0.16%	1.05%	**Household Hazardous**	**0.07%**	**0.12**	**0.00%**	**0.14%**
Subtotal Metals	**7.25%**		**3.42%**	**11.07%**					
					Electronics	**4.40%**	**6.65**	**0.54%**	**8.25%**
Glass	**2.30%**	**1.73**	**1.30%**	**3.30%**					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Composition of MSW Disposed at Kent County Waste to Energy
Mean % By Weight

			Conf Int. (90%)					Conf Int. (90%)	
Material	**Mean**	**Stdev**	**Lower**	**Upper**	**Material**	**Mean**	**Stdev**	**Lower**	**Upper**
Paper					**Other Wastes**				
Mixed	11.65%	4.29	9.16%	14.13%	Textiles	2.62%	1.64	1.67%	3.57%
Newsprint	1.18%	1.05	0.58%	1.79%	Bulk Items	0.98%	3.11	-0.82%	2.78%
Corrugated	5.61%	3.13	3.79%	7.42%	Other Inorganics	18.18%	15.63	9.11%	27.24%
Subtotal Paper	**18.44%**		**13.53%**	**23.34%**	***Subtotal Other Wastes***	**21.78%**		**9.96%**	**33.59%**
Plastic					**Organic**				
Plastic (#3,4,5,7)	2.92%	2.55	1.44%	4.40%	Food Waste	15.19%	7.57	10.80%	19.57%
Plastic Bags	2.83%	1.47	1.98%	3.68%	Yard Waste	10.24%	10.50	4.16%	16.33%
Plastic Packaging (#2-5,7)	5.04%	1.95	3.91%	6.17%	Soil	0.13%	0.40	-0.11%	0.36%
PET Beverage (#1)	1.04%	0.45	0.78%	1.30%	Wood	5.71%	6.34	2.04%	9.39%
Polystyrene	0.72%	0.38	0.50%	0.94%	Other Organics	8.42%	5.70	5.12%	11.73%
Subtotal Plastic	**12.55%**		**8.61%**	**16.49%**	***Subtotal Organic***	**39.69%**		**22.01%**	**57.38%**
Metals					**MI Deposits**	**0.20%**	**0.14**	**0.12%**	**0.28%**
Ferrous	2.00%	1.55	1.11%	2.90%					
Aluminum	0.50%	0.45	0.24%	0.76%	**Household Hazardous**	**1.21%**	**2.32**	**-0.13%**	**2.56%**
Subtotal Metals	**2.50%**		**1.35%**	**3.66%**					
					Electronics	**1.75%**	**1.90**	**0.65%**	**2.85%**
Glass	**1.87%**	**1.57**	**0.96%**	**2.78%**					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Composition of MSW Disposed at Elk Run Landfill
Mean % By Weight

			Conf Int. (90%)					Conf Int. (90%)	
Material	**Mean**	**Stdev**	**Lower**	**Upper**	**Material**	**Mean**	**Stdev**	**Lower**	**Upper**
Paper					**Other Wastes**				
Mixed	15.22%	5.67	11.71%	18.74%	Textiles	3.57%	3.01	1.70%	5.44%
Newsprint	1.34%	1.39	0.48%	2.20%	Bulk Items	2.68%	8.03	-2.30%	7.66%
Corrugated	5.67%	5.11	2.50%	8.83%	Other Inorganics	14.33%	14.65	5.25%	23.40%
Subtotal Paper	**22.23%**		**14.69%**	**29.77%**	***Subtotal Other Wastes***	**20.58%**		**4.65%**	**36.50%**
Plastic					**Organic**				
Plastic (#3,4,5,7)	3.34%	2.21	1.98%	4.71%	Food Waste	15.10%	10.76	8.43%	21.77%
Plastic Bags	3.26%	2.13	1.94%	4.58%	Yard Waste	5.45%	6.60	1.36%	9.54%
Plastic Packaging (#2-5,7)	6.09%	3.47	3.94%	8.24%	Soil	0.00%	0.00	0.00%	0.00%
PET Beverage (#1)	0.86%	0.96	0.26%	1.46%	Wood	4.52%	4.86	1.51%	7.54%
Polystyrene	0.57%	0.45	0.28%	0.85%	Other Organics	9.22%	6.42	5.25%	13.20%
Subtotal Plastic	**14.12%**		**8.40%**	**19.84%**	***Subtotal Organic***	**34.29%**		**16.55%**	**52.05%**
Metals					**MI Deposits**	**0.22%**	**0.34**	**0.01%**	**0.43%**
Ferrous	2.40%	1.06	1.74%	3.06%					
Aluminum	0.45%	0.40	0.21%	0.70%	**Household Hazardous**	**0.74%**	**1.71**	**-0.31%**	**1.80%**
Subtotal Metals	**2.85%**		**1.95%**	**3.76%**					
					Electronics	**1.24%**	**1.31**	**0.43%**	**2.06%**
Glass	**3.72%**	**3.41**	**1.61%**	**5.84%**					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Composition of MSW Disposed at Oakland Heights Landfill
Mean % By Weight

			Conf Int. (90%)					Conf Int. (90%)	
Material	**Mean**	**Stdev**	**Lower**	**Upper**	**Material**	**Mean**	**Stdev**	**Lower**	**Upper**
Paper					**Other Wastes**				
Mixed	14.27%	6.04	10.77%	17.77%	Textiles	3.47%	2.91	1.78%	5.16%
Newsprint	0.76%	0.68	0.36%	1.16%	Bulk Items	3.73%	9.47	-1.76%	9.22%
Corrugated	9.93%	7.95	5.32%	14.54%	Other Inorganics	12.58%	6.01	9.09%	16.06%
Subtotal Paper	**24.96%**		**16.45%**	**33.47%**	***Subtotal Other Wastes***	**19.78%**		**9.11%**	**30.44%**
Plastic					**Organic**				
Plastic (#3,4,5,7)	3.39%	3.13	1.58%	5.21%	Food Waste	14.61%	2.76	13.01%	16.21%
Plastic Bags	2.34%	1.06	1.73%	2.95%	Yard Waste	10.28%	7.36	6.01%	14.55%
Plastic Packaging (#2-5,7)	4.44%	1.24	3.72%	5.16%	Soil	0.00%	0.00	0.00%	0.00%
PET Beverage (#1)	0.71%	0.42	0.47%	0.96%	Wood	3.09%	3.88	0.85%	5.34%
Polystyrene	0.75%	0.68	0.35%	1.14%	Other Organics	10.81%	7.20	6.64%	14.98%
Subtotal Plastic	**11.63%**		**7.85%**	**15.42%**	***Subtotal Organic***	**38.79%**		**26.51%**	**51.08%**
Metals					**MI Deposits**	**0.28%**	**0.31**	**0.10%**	**0.47%**
Ferrous	1.73%	1.15	1.06%	2.40%					
Aluminum	0.32%	0.25	0.17%	0.46%	**Household Hazardous**	**0.00%**	**0.00**	**0.00%**	**0.00%**
Subtotal Metals	**2.05%**		**1.23%**	**2.86%**					
					Electronics	**1.06%**	**1.00**	**0.48%**	**1.64%**
Glass	**1.44%**	**1.44**	**0.61%**	**2.28%**					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Composition of MSW Disposed at Central Sanitary Landfill
Mean % By Weight

			Conf Int. (90%)					Conf Int. (90%)	
Material	**Mean**	**Stdev**	**Lower**	**Upper**	**Material**	**Mean**	**Stdev**	**Lower**	**Upper**
Paper					**Other Wastes**				
Mixed	13.22%	5.47	10.05%	16.39%	Textiles	2.51%	1.39	1.70%	3.31%
Newsprint	1.45%	1.39	0.64%	2.25%	Bulk Items	0.26%	0.83	-0.22%	0.75%
Corrugated	10.82%	6.06	7.31%	14.33%	Other Inorganics	11.49%	6.34	7.82%	15.16%
Subtotal Paper	**25.49%**		**18.00%**	**32.97%**	***Subtotal Other Wastes***	**14.26%**		**9.30%**	**19.22%**
Plastic					**Organic**				
Plastic (#3,4,5,7)	4.66%	2.38	3.28%	6.04%	Food Waste	14.60%	8.49	9.68%	19.52%
Plastic Bags	2.30%	0.55	1.97%	2.62%	Yard Waste	2.40%	2.78	0.79%	4.01%
Plastic Packaging (#2-5,7)	9.49%	3.11	7.68%	11.29%	Soil	3.60%	8.59	-1.38%	8.58%
PET Beverage (#1)	1.19%	0.68	0.80%	1.58%	Wood	1.50%	1.23	0.79%	2.22%
Polystyrene	0.84%	0.46	0.57%	1.11%	Other Organics	9.87%	4.58	7.21%	12.52%
Subtotal Plastic	**18.48%**		**14.30%**	**22.64%**	***Subtotal Organic***	**31.97%**		**17.09%**	**46.85%**
Metals					**MI Deposits**	**0.29%**	**0.36**	**0.08%**	**0.50%**
Ferrous	3.66%	3.05	1.89%	5.42%					
Aluminum	0.37%	0.35	0.17%	0.58%	**Household Hazardous**	**1.50%**	**2.60**	**0.00%**	**3.01%**
Subtotal Metals	**4.03%**		**2.06%**	**6.00%**					
					Electronics	**1.78%**	**2.44**	**0.37%**	**3.19%**
Glass	**2.21%**	**1.97**	**1.07%**	**3.35%**					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Composition of MSW Disposed at North Kent Transfer Station
Mean % By Weight

			Conf Int. (90%)					Conf Int. (90%)	
Material	**Mean**	**Stdev**	**Lower**	**Upper**	**Material**	**Mean**	**Stdev**	**Lower**	**Upper**
Paper					**Other Wastes**				
Mixed	14.11%	6.80	10.17%	18.05%	Textiles	2.54%	1.48	1.68%	3.40%
Newsprint	0.87%	0.75	0.43%	1.30%	Bulk Items	0.00%	0.00	0.00%	0.00%
Corrugated	11.47%	7.39	7.19%	15.76%	Other Inorganics	21.84%	11.36	15.26%	28.43%
Subtotal Paper	**26.45%**		**17.79%**	**35.11%**	***Subtotal Other Wastes***	**24.38%**		**16.94%**	**31.83%**
Plastic					**Organic**				
Plastic (#3,4,5,7)	3.64%	2.84	1.99%	5.29%	Food Waste	10.29%	5.70	6.99%	13.59%
Plastic Bags	2.19%	0.89	1.67%	2.71%	Yard Waste	1.38%	2.00	0.22%	2.54%
Plastic Packaging (#2-5,7)	6.77%	3.79	4.58%	8.97%	Soil	1.17%	3.70	-0.97%	3.31%
PET Beverage (#1)	0.96%	0.53	0.66%	1.27%	Wood	1.63%	1.24	0.91%	2.34%
Polystyrene	0.81%	0.61	0.45%	1.16%	Other Organics	11.74%	4.35	9.22%	14.26%
Subtotal Plastic	**14.37%**		**9.35%**	**19.40%**	***Subtotal Organic***	**26.21%**		**16.37%**	**36.04%**
Metals					**MI Deposits**	**0.45%**	**0.85**	**-0.04%**	**0.94%**
Ferrous	3.38%	3.69	1.24%	5.52%					
Aluminum	0.25%	0.18	0.15%	0.36%	**Household Hazardous**	**0.55%**	**1.00**	**-0.03%**	**1.13%**
Subtotal Metals	**3.63%**		**1.39%**	**5.88%**					
					Electronics	**1.47%**	**1.43**	**0.64%**	**2.30%**
Glass	**2.50%**	**2.81**	**0.87%**	**4.12%**					

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

West Michigan Sustainable Business Forum
MSW Waste Characterization and Valuation Study
Waste Sorting Record

Date: _____ **Community (ies) Served:** _____

Facility: _____ **Vehicle Type:** _____

Weather: _____ **Vehicle No.:** _____

Total Wt.: _____ **Route Type (circle):** **Residential** **Commercial** **Mixed Res/Comm**

Vehicle Wt.: _____ **Recorded By:** _____

Load Wt.: _____ **Notes:** _____

Category	Weight in Pounds						Percentage of Total*
	Bin 1			Bin 2			
	Gross	Tare	Tare Re-Weigh	Gross	Tare	Tare Re-Weigh	
Mixed paper							
Newsprint							
Corrugated							
Plastic							
Plastic bags							
All plastic packaging							
PET beverage containers							
Michigan deposit-returnable containers							
Polystyrene							
Yard waste							
Soil							
Food waste							
Wood							
Other Organics/Combustibles							
Ferrous							
Aluminum							
Glass							
Other Inorganics/Non-Combustibles							
Textiles							
Bulk Items							
Electronics							
Household Hazardous Waste							

Truck #9
↳ #5

West Michigan Sustainable Business Forum
MSW Waste Characterization and Valuation Study
Waste Sorting Record

1 of 1

Date: 6/24/2015 Community (ies) Served: Ionia County
Facility: C.S.L. Vehicle Type: Front load
Weather: Sunny Vehicle No.: 1309
Total Wt.: 69,640 Route Type (circle): Residential (Commercial) Mixed Res/Comm
Vehicle Wt.: 45,560 Recorded By: Brad Vander Galien
Load Wt.: 24,080 Notes:

Category	Weight in Pounds						Percentage of Total*
	Bin 1			Bin 2			
	Gross	Tare	Tare Re-Weigh	Gross	Tare	Tare Re-Weigh	
Mixed paper	26.20	5.15			5.05		
Newsprint	14.55	5.15					
Corrugated	11.45	5.15		10.35	4.60		
Plastic	11.00	5.05		5.70	4.85		
Plastic bags	9.00	4.85					
All plastic packaging	14.75	5.05		11.10	5.15		
PET beverage containers	5.70	4.70					
Michigan deposit-returnable containers 3	5.05	4.60					
Polystyrene	5.70	4.70					
Yard waste	20.60	4.95					
Soil	64.15	3.95					
Food waste		3.60					
Wood	12.85	4.95					
Other Organics/Combustibles	13.75	5.05			4.85		
Ferrous	11.20	4.95					
Aluminum	5.05	4.95					
Glass	8.70	4.85					
Other Inorganics/Non-Combustibles	22.90	4.85		15.30	4.70		
Textiles	7.25	4.95					
Bulk Items							
Electronics	19.95	4.85					
Household Hazardous Waste		4.95					

Site 1: Muskegon						Truck 1 (#5)													
Date: 5/20/2015				Total Wt.: -					Communities Served: Spring Lake/Northern										
Weather: Sunny-cool				Vehicle Wt.: -					Vehicle Type: 117										
Vehicle #: 5				Load Wt.: 19,200 lbs					Route Type: Residential										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	20.15	5.05	5.05	14.3	5.05		27.65		5.05	13.85	5.05		12	5.05		5.95	5.05		63.6	17.70
Newsprint	12.1	5.15			5.05														6.95	1.93
Corrugated	11.35	5.05	5.05	12.55	4.95	5.05	10.1		5.05	5.6	5.05						5.05		19.5	5.43
Plastic	14.3	5.15	5.15		5.05		10.55		5.05							9.9			24.55	6.83
Plastic Bags	11.55	5.05	5.05	8.9	5.05	5.05	7.15		5.05	6.8	5.05		8.9	5.05		6.6			24.65	6.86
Plastic Packaging	12.85	4.95	4.95	11.2	5.05		7.35		5.05	8.9	4.95	5.05				8.9			29.2	8.13
PET Beverage	6.25	5.05			5.05														1.2	0.33
MI Deposit	6.35	5.05																	1.3	0.36
Polystyrene	7.9	5.05																	2.85	0.79
Yard Waste	12.2	5.05																	7.15	1.99
Food Waste	24.9	5.05																	19.85	5.53
Wood	9.55	4.6	4.6				5.15												10.1	2.81
Other Organics	11.65	4.5	4.5	23.8	5.05		15.65		4.5				31.4			11	5.05		74.4	20.71
Ferrous	17.7	5.15	5.05				11.65												24.2	6.74
Aluminum	6.8	5.25																	1.55	0.43
Glass	8.8	5.15																	3.65	1.02
Other Inorganics	11.75	5.05	5.05		5.05		12.75			15.95		4.5							35.4	9.85
Furniture																			0	0.00
Electronics	13.55	5.05	5.05																8.5	2.37
Household Haz	5.8	5.15																	0.65	0.18
Soil																			0	0.00
Textiles																			0	0.00
TOTAL																			359.25	100.00
Number of MI Deposits	8																			
Types of Electronics	Christmas Lights, Vacuum, Battery charger, cable cord																			

Site 1: Muskegon							Truck 2 (#9)													
Date: 5/20/2015				Total Wt.: -						Communities Served: Norton Shores/City of										
Weather: Sunny-cool				Vehicle Wt.: -						Vehicle Type: 597										
Vehicle #: 9				Load Wt.: 19,000 lbs						Route Type: Mixed Residential/Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	5.8	5.05			5.05														0.75	0.62
Newsprint	17.3	5.05			5.05														12.25	10.09
Corrugated	8.45	5.05			5.05														3.4	2.80
Plastic	6.9	5.05			5.05														1.85	1.52
Plastic Bags	5.8	5.05			5.05														0.75	0.62
Plastic Packaging		4.95		8	5.05														2.95	2.43
PET Beverage		4.95		5.4	5.05														0	0.00
MI Deposit	5.15	5.05																	0.1	0.08
Polystyrene	4.9	5.05																	0	0.00
Yard Waste		5.05																	0	0.00
Food Waste	6.35	5.05																	1.3	1.07
Wood	25.45	4.6																	20.85	17.18
Other Organics	10.8	4.5			5.05														6.3	5.19
Ferrous	7.45	5.15																	2.3	1.90
Aluminum		5.25																	0	0.00
Glass	6.7	5.15																	1.55	1.28
Other Inorganics	16.2	5.05		7.8	5.05														13.9	11.45
Furniture	6.35																		6.35	5.23
Electronics	51.8	5.05																	46.75	38.52
Household Haz		5.05																	0	0.00
Soil																			0	0.00
Textiles																			0	0.00
TOTAL																			121.35	100.00
Number of MI Deposits	2																			
Types of Electronics	Mixer, Burger King Toy																			

Site 1: Muskegon				Truck 3 (#10)																	
Date: 5/20/2015				Total Wt.: -										Communities Served: Cutlerville							
Weather: Sunny-cool				Vehicle Wt.: -										Vehicle Type: C.C.							
Vehicle #: 10				Load Wt.: 19,600 lbs										Route Type: Residential							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	15.4	5.05	4.95	7.05	4.95														12.45	1.74
Newsprint	8.55	5.05			4.95														3.5	0.49
Corrugated	7.25	5.05		8	5.05	4.95													5.15	0.72
Plastic	8.45	4.85			5.05														3.6	0.50
Plastic Bags	9.35	4.95	4.95	7.6	4.95	5.05													7.05	0.99
Plastic Packaging	10.65	4.95	4.95	7.45	5.05	4.95	5.95												14.05	1.96
PET Beverage	7.7	4.95			5.05														2.75	0.38
MI Deposit	5.4	4.95																	0.45	0.06
Polystyrene	6.25	5.05																	1.2	0.17
Yard Waste	23.65	4.95																	18.7	2.61
Food Waste	30.3	5.05																	25.25	3.53
Wood	6.15	4.6																	1.55	0.22
Other Organics	25.75	4.25	4.5	10.65	4.95	5.05				5.7									32.9	4.60
Ferrous	9.8	5.05																	4.75	0.66
Aluminum	5.5	5.15																	0.35	0.05
Glass	10	5.05																	4.95	0.69
Other Inorganics	15.3	5.05	5.05	31.85	4.95	5.05				15.3									52.45	7.33
Furniture																			0	0.00
Electronics		4.95																	0	0.00
Household Haz	7.05	4.95																	2.1	0.29
Soil	97.65	4.95	5.05	70.75	4.95	4.95	86.6			85.2			93.65			98.2			522.15	72.99
Textiles																			0	0.00
TOTAL																			715.35	100.00
Number of MI Deposits	3																			
Types of Electronics																				

Site 1: Muskegon							Truck 4 (#11)													
Date: 5/20/2015				Total Wt.: -									Communities Served: Muskegon & Ravenna							
Weather: Sunny-cool				Vehicle Wt.: -									Vehicle Type: C.C.							
Vehicle #: 11				Load Wt.: 19,000 lbs									Route Type: Commercial							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	18.6	4.95	4.95	12	4.95	5.05	11.65												32.35	8.48
Newsprint	8.35	5.05			4.95														3.3	0.87
Corrugated	16.3	5.05	4.95	16.4	4.85	4.95	16.75		4.95	11.55		4.95	17.95		5.05	15.95			85	22.29
Plastic	21.7	5.05	4.95		5.02		12.55												29.2	7.66
Plastic Bags	11.2	4.95	4.95		4.95		10		5.05				5.8						22.05	5.78
Plastic Packaging	12.45	4.85	4.95	8.45	4.95		14.4												25.5	6.69
PET Beverage	8.25	5.05			4.95														3.2	0.84
MI Deposit	7.45	9.95																	0	0.00
Polystyrene		5.05					6.05												6.05	1.59
Yard Waste	5.8	4.95																	0.85	0.22
Food Waste	41.65	5.05	5.05				21.6		5.05										58.2	15.26
Wood	16.6	4.5	4.5																12.1	3.17
Other Organics		4.5		13.65	4.95	5.05				14.95		4.95				17.6			41.25	10.82
Ferrous	16.3	5.05	5.05				8.7												19.95	5.23
Aluminum	10.1	5.15																	4.95	1.30
Glass	7.7	5.05																	2.65	0.69
Other Inorganics	21.7	4.95	4.95		5.05		14.55												31.3	8.21
Furniture																			0	0.00
Electronics	6.6	4.85	4.95																1.75	0.46
Household Haz	6.7	5.05																	1.65	0.43
Soil																			0	0.00
Textiles																			0	0.00
TOTAL																			381.3	100.00
Number of MI Deposits	13																			
Types of Electronics	Charger, TV Remote, Radio																			

Site 1: Muskegon						Truck 5 (#1)														
Date: 5/21/2015				Total Wt.: -					Communities Served: Muskegon											
Weather: -				Vehicle Wt.: -					Vehicle Type: -											
Vehicle #: 1				Load Wt.: 20,000 lbs					Route Type: Commercial											
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	21.9	5.05		5.8	5.05			5.05		5.15									22.75	14.49
Newsprint	5.4	5.05			4.95														0.35	0.22
Corrugated	13	5.05		7.05	4.95			5.05											10.05	6.40
Plastic	11.1	5.05			5.05			5.05											6.05	3.85
Plastic Bags	9.35	5.05		9.45	5.05			5.05			4.95								8.7	5.54
Plastic Packaging	6.5	4.95	4.95	5.15	5.05			4.95											1.65	1.05
PET Beverage	5.8	5.05			5.05														0.75	0.48
MI Deposit	6.05	5.05																	1	0.64
Polystyrene	5.6	5.05																	0.55	0.35
Yard Waste		5.05																	0	0.00
Food Waste	5.8	5.05																	0.75	0.48
Wood	28.95	4.6					6.8	4.5											26.65	16.97
Other Organics	9.55	4.5		13.4	5.05								7.15						20.55	13.09
Ferrous	9.9	5.15																	4.75	3.03
Aluminum	8.35	5.25						5.25											3.1	1.97
Glass	5.7	5.15																	0.55	0.35
Other Inorganics	10.35	5.05		24	5.05			4.95											24.25	15.45
Furniture	7.8	0																	7.8	4.97
Electronics	8.8	5.05						4.95											3.75	2.39
Household Haz	5.5	5.05																	0.45	0.29
Soil		5.05																	0	0.00
Textiles	12.55																		12.55	7.99
TOTAL								5.05											157	100
Number of MI Deposits	5																			
Types of Electronics	Phone Cords, Computer Charger, Car-Lighter, Printer Cord																			

Site 1: Muskegon				Truck 6 (#4)		
Date: 5/21/2015			Total Wt.: -			Communities Served: Fruitport
Weather: -			Vehicle Wt.: -			Vehicle Type: - C.C.(0781)
Vehicle #: 4			Load Wt.: 14,800 lbs			Route Type: Residential

	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	16.05	5.05		5.4	5.05														11.35	6.32
Newsprint	8.25	5.05			4.95														3.2	1.78
Corrugated	9.7	5.05			4.95														4.65	2.59
Plastic	11.75	5.15		5.5	5.05														7.05	3.92
Plastic Bags	12.2	5.05		5.15	5.05														7.25	4.03
Plastic Packaging	10.55	4.95		6.05	5.05														6.6	3.67
PET Beverage	6.9	4.95			4.95														1.95	1.09
MI Deposit	5.95	5.05																	0.9	0.50
Polystyrene	6.8	5.05																	1.75	0.97
Yard Waste	5.15	4.95																	0.2	0.11
Food Waste	43.3	5.05																	38.25	21.29
Wood	12.75	4.6																	8.15	4.54
Other Organics	13.75	4.4		21.8	5.05														26.1	14.52
Ferrous	11.9	5.05																	6.85	3.81
Aluminum	5.8	5.25																	0.55	0.31
Glass	10.5	5.05																	5.45	3.03
Other Inorganics	25.55	4.95		15.75	4.95														31.4	17.47
Furniture																			0	0.00
Electronics	8.15	4.95																	3.2	1.78
Household Haz	7.35	5.95																	1.4	0.78
Soil		5.05																	0	0.00
Textiles	18.5	5.05																	13.45	7.48
TOTAL																			179.7	100.00
Number of MI Deposits	8																			
Types of Electronics																				

Site 1: Muskegon			Truck 7 (#7)
Date: 5/21/2015	Total Wt.: -		Communities Served: Muskegon County
Weather: -	Vehicle Wt.: -		Vehicle Type: - C.C.(0683)
Vehicle #: 7	Load Wt.: 3,600 lbs		Route Type: Commercial

	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6			Bin 7			Bin 8			All	
	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Bins	%
Mixed Paper	11	4.95		16.2	4.95		10.25	5.05		11.2	5.05														28.65	12.05
Newsprint	6.15	5.05			5.05																				1.1	0.46
Corrugated	16.05	5.05		11.2	4.85		13.75	5.05		11	4.85		7.35			8.7	4.95		1	5.05		13.2	4.95		51.55	21.69
Plastic	9.35	5.05		8.15	4.95		13.4	5.05					5.7												21.55	9.07
Plastic Bags	6.8	5.05		8.55	4.95																				5.35	2.25
Plastic Packaging	8.7	4.85			5.05																				3.85	1.62
PET Beverage	7.9	4.95			4.95																				2.95	1.24
MI Deposit	5.05	4.95																							0.1	0.04
Polystyrene	6.25	4.95																							1.3	0.55
Yard Waste	14.55	5.05																							9.5	4.00
Food Waste	29.5	5.05																							24.45	10.29
Wood	41.1	4.6					8.45	4.6																	40.35	16.98
Other Organics	12	4.4		9.55	4.95																				12.2	5.13
Ferrous	6.15	5.05																							1.1	0.46
Aluminum	6.15	5.15																							1	0.42
Glass	6.7	5.15																							1.55	0.65
Other Inorganics	15.4	4.95		15.4	4.95																				20.9	8.79
Furniture																									0	0.00
Electronics	7.25	4.95																							2.3	0.97
Household Haz	5.05	5.05																							0	0.00
Soil	10.25	5.05																							5.2	2.19
Textiles	7.7	4.95																							2.75	1.16
TOTAL																									237.7	100
Number of MI	1																									
Types of Electronics	Calculator, Toy Car, Battery Pack																									

Site 1: Muskegon				Truck 8 (#8)																		
Date: 5/21/2015				Total Wt.: -										Communities Served: Muskegon								
Weather: -				Vehicle Wt.: -										Vehicle Type: C.C.(0778)								
Vehicle #: 8				Load Wt.: 10,000 lbs										Route Type: Mixed Residential/Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6					
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	20.8	5.05		17.6	5.05														28.3	11.16
Newsprint	16.4	5.05			5.05														11.35	4.48
Corrugated	10.9	5.05		7.6	4.95														8.5	3.35
Plastic	14.3	5.05		7.7	5.05														11.9	4.69
Plastic Bags	11.55	5.05			5.05														6.5	2.56
Plastic Packaging	12.45	4.95		5.8	5.05														8.25	3.25
PET Beverage	9	5.05																	3.95	1.56
MI Deposit	5.6	5.05																	0.55	0.22
Polystyrene	6.5	5.05																	1.45	0.57
Yard Waste		4.95																	0	0.00
Food Waste	34.8	5.15				5.05	19.6	5.05											44.2	17.44
Wood	12.75	4.6																	8.15	3.21
Other Organics	19.8	4.4				4.95		4.95											15.4	6.07
Ferrous	13.4	5.05																	8.35	3.29
Aluminum	7.05	5.25																	1.8	0.71
Glass	9.9	5.05																	4.85	1.91
Other Inorganics	17.71	4.95		11	5.05		10.25	5.05											23.91	9.43
Furniture																			0	0.00
Electronics	13.75	4.95																	8.8	3.47
Household Haz	22.55	4.95																	17.6	6.94
Soil	19.95	5.05						4.95											14.9	5.88
Textiles	27.1	5.05		7.7	4.95														24.8	9.78
TOTAL																			253.51	100
Number of MI Deposits	9																			
Types of Electronics	Speakers, Transmitter, Pump																			

Site 1: Muskegon				Truck 9 (#9)		
Date: 5/21/2015			Total Wt.: -			Communities Served: Norton Shores
Weather: -			Vehicle Wt.: -			Vehicle Type: C.C.(0757)
Vehicle #: 9			Load Wt.: 18,400 lbs			Route Type: Residential

	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	20.8	4.95		14.3	5.05														25.1	8.58
Newsprint	9.9	5.05			4.95														4.85	1.66
Corrugated	13.3	4.4		11.35	4.85		5.05												20.45	6.99
Plastic	8.9	5.05			5.05														3.85	1.32
Plastic Bags	10.9	5.05		5.25	5.05														6.05	2.07
Plastic Packaging	10.45	4.6		5.25	5.05														6.05	2.07
PET Beverage	10.65	5.05			5.05														5.6	1.91
MI Deposit	5.25	4.95																	0.3	0.10
Polystyrene	6.35	5.05																	1.3	0.44
Yard Waste		4.95																	0	0.00
Food Waste	26.3	5.05					16.75	5.05											32.95	11.26
Wood	6.5	4.25																	2.25	0.77
Other Organics	21.05	4.25		7.05	5.05														23.75	8.12
Ferrous	27.4	5.15					6.7	0											28.95	9.90
Aluminum	5.7	5.25																	0.45	0.15
Glass		5.05																	0	0.00
Other Inorganics	25.2	4.95		29.1	4.95		26.45	0											70.85	24.22
Furniture																			0	0.00
Electronics	7.15	4.95																	2.2	0.75
Household Haz	6.7	4.95																	1.75	0.60
Soil	13.1	5.05																	8.05	2.75
Textiles	33.8	5.05		5.25			18.8	5.05											47.75	16.32
TOTAL																			292.5	100.00
Number of MI Deposits	3																			
Types of Electronics	Industrial Pump, Fan, Industrial Circuit Board, Cord/Wire																			

Site 1: Muskegon						Truck 10 (#13)													
Date: 5/21/2015				Total Wt.: -					Communities Served: Fruitport										
Weather: -				Vehicle Wt.: -					Vehicle Type: C.C.										
Vehicle #: 13				Load Wt.: 17,440 lbs					Route Type: Residential										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	19.7	4.95			5.05														14.75	7.82
Newsprint	8.8	5.05			5.05														3.75	1.99
Corrugated	7.45	5.05			4.85														2.4	1.27
Plastic	21.9	4.95			5.05														16.95	8.99
Plastic Bags	11.45	5.05		7.05	5.05														8.4	4.46
Plastic Packaging	9.35	4.85		6.25	5.05														5.7	3.02
PET Beverage	7.6	4.95			4.95														2.65	1.41
MI Deposit	6.15	4.95																	1.2	0.64
Polystyrene	6.15	4.95																	1.2	0.64
Yard Waste		4.85																	0	0.00
Food Waste	45.4	4.95		15.75	5.05														51.15	27.13
Wood	10.35	4.5																	5.85	3.10
Other Organics	9.1	4.85			4.25														4.25	2.25
Ferrous	10.8	5.05																	5.75	3.05
Aluminum	6.05	5.15																	0.9	0.48
Glass	7.35	4.85																	2.5	1.33
Other Inorganics	22.8	4.85			4.95														17.95	9.52
Furniture																			0	0.00
Electronics	16.95	4.7																	12.25	6.50
Household Haz	6.5	4.95																	1.55	0.82
Soil	21.05	4.85																	16.2	8.59
Textiles	18.15	4.95																	13.2	7.00
TOTAL																			188.55	100.00
Number of MI Deposits	15																			
Types of Electronics	Electronics, 3 Cords, Space Heater, Lamp, Calculator, Drill, Switch																			

Site 2: Ottawa Farms																					
Truck 1 (#1)																					
Date: 5/27/2015				Total Wt.: 67,720 lbs									Communities Served: Hudsonville, Jenison, Allendale								
Weather: Cloudy				Vehicle Wt.: 45,500 lbs									Vehicle Type: Commercial Flatload (1239)								
Vehicle #: 1				Load Wt.: 22,220 lbs									Route Type: Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	11.2	4.95			4.95														6.25	5.46
Newsprint	5.95	5.05			5.05														0.9	0.79
Corrugated	7.25	5.05			4.85														2.2	1.92
Plastic	22.35	4.95		14.1	5.05			4.95		6.05	4.85								27.65	24.16
Plastic Bags	5.5	4.95			5.05														0.55	0.48
Plastic Packaging	8.7	4.95			4.85														3.75	3.28
PET Beverage		5.05			5.05														0	0.00
MI Deposit		5.05																	0	0.00
Polystyrene	7.05	4.95																	2.1	1.83
Yard Waste		4.95																	0	0.00
Food Waste		5.05																	0	0.00
Wood	28.1	4.5																	23.6	20.62
Other Organics		4.25			5.05														0	0.00
Ferrous	13.3	5.05																	8.25	7.21
Aluminum		5.25																	0	0.00
Glass		5.05																	0	0.00
Other Inorganics	16.2	4.95		16.6	4.95														22.9	20.01
Bulk Items		0																	0	0.00
Electronics	5.05	5.05																	0	0.00
Household Haz		4.95																	0	0.00
Soil		5.05																	0	0.00
Textiles	21.35	5.05																	16.3	14.24
TOTAL																			114.45	100.00
Number of MI Deposits	0																			
Types of Electronics	1 Cord																			

Site 2: Ottawa Farms		Truck 2 (#6)
Date: 5/27/2015	Total Wt.: 69,480 lbs	Communities Served: Silver Lake, Oceana County
Weather: Cloudy	Vehicle Wt.: 44,880 lbs	Vehicle Type: Residential Flatload (2206)
Vehicle #: 6	Load Wt.: 24,500 lbs	Route Type: Mixed Residential/Commercial

	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	18.4	5.05			4.95														13.35	6.32
Newsprint		5.05			5.05														0	0.00
Corrugated	9.35	5.15		31.15	4.85		18.05	4.95											43.6	20.64
Plastic	9.7	5.05			5.05														4.65	2.20
Plastic Bags	12.55	4.95			5.05														7.6	3.60
Plastic Packaging	13	4.95		7.35	4.95														10.45	4.95
PET Beverage	7.9	5.05			5.05														2.85	1.35
MI Deposit	8.7	5.05																	3.65	1.73
Polystyrene	6.35	5.05																	1.3	0.62
Yard Waste	12	4.95																	7.05	3.34
Food Waste	51.9	5.05																	46.85	22.18
Wood	11.45	4.5																	6.95	3.29
Other Organics	25.65	4.25			5.05														21.4	10.13
Ferrous	9.8	5.05																	4.75	2.25
Aluminum		5.25																	0	0.00
Glass	11.2	5.05																	6.15	2.91
Other Inorganics	15.85	5.05		9.1	5.05														14.85	7.03
Bulk Items																			0	0.00
Electronics	6.7	4.95																	1.75	0.83
Household Haz	15.65	4.95																	10.7	5.07
Soil		5.05																	0	0.00
Textiles	8.35	5.05																	3.3	1.56
TOTAL																			211.2	100.00
Number of MI Deposits	8																			
Types of Electronics	Christmas Lights, Lamp, Satellite Reciever																			

Site 2: Ottawa Farms																					
Date: 5/27/2015																					
Weather: Cloudy																					
Vehicle #: 7																					
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	13.55	4.95		10.1	4.95			4.95											13.75	12.39
Newsprint	7.05	4.95			4.85														2.1	1.89
Corrugated	11.65	5.05		6.15	4.95														7.8	7.03
Plastic	9.7	5.05			5.05														4.65	4.19
Plastic Bags	9.25	4.95			4.95														4.3	3.87
Plastic Packaging	9.1	4.85			5.05														4.25	3.83
PET Beverage	5.8	4.95																	0.85	0.77
MI Deposit		4.95																	0	0.00
Polystyrene	5.25	5.05																	0.2	0.18
Yard Waste	16.4	4.85																	11.55	10.41
Food Waste	25.75	4.95																	20.8	18.74
Wood	11	4.5																	6.5	5.86
Other Organics	11.35	4.25			4.95														7.1	6.40
Ferrous	9.35	5.05																	4.3	3.87
Aluminum	5.8	5.05																	0.75	0.68
Glass		5.05																	0	0.00
Other Inorganics	12.85	4.95			4.85														7.9	7.12
Bulk Items																			0	0.00
Electronics	5.8	4.7																	1.1	0.99
Household Haz	6.8	5.05																	1.75	1.58
Soil		4.95																	0	0.00
Textiles	16.3	4.95			4.95														11.35	10.23
TOTAL																			111	100.00
Number of MI Deposits	0																			
Types of Electronics	5 Plugs, 1 Charger																			

Truck 3 (#7)	
Total Wt.: 65,720 lbs	Communities Served: Muskegon and Muskega Hts
Vehicle Wt.: 42,920 lbs	Vehicle Type: Commercial Flatload (1364)
Load Wt.: 22,800 lbs	Route Type: Commercial

Site 2: Ottawa Farms																					
Truck 4 (#9)																					
Date: 5/27/2015				Total Wt.: 68,300 lbs									Communities Served: Whitehall, Montague, Muskegon, N. Muskegon								
Weather: Cloudy				Vehicle Wt.: 42,500 lbs									Vehicle Type: Commercial Flatload (1366)								
Vehicle #: 9				Load Wt.: 25,800 lbs									Route Type: Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	18.5	5.05		6.9	4.95														15.4	8.15
Newsprint	6.6	5.05			4.95														1.55	0.82
Corrugated	18.5	5.05			4.95														13.45	7.12
Plastic	13.95	5.05		6.05	5.15														9.8	5.19
Plastic Bags	15.95	5.05		11.2	5.05														17.05	9.03
Plastic Packaging	11.85	4.85		6.7	5.15														8.55	4.53
PET Beverage	7.25	5.05																	2.2	1.16
MI Deposit	5.8	4.95																	0.85	0.45
Polystyrene	7.15	4.95																	2.2	1.16
Yard Waste	7.9	5.05																	2.85	1.51
Food Waste	36.35	5.15																	31.2	16.52
Wood	20.25	4.4																	15.85	8.39
Other Organics	31.3	4.4		8.7	4.85														30.75	16.28
Ferrous	7.25	5.05																	2.2	1.16
Aluminum	8	5.25																	2.75	1.46
Glass		5.05																	0	0.00
Other Inorganics	20.7	4.95			4.95														15.75	8.34
Bulk Items																			0	0.00
Electronics	21.15	4.95																	16.2	8.58
Household Haz	5.15	5.05																	0.1	0.05
Soil		5.05																	0	0.00
Textiles	5.15	4.95																	0.2	0.11
TOTAL																			188.9	100.00
Number of MI Deposits	19																			
Types of Electronics	CR TV, Tizon																			

Site 2: Ottawa Farms							Truck 5 (#10)														
Date: 5/27/2015				Total Wt.: 63,660 lbs									Communities Served: Grand Haven								
Weather: Cloudy				Vehicle Wt.: 44,280 lbs									Vehicle Type: Residential Flatload (2370)								
Vehicle #: 10				Load Wt.: 19,380 lbs									Route Type: Residential								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	15.2	5.05		9.35	4.85		9.25	5.05											18.85	7.88
Newsprint	6.7	4.95			5.05														1.75	0.73
Corrugated	9.35	4.95		7.45	4.95														6.9	2.88
Plastic	10.65	5.05		8.45	5.05			4.95											9	3.76
Plastic Bags	11.65	5.05		7.6	5.05		7.9	5.05											12	5.02
Plastic Packaging	8.25	4.85		7.8	4.95		8.45	4.85			5.05								9.85	4.12
PET Beverage	5.95	5.05																	0.9	0.38
MI Deposit	5.05	5.05																	0	0.00
Polystyrene	5.95	4.85																	1.1	0.46
Yard Waste	5.7	4.7					3.6	0											4.6	1.92
Food Waste	48.15	4.95																	43.2	18.06
Wood	7.9	4.5																	3.4	1.42
Other Organics	25.45	4.4		25.2	5.05														41.2	17.22
Ferrous	12.65	5.05																	7.6	3.18
Aluminum	5.25	5.15																	0.1	0.04
Glass	9	5.05																	3.95	1.65
Other Inorganics	22.35	4.95		13.65	4.95		8.15	4.95											29.3	12.25
Bulk Items																			0	0.00
Electronics	19.7	4.95																	14.75	6.17
Household Haz	6.6	5.15																	1.45	0.61
Soil		4.95																	0	0.00
Textiles	32.7	4.95					6.6	5.05											29.3	12.25
TOTAL																			239.2	100.00
Number of MI Deposits	2																			
Types of Electronics	Vacuum, Coffee Maker																			

Site 2: Ottawa Farms							Truck 6 (#12)													
Date: 5/27/2015				Total Wt.: 65,860 lbs						Communities Served: Grand Haven										
Weather: Cloudy				Vehicle Wt.: 42,520 lbs						Vehicle Type: Commercial Flatload (1367)										
Vehicle #: 12				Load Wt.: 23,340 lbs						Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	18.4	4.95		13.4	5.05														21.8	10.69
Newsprint	6.35	4.95			4.95														1.4	0.69
Corrugated	25.55	5.05		10.65	4.95														26.2	12.85
Plastic	11.1	5.05			5.05														6.05	2.97
Plastic Bags	15.2	5.05		6.15	4.95														11.35	5.57
Plastic Packaging	10.25	4.95			4.95														5.3	2.60
PET Beverage	8	5.05																	2.95	1.45
MI Deposit	5.6	5.05																	0.55	0.27
Polystyrene	5.5	5.05																	0.45	0.22
Yard Waste		5.05																	0	0.00
Food Waste	38.2	5.05																	33.15	16.25
Wood	8.9	4.5																	4.4	2.16
Other Organics	14.1	4.5		8.9	4.95														13.55	6.64
Ferrous	11.75	5.05																	6.7	3.29
Aluminum	6.6	5.25																	1.35	0.66
Glass	9.8	5.05																	4.75	2.33
Other Inorganics	39.65	4.95		7.9	4.95														37.65	18.46
Bulk Items																			0	0.00
Electronics	4.95	5.05																	0	0.00
Household Haz	5.15	5.05																	0.1	0.05
Soil		5.05																	0	0.00
Textiles	31.3	5.05																	26.25	12.87
TOTAL																			203.95	100.00
Number of MI Deposits	8																			
Types of Electronics	None																			

Site 2: Ottawa Farms							Truck 7 (#17)													
Date: 5/27/2015				Total Wt.: 47,460 lbs						Communities Served: Allendale, Hudsonville										
Weather: Cloudy				Vehicle Wt.: 31,620 lbs						Vehicle Type: Residential SL										
Vehicle #: 17				Load Wt.: 15,840 lbs						Route Type: Residential										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	16.6	4.95		6.9	5.05														13.5	6.79
Newsprint	6.05	4.95			4.95														1.1	0.55
Corrugated	12.85	5.05		8.35	4.85														11.3	5.68
Plastic	10	4.95		6.15	4.95														6.25	3.14
Plastic Bags	9.1	5.05			4.85														4.05	2.04
Plastic Packaging	10.45	4.85		8.8	4.85														9.55	4.80
PET Beverage	6.8	5.05																	1.75	0.88
MI Deposit	5.5	4.95																	0.55	0.28
Polystyrene	6.25	4.95																	1.3	0.65
Yard Waste	5.4	4.95																	0.45	0.23
Food Waste	70.75	5.05					27.75	4.95											88.5	44.48
Wood	10.55	4.5					16.2	0											22.25	11.18
Other Organics	19.5	4.5			4.85														15	7.54
Ferrous	10.1	4.95																	5.15	2.59
Aluminum	5.8	5.15																	0.65	0.33
Glass	9.7	4.95																	4.75	2.39
Other Inorganics	13.1	4.85			4.95														8.25	4.15
Bulk Items																			0	0.00
Electronics	6.35	4.85																	1.5	0.75
Household Haz	5.4	5.05																	0.35	0.18
Soil		4.95																	0	0.00
Textiles	7.8	5.05																	2.75	1.38
TOTAL																			198.95	100
Number of MI Deposits	1																			
Types of Electronics	Vacuum Parts																			

Site 2: Ottawa Farms							Truck 8 (#22)													
Date: 5/27/2015				Total Wt.: 65,800 lbs						Communities Served: Muskegon & Muskegon Heights										
Weather: Cloudy				Vehicle Wt.: 42,920 lbs						Vehicle Type: Commercial Flatbed(1364)										
Vehicle #: 22				Load Wt.: 22,880 lbs						Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	23.45	4.85		14.3	4.95														27.95	14.57
Newsprint	12.85	5.05			4.95														7.8	4.07
Corrugated	13	4.25			4.85														8.75	4.56
Plastic	14.85	5.05		6.25	5.05														11	5.73
Plastic Bags	14.3	4.85			4.95														9.45	4.93
Plastic Packaging	13.2	4.95		9.7	4.85														13.1	6.83
PET Beverage	8.15	4.7																	3.45	1.80
MI Deposit	5.8	4.95																	0.85	0.44
Polystyrene	6.9	4.95																	1.95	1.02
Yard Waste	5.7	4.85																	0.85	0.44
Food Waste	23.25	5.15																	18.1	9.43
Wood	19.15	4.4																	14.75	7.69
Other Organics	14.65	4.05			4.15														10.6	5.53
Ferrous	12.65	4.95																	7.7	4.01
Aluminum	5.4	5.15																	0.25	0.13
Glass	10.35	4.95																	5.4	2.81
Other Inorganics	26	4.7		13.4	5.05														29.65	15.45
Bulk Items																			0	0.00
Electronics	13.65	4.85																	8.8	4.59
Household Haz		5.05																	0	0.00
Soil		4.85																	0	0.00
Textiles	16.4	4.95																	11.45	5.97
TOTAL																			191.85	100.00
Number of MI Deposits	0																			
Types of Electronics	None																			

Site 2: Ottawa Farms							Truck 9 (#24)													
Date: 5/27/2015				Total Wt.: 59,550 lbs									Communities Served: Ottawa, Allendale, Coopersville, Muskegon, Conllin, Standale							
Weather: Cloudy				Vehicle Wt.: 38,150 lbs									Vehicle Type: Front Load (44)							
Vehicle #: 24				Load Wt.: 21,400 lbs									Route Type: Commercial							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	14.65	4.95		15.4	4.95										14.65				20.15	10.24
Newsprint		4.95			4.95														0	0.00
Corrugated	18.15	5.05		22.35	4.95		15.85	5.05		8	4.85		14.3	5.05	18.15				53.7	27.30
Plastic	8.35	5.05			4.95										8.35				3.3	1.68
Plastic Bags	11	4.95			5.05										11				6.05	3.08
Plastic Packaging	9.7	4.7		5.7	5.05										9.7				5.65	2.87
PET Beverage	6.25	5.15													6.25				1.1	0.56
MI Deposit	5.25	5.05													5.25				0.2	0.10
Polystyrene	6.5	4.95													6.5				1.55	0.79
Yard Waste		5.05																	0	0.00
Food Waste	22.7	4.95													22.7				17.75	9.02
Wood	10.25	4.6													10.25				5.65	2.87
Other Organics	9.35	4.5		9.45	4.95										9.35				9.35	4.75
Ferrous	6.15	5.05													6.15				1.1	0.56
Aluminum	5.4	5.15													5.4				0.25	0.13
Glass	19.25	5.05													19.25				14.2	7.22
Other Inorganics	11.45	4.95		8.15	4.95										11.45				9.7	4.93
Bulk Items																			0	0.00
Electronics	8.55	4.95													8.55				3.6	1.83
Household Haz	33.7	5.15													33.7				28.55	14.51
Soil	18.6	4.95													18.6				13.65	6.94
Textiles	6.25	5.05													6.25				1.2	0.61
TOTAL																			196.7	100.00
Number of MI Deposits	2																			
Types of Electronics	Large Cord																			

Site 2: Ottawa Farms																					
Truck 10 (#28)																					
Date: 5/27/2015				Total Wt.: 72,980 lbs									Communities Served: Grand Haven								
Weather: Cloudy				Vehicle Wt.: 43,840 lbs									Vehicle Type: Front Load Residential (2366)								
Vehicle #: 28				Load Wt.: 29,140 lbs									Route Type: Residential								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	21.6	4.95		10.1	4.95														21.8	16.87
Newsprint	5.6	4.95			4.95														0.65	0.50
Corrugated	8.9	5.05		7.15	4.95														6.05	4.68
Plastic	9	5.05		7.8	4.95														6.8	5.26
Plastic Bags	12.2	4.95			5.05														7.25	5.61
Plastic Packaging	11.2	4.85		8.35	5.05														9.65	7.47
PET Beverage	8.25	5.05																	3.2	2.48
MI Deposit	5.8	4.95																	0.85	0.66
Polystyrene	7.05	5.05																	2	1.55
Yard Waste	18.15	4.95																	13.2	10.22
Food Waste	19.15	5.05																	14.1	10.91
Wood	9.1	4.4																	4.7	3.64
Other Organics	13.3	4.4			4.95														8.9	6.89
Ferrous	7.25	4.95																	2.3	1.78
Aluminum	5.5	5.15																	0.35	0.27
Glass	8.25	4.95																	3.3	2.55
Other Inorganics	11.9	4.95			5.05														6.95	5.38
Bulk Items																			0	0.00
Electronics	9.1	4.6																	4.5	3.48
Household Haz		5.05																	0	0.00
Soil		5.05																	0	0.00
Textiles	17.7	5.05																	12.65	9.79
TOTAL																			129.2	100.00
Number of MI Deposits	2																			
Types of Electronics	2 Chargers, 1 Crockpot																			

Site 3: South Kent																					
Truck 1 (#6)																					
Date: 6/3/2015				Total Wt.: 65,960 lbs						Communities Served: Allegan											
Weather: Sunny-Hot				Vehicle Wt.: 44,640 lbs						Vehicle Type: Packer (1251)											
Vehicle #: 6				Load Wt.: 21,320 lbs						Route Type: -											
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	11.45	4.95			5.05														6.5	1.52
Newsprint		4.95			5.05														0	0.00
Corrugated	10.8	5.15		16.5	5.05		12.3	5.05		15.2	4.95								34.6	8.10
Plastic	17.85	5.05		11	5.05		20.15	0		7.25	5.15								41	9.60
Plastic Bags	5.7	5.05			5.05														0.65	0.15
Plastic Packaging	8.25	4.95		5.6	5.05														3.85	0.90
PET Beverage	6.8	5.05			4.95														1.75	0.41
MI Deposit	5.25	5.05																	0.2	0.05
Polystyrene	7.35	5.05																	2.3	0.54
Yard Waste	48.6	4.95		42.85	4.95		47.8	5.05		44.3	4.95								163.65	38.33
Food Waste	26.55	5.15					9.9	5.05											26.25	6.15
Wood	12.75	4.6																	8.15	1.91
Other Organics	27.55	4.5			5.05														23.05	5.40
Ferrous	8.9	5.15																	3.75	0.88
Aluminum	5.8	5.25																	0.55	0.13
Glass	21.05	5.05																	16	3.75
Other Inorganics	13.95	5.05		17.7	5.05		24.45	4.95		13.4	4.95								49.5	11.59
Bulk Items	13.65	5.05						5.05											8.6	2.01
Electronics																			0	0.00
Household Haz	19.05	4.95		5.95	4.95		26.55	5.05											36.6	8.57
Soil		5.15																	0	0.00
Textiles		5.05																	0	0.00
TOTAL																			426.95	100.00
Number of MI Deposits	5																			
Types of Electronics	1 Medium Size TV, 1 Small TV, 3 Light Bulbs																			

Site 3: South Kent																					
												Truck 2									
Date: 6/3/2015						Total Wt.: 40,920 lbs								Communities Served: Kent							
Weather: Sunny-Hot						Vehicle Wt.: 30,840 lbs								Vehicle Type: Packer (1756)							
Vehicle #: -						Load Wt.: 10,080 lbs								Route Type: -							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	17.3	4.95		12.1	5.05		15.95	5.05		5.95	5.05								31.2	10.48
Newsprint	5.95	5.05			5.05														0.9	0.30
Corrugated	9.55	5.05		11.2	4.95		7.35	5.05		8.15	4.95								16.25	5.46
Plastic	9.45	5.05		8.15	4.95		6.7	5.05											9.25	3.11
Plastic Bags	10.65	5.05			5.05														5.6	1.88
Plastic Packaging	9.55	4.95		10	5.05		11.35	4.95			5.05								15.95	5.36
PET Beverage	6.6	5.05																	1.55	0.52
MI Deposit	6.05	4.95																	1.1	0.37
Polystyrene	6.8	5.05																	1.75	0.59
Yard Waste	24.35	5.15						4.95											19.2	6.45
Food Waste	75.5	5.05					29.85	5.05											95.25	31.98
Wood	20.7	4.5																	16.2	5.44
Other Organics	18.25	4.5			4.95														13.75	4.62
Ferrous	17.85	5.15																	12.7	4.26
Aluminum	6.25	5.25																	1	0.34
Glass	21.9	5.05						5.15											16.85	5.66
Other Inorganics	35.35	4.95		10.9	5.05			4.85											36.25	12.17
Bulk Items	6.25	5.05																	1.2	0.40
Electronics																			0	0.00
Household Haz	5.8	4.95																	0.85	0.29
Soil	6.15	5.15																	1	0.34
Textiles		4.95																	0	0.00
TOTAL																			297.8	100.00
Number of MI Deposits	23																			
Types of Electronics	2 Light Bulbs, 1 Digital Blood Pressure Monitor																			

Site 3: South Kent																					
												Truck 3									
Date: 6/3/2015						Total Wt.: 37,180 lbs								Communities Served: Allegan							
Weather: Sunny-Hot						Vehicle Wt.: 29,360 lbs								Vehicle Type: Packer (3000)							
Vehicle #: -						Load Wt.: 7,820 lbs								Route Type: -							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	10.9	5.05		10.65	5.05		20.25	5.05											26.65	11.81
Newsprint	10.45	5.05			5.05														5.4	2.39
Corrugated	19.5	5.15		11.35	5.05		10.45	5.05		7.7	4.95								28.8	12.76
Plastic	7.15	5.05			5.05														2.1	0.93
Plastic Bags	9.8	5.15		5.7	5.05														5.3	2.35
Plastic Packaging	9.8	4.95		9.9	5.05		7.7	4.95		6.2	5.05								13.6	6.03
PET Beverage	7.15	5.05																	2.1	0.93
MI Deposit	5.4	5.05																	0.35	0.16
Polystyrene	6.05	5.05																	1	0.44
Yard Waste	5.8	4.95																	0.85	0.38
Food Waste	21.6	5.05																	16.55	7.33
Wood	26.45	4.6																	21.85	9.68
Other Organics	14.2	4.5		8.15	5.05														12.8	5.67
Ferrous	10.9	5.05					22.25	0											28.1	12.45
Aluminum	11.2	5.25																	5.95	2.64
Glass	8.35	5.15																	3.2	1.42
Other Inorganics	9.8	4.95		11.55	5.05		16.75	5.05											23.05	10.21
Bulk Items	12.45	5.05																	7.4	3.28
Electronics																			0	0.00
Household Haz	22.9	4.95																	17.95	7.95
Soil		5.15																	0	0.00
Textiles	7.7	5.05																	2.65	1.17
TOTAL																			225.65	100.00
Number of MI Deposits	4																			
Types of Electronics	1 Fan, 1 Boat Motor																			

Site 3: South Kent																					
Truck 4																					
Date: 6/3/2015				Total Wt.: 62,800 lbs									Communities Served: Allegan								
Weather: Sunny-Hot				Vehicle Wt.: 41,500 lbs									Vehicle Type: Packer (2421)								
Vehicle #: -				Load Wt.: 21,300 lbs									Route Type: -								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	31.05	5.05		19.6	5.05														40.55	21.8
Newsprint	5.4	5.05			5.05														0.35	0.2
Corrugated	11.75	5.15			5.05														6.6	3.5
Plastic	7.45	5.05			5.15		8.25	0											10.65	5.7
Plastic Bags	8.9	5.15			5.05														3.75	2.0
Plastic Packaging	10.1	4.95		10.35	5.05														10.45	5.6
PET Beverage	6.6	5.05																	1.55	0.8
MI Deposit	5.15	5.05																	0.1	0.1
Polystyrene	5.5	5.15																	0.35	0.2
Yard Waste	5.5	5.05																	0.45	0.2
Food Waste	25.75	5.05																	20.7	11.1
Wood	13.55	4.6																	8.95	4.8
Other Organics	25.9	4.5		10.65	5.05														27	14.5
Ferrous	31.5	5.05																	26.45	14.2
Aluminum	5.8	5.25																	0.55	0.3
Glass	6.6	5.15																	1.45	0.8
Other Inorganics	18.8	5.05			5.05														13.75	7.4
Bulk Items	10.35	5.05																	5.3	2.8
Electronics																			0	0.0
Household Haz		4.95																	0	0.0
Soil		5.05																	0	0.0
Textiles	12.2	5.05																	7.15	3.8
TOTAL																			186.1	100.0
Number of MI Deposits	3																			
Types of Electronics	None																			

Site 3: South Kent																				
												Truck 5								
Date: 6/3/2015					Total Wt.: 56,840 lbs									Communities Served: Kent						
Weather: Sunny-Hot					Vehicle Wt.: 38,240 lbs									Vehicle Type: Packer (1897)						
Vehicle #: -					Load Wt.: 18,600 lbs									Route Type: -						
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	7.9	5.05			5.05														2.85	1.24
Newsprint		5.05			4.95														0	0.00
Corrugated	10.8	5.15			5.05														5.65	2.45
Plastic	12.55	5.05			5.05														7.5	3.25
Plastic Bags	5.95	4.95			4.95														1	0.43
Plastic Packaging	7.9	4.95			5.05														2.95	1.28
PET Beverage		5.05																	0	0.00
MI Deposit		5.05																	0	0.00
Polystyrene		5.05																	0	0.00
Yard Waste	12.55	4.95																	7.6	3.30
Food Waste	9.35	5.15																	4.2	1.82
Wood	24.25	4.6		42.6	4.6		20.6	4.6		31.95	4.7		29.65	4.6					125.95	54.64
Other Organics	8	4.4			5.05														3.6	1.56
Ferrous	6.9	5.05																	1.85	0.80
Aluminum	6.6	5.25																	1.35	0.59
Glass		5.15																	0	0.00
Other Inorganics	23.9	5.05		14.55	4.95														28.45	12.34
Bulk Items	6.35	5.05																	1.3	0.56
Electronics																			0	0.00
Household Haz																			0	0.00
Soil																			0	0.00
Textiles	41.3	5.05																	36.25	15.73
TOTAL																			230.5	100.00
Number of MI Deposits	0																			
Types of Electronics	None																			

Site 3: South Kent							Truck 6 (#2)													
Date: 6/4/2015				Total Wt.: 66,780 lbs						Communities Served: Kent										
Weather: Sunny-Hot				Vehicle Wt.: 44,020 lbs						Vehicle Type: Packer (1649)										
Vehicle #: 2				Load Wt.: 22,960 lbs						Route Type: -										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	25.1	5.05		12.1	5.05														27.1	8.41
Newsprint		5.05			5.05														0	0.00
Corrugated	17.15	5.05		18.15	4.95		10.9	5.05		7.6	5.05								33.7	10.46
Plastic	10.9	5.05			5.05														5.85	1.82
Plastic Bags	7.9	5.15			5.05														2.75	0.85
Plastic Packaging	11	4.95		9.9	5.05														10.9	3.38
PET Beverage	5.8	5.05																	0.75	0.23
MI Deposit	7.7	5.05																	2.65	0.82
Polystyrene	5.4	5.05																	0.35	0.11
Yard Waste	35.6	5.05																	30.55	9.48
Food Waste	41.85	5.15																	36.7	11.39
Wood	62.5	4.6					17.5	4.6											70.8	21.98
Other Organics	6.25	4.5			5.05														1.75	0.54
Ferrous	20.5	5.05																	15.45	4.80
Aluminum	5.8	5.25																	0.55	0.17
Glass	7.9	5.15																	2.75	0.85
Other Inorganics	15.4	5.05		12.3	4.95														17.7	5.50
Bulk Items	17.3	5.05																	12.25	3.80
Electronics																			0	0.00
Household Haz	5.4	5.05																	0.35	0.11
Soil	5.5	5.15																	0.35	0.11
Textiles	53.9	5.05																	48.85	15.17
TOTAL																			322.1	100.00
Number of MI Deposits	8																			
Types of Electronics	2 Toys																			

Site 3: South Kent							Truck 7 (#3)													
Date: 6/4/2015				Total Wt.: 60,790 lbs						Communities Served: Kent										
Weather: Sunny-Hot				Vehicle Wt.: 37,900 lbs						Vehicle Type: Packer (0935)										
Vehicle #: 3				Load Wt.: 22,880 lbs						Route Type: -										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	14.85	5.05		21.6	4.95		16.75	5.05		13.75	5.05								46.85	12.72
Newsprint	9.8	5.05			5.05														4.75	1.29
Corrugated	17.95	5.05		18.6	4.95		16.2	5.15		13	5.05		18.7	0			5.05		64.25	17.45
Plastic	12.65	5.05		18.4	5.05		11.65	5.05											27.55	7.48
Plastic Bags	10.9	5.05			5.15														5.85	1.59
Plastic Packaging	11.1	5.05		9.35	5.05														10.35	2.81
PET Beverage	7.15	5.05																	2.1	0.57
MI Deposit	5.7	5.15																	0.55	0.15
Polystyrene	6.25	5.05																	1.2	0.33
Yard Waste	36.8	5.05																	31.75	8.62
Food Waste	28.95	5.15																	23.8	6.46
Wood	11.65	4.6																	7.05	1.91
Other Organics	25.55	4.5		13.55	5.05														29.55	8.03
Ferrous	22.55	5.05																	17.5	4.75
Aluminum	8.55	5.25																	3.3	0.90
Glass	11.55	5.25																	6.3	1.71
Other Inorganics	9.7	5.05		21.8	4.95		14.1	5.05		8.8	4.95		16.85	5.05		11.65	5.15		52.7	14.31
Bulk Items	15.3	5.05																	10.25	2.78
Electronics																			0	0.00
Household Haz	26.55	5.05																	21.5	5.84
Soil	5.95	5.15																	0.8	0.22
Textiles	5.4	5.15																	0.25	0.07
TOTAL																			368.2	100.00
Number of MI Deposits	11																			
Types of Electronics	Half of a Treadmill, 1 Toy Bear, 1 Circuit Board, 1 Light Bulb, 4 Cords, 1 Toy																			

Site 3: South Kent																					
Truck 8 (#7)																					
Date: 6/4/2015				Total Wt.: 27,000 lbs									Communities Served: Allegan								
Weather: Sunny-Hot				Vehicle Wt.: 21,180 lbs									Vehicle Type: Packer (1515)								
Vehicle #: 7				Load Wt.: 5,820 lbs									Route Type: -								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6					
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%	
Mixed Paper	31.7	5.05		13.95	5.05		20.35	5.05											50.85	13.43	
Newsprint	12	5.05			5.05														6.95	1.83	
Corrugated	15.5	5.05		12.85	4.95		11.3	5.15		15.5	5.05		9.45	5.05					39.35	10.39	
Plastic	16.05	5.05		14.1	5.05		7.8	5.15		13.1	5.15								30.65	8.09	
Plastic Bags	16.4	5.05			5.05														11.35	3.00	
Plastic Packaging	15.1	5.05			5.05		13.65	5.05		10	5.05								23.6	6.23	
PET Beverage	11.45	5.05																	6.4	1.69	
MI Deposit	6.5	5.05																	1.45	0.38	
Polystyrene	8.8	5.15						5.05											3.65	0.96	
Yard Waste	5.6	5.05																	0.55	0.15	
Food Waste	23.65	5.15					10.45	5.15											23.8	6.28	
Wood	12.2	4.6																	7.6	2.01	
Other Organics	19.7	4.5		5.95	5.05														16.1	4.25	
Ferrous	22.15	5.15																	17	4.49	
Aluminum	8.15	5.25																	2.9	0.77	
Glass	16.5	5.15																	11.35	3.00	
Other Inorganics	27.4	5.05		39.2	5.05		34.05	5.05		8.25	5.05		24.45	5.05					108.1	28.54	
Bulk Items	19.5	5.05																	14.45	3.82	
Electronics																			0	0.00	
Household Haz	7.7	5.05																	2.65	0.70	
Soil		5.15																	0	0.00	
Textiles		5.05																	0	0.00	
TOTAL																			378.75	100.00	
Number of MI Deposits	7																				
Types of Electronics	1 Pump, 1 Light Bulb																				

Site 3: South Kent				Truck 9 (#11)		
Date: 6/4/2015	Total Wt.: 64,240 lbs			Communities Served: Kent		
Weather: Sunny-Hot	Vehicle Wt.: 44,020 lbs			Vehicle Type: Packer (1649)		
Vehicle #: 11	Load Wt.: 20,220 lbs			Route Type: Commercial		

	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6			Bin 7			Bin 8			All	
	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Gros	Tar	Re	Bins	%
Mixed Paper	12.85	5.05		12.65	5.05																				15.4	4.46
Newsprint		5.05			4.95																				0	0.00
Corrugated	11.2	5.05			4.95																				6.15	1.78
Plastic	12.65	5.15		7.98	5.05																				10.43	3.02
Plastic Bags	7.05	5.05			5.05																				2	0.58
Plastic Packaging	9	4.95		7.45	5.05																				6.45	1.87
PET Beverage	7.45	5.05																							2.4	0.69
MI Deposit	5.15	5.05																							0.1	0.03
Polystyrene	5.6	5.05																							0.55	0.16
Yard Waste		5.05																							0	0.00
Food Waste	9.25	5.05																							4.2	1.22
Wood	24						7.25	4.6																	26.65	7.72
Other Organics	11.35	4.5		14.55	4.95																				16.45	4.76
Ferrous	32.4			13.65			18.8	5.15																	59.7	17.29
Aluminum	5.5	5.25																							0.25	0.07
Glass	12.2	5.15																							7.05	2.04
Other Inorganics	30.3	5.05		40.45	10.1		16.85	5.05		28.65	5.05		26.3	5.05		23.9	5.05		26.1	5.05		17.05	5.05		164.15	47.53
Furniture	23.1																								23.1	6.69
Electronics		5.05																							0	0.00
Household Haz		5.05																							0	0.00
Soil		5.05																							0	0.00
Textiles	5.4	5.05																							0.35	0.10
TOTAL																									345.38	100.0
Number of MI	3																									
Types of	None																									

Site 3: South Kent				Truck 10 (#17)																	
Date: 6/4/2015				Total Wt.: 48,240 lbs										Communities Served: Barry County							
Weather: Sunny-Hot				Vehicle Wt.: 41,500 lbs										Vehicle Type: Packer (2421)							
Vehicle #: 17				Load Wt.: 6,740 lbs										Route Type: -							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	14.2	5.05		18.25	5.05		13.3	5.05		14.65	5.15								40.1	10.39
Newsprint	10.65	5.05			5.15														5.6	1.45
Corrugated	9.8	5.05		9.45	5.05		7.15	5.05		11.45	5.05								17.65	4.57
Plastic	9.45	5.15			5.05														4.3	1.11
Plastic Bags	7.6	5.05			5.05														2.55	0.66
Plastic Packaging	9.9	5.05		8.9	5.15		8.7	5.05		14.55	5.05		10	4.95					26.8	6.95
PET Beverage	8.35	5.15																	3.2	0.83
MI Deposit	5.7	5.15																	0.55	0.14
Polystyrene	10.7	5.05					5.25	5.05											5.85	1.52
Yard Waste	14.3	5.05																	9.25	2.40
Food Waste	51.8	5.15					32.7	5.15		7.25	5.15								76.3	19.78
Wood	6.15	4.5																	1.65	0.43
Other Organics	9.25	4.5		6.05	5.05														5.75	1.49
Ferrous	14.65	5.15					5.25	5.05											9.7	2.51
Aluminum	5.95	5.25																	0.7	0.18
Glass	19.8	5.15																	14.65	3.80
Other Inorganics	12.55	5.05		28	5.05		21.9	5.05		8.55	5.05								50.8	13.17
Bulk Items	9.5																		9.5	2.46
Electronics	60.8	4.95					18.6			9.7	5.05								79.1	20.50
Household Haz	5.25	5.15																	0.1	0.03
Soil		5.05																	0	0.00
Textiles	23.65	5.15					8.25	5.05											21.7	5.62
TOTAL					5.15														385.8	100.00
Number of MI Deposits	0																			
Types of Electronics	1 Vacuum, 1 Keyboard/Organ, 1 Disk Drive, 1 Battery, 1 Advertising Button, Christmas Lights, 1 Phone Cord, 1 Light Bulb, 1 Hair Dryer																			

Site 4: Covanta																						
Date: 6/9/2015				Total Wt.: 48,580 lbs									Truck 1 (#2)									
Weather: Sunny				Vehicle Wt.: 42,080 lbs									Communities Served: Walker									
Vehicle #: 2				Load Wt.: 6,500 lbs									Vehicle Type: Packer (2421)									
													Route Type: Residential									
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6					
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%		
Mixed Paper	17.7	5.05		10.1	5.05		27.85	5.05		18.7	10.1								49.1	17.94		
Newsprint	10	5.05			5.05														4.95	1.81		
Corrugated	8.8	5.05		8.8	4.95		6.9	5.05											9.45	3.45		
Plastic	7.9	5.15			5.05														2.75	1.00		
Plastic Bags	13.85	5.05			5.05														8.8	3.22		
Plastic Packaging	9.9	4.95		11.35	5.05		10.55	5.05		6.6	4.95								18.4	6.72		
PET Beverage	8.45	5.05																	3.4	1.24		
MI Deposit	5.7	5.05																	0.65	0.24		
Polystyrene	7.45	5.05					5.15	5.05											2.5	0.91		
Yard Waste	7.35	5.05																	2.3	0.84		
Food Waste	73.15	5.05					8.9	5.15											71.85	26.25		
Wood	12	4.5																	7.5	2.74		
Other Organics	29.3	4.4			5.05														24.9	9.10		
Ferrous	9.7	5.05																	4.65	1.70		
Aluminum	6.15	5.25																	0.9	0.33		
Glass	15.1	5.05																	10.05	3.67		
Other Inorganics	13.65	5.05		13.3	5.05		25.45	4.95		5.6	5.05								37.9	13.85		
Bulk Items																			0	0.00		
Electronics	11.65	5.05																	6.6	2.41		
Household Haz	6.15	5.15																	1	0.37		
Soil		5.05																	0	0.00		
Textiles	11.1	5.05																	6.05	2.21		
TOTAL																			273.7	100.00		
Number of MI Deposits	3																					
Types of Electronics	1 Leaf Blower, 1 Light Bulb, 1 Razor, 1 Large Cord																					

Site 4: Covanta							Truck 2 (#5)														
Date: 6/9/2015				Total Wt.: 63,580 lbs									Communities Served: Downtown Grand Rapids								
Weather: Sunny				Vehicle Wt.: 42,520 lbs									Vehicle Type: Packer (1934)								
Vehicle #: 5				Load Wt.: 21,060 lbs									Route Type: Mixed								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	18.15	5.05		14.65	5.05		26.2	5.05											43.85	16.70
Newsprint	8.15	5.05			5.05														3.1	1.18
Corrugated	16.05	5.05		10.65	5.05		6.15	5.15											17.6	6.70
Plastic	9.45	5.05			5.05														4.4	1.68
Plastic Bags	13	5.05		6.9	5.05					7.8	5.05								12.55	4.78
Plastic Packaging	14.1	5.15		9	5.05														12.9	4.91
PET Beverage	9.9	5.05																	4.85	1.85
MI Deposit	5.4	5.05																	0.35	0.13
Polystyrene	8.35	5.05																	3.3	1.26
Yard Waste		5.05																	0	0.00
Food Waste	27	5.25																	21.75	8.28
Wood	10.1	4.6																	5.5	2.09
Other Organics	26.3	4.5		15.85	5.05					20.7	5.05								48.25	18.38
Ferrous	7.7	5.25																	2.45	0.93
Aluminum	7.05	5.25																	1.8	0.69
Glass	6.35	5.15																	1.2	0.46
Other Inorganics	16.3	5.05		19.05	5.05		18.95	5.05											39.15	14.91
Bulk Items																			0	0.00
Electronics	20.8	5.05																	15.75	6.00
Household Haz	6.15	5.15		19.05	5.05														15	5.71
Soil		5.05																	0	0.00
Textiles	13.85	5.05																	8.8	3.35
TOTAL																			262.55	100.00
Number of MI Deposits	5																			
Types of Electronics	1 Speaker, 2 Computer Keyboards, 1 Battery/Power Source																			

Site 4: Covanta																						
												Truck 3 (#6)										
Date: 6/9/2015							Total Wt.: 52,200 lbs								Communities Served: Grand Rapids							
Weather: Sunny							Vehicle Wt.: 36,680 lbs								Vehicle Type: Packer (0939)							
Vehicle #: 6							Load Wt.: 15,520 lbs								Route Type: Mixed							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6					
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	26.65	4.95		17.4	5.05		20.8	5.05			5.05								49.8	15.59
Newsprint	6.15	5.05			5.05														1.1	0.34
Corrugated	16.3	5.05		16.6	4.95		8.9	5.05		16.05	10								32.8	10.27
Plastic	11.35	5.05		10.55	5.05		7.15	0		14.95	5.05								28.85	9.03
Plastic Bags	6.9	5.05		6.5	5.05														3.3	1.03
Plastic Packaging	13.85	5.05		9.8	5.05		6.15	5.15											14.55	4.55
PET Beverage	7.25	5.05																	2.2	0.69
MI Deposit		5.05																	0	0.00
Polystyrene	8.55	5.05																	3.5	1.10
Yard Waste		5.05																	0	0.00
Food Waste	22	5.15																	16.85	5.27
Wood	24.35	4.6					6.6	4.6											21.75	6.81
Other Organics	20.35	4.5		14.75	5.05														25.55	8.00
Ferrous	11.35	5.25																	6.1	1.91
Aluminum	5.4	5.4																	0	0.00
Glass	11.75	5.15																	6.6	2.07
Other Inorganics	28.5	5.05		12.55	5.05		10.35	5.05		10.9	5.05								42.1	13.18
Bulk Items	31.4	0																	31.4	9.83
Electronics	16.85	5.05																	11.8	3.69
Household Haz	22.7	5.15																	17.55	5.49
Soil		5.05																	0	0.00
Textiles	8.7	5.05																	3.65	1.14
TOTAL																			319.45	100.00
Number of MI Deposits	0																			
Types of Electronics	1 Air Compressor, 1 Satellite Dish, 1 Controller																			

Site 4: Covanta							Truck 4 (#7)													
Date: 6/9/2015				Total Wt.: 32,400 lbs						Communities Served: Grand Rapids										
Weather: Sunny				Vehicle Wt.: 25,960 lbs						Vehicle Type: Packer (0932)										
Vehicle #: 7				Load Wt.: 6,440 lbs						Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	22.55	5.05		13.2	5.05		17.4	4.95		12.65	5.05								45.7	11.16
Newsprint	20.7	5.05			5.05														15.65	3.82
Corrugated	10.1	5.05		11.2	4.95						4.95								11.3	2.76
Plastic	7.7	5.05			5.05														2.65	0.65
Plastic Bags	9.35	5.05			5.05														4.3	1.05
Plastic Packaging	10.45	4.95		8.35	5.05														8.8	2.15
PET Beverage	7.35	5.05																	2.3	0.56
MI Deposit	5.15	5.05																	0.1	0.02
Polystyrene	5.8	5.05																	0.75	0.18
Yard Waste	55.4	5.05						5.05											50.35	12.29
Food Waste	52.65	5.25					42.65	5.15											84.9	20.73
Wood	4.95	4.6																	0.35	0.09
Other Organics	18.6	4.4		10.55															24.75	6.04
Ferrous	13.55	5.15																	8.4	2.05
Aluminum	9	5.25																	3.75	0.92
Glass	17.7	5.15																	12.55	3.06
Other Inorganics	97.85	4.95		27.85	5.05		21.6	4.95			4.95								132.35	32.31
Bulk Items																			0	0.00
Electronics	5.15	5.05																	0.1	0.02
Household Haz		5.15																	0	0.00
Soil		5.05																	0	0.00
Textiles	5.6	5.05																	0.55	0.13
TOTAL																			409.6	100.00
Number of MI Deposits	0																			
Types of Electronics	None																			

Site 4: Covanta																					
Truck 5 (#10)																					
Date: 6/9/2015				Total Wt.: 57,560 lbs									Communities Served: Wyoming								
Weather: Sunny				Vehicle Wt.: 42,440 lbs									Vehicle Type: Packer (1578)								
Vehicle #: 10				Load Wt.: 15,120 lbs									Route Type: Mixed								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	22.7	5.05		13.3	5.05			4.95											25.9	6.98
Newsprint	8.25	5.05			5.05														3.2	0.86
Corrugated	11.45	5.05			4.95														6.4	1.72
Plastic	10.1	5.05			5.05			5.15											5.05	1.36
Plastic Bags	15.75	5.05			5.05														10.7	2.88
Plastic Packaging	12.1	4.95		11.1	5.05			4.95											13.2	3.56
PET Beverage	8.15	5.05																	3.1	0.84
MI Deposit	5.95	5.05																	0.9	0.24
Polystyrene	7.05	5.05						5.05											2	0.54
Yard Waste	60.7	5.05					60.4	5.05											111	29.91
Food Waste	53.45	5.25																	48.2	12.99
Wood	14.95	4.6						4.6											10.35	2.79
Other Organics	39.35	4.5		31.7	5.05			4.5											61.5	16.57
Ferrous	9.7	5.15																	4.55	1.23
Aluminum	5.95	5.25																	0.7	0.19
Glass	23	5.15																	17.85	4.81
Other Inorganics	37.1	5.05			5.05			5.05											32.05	8.64
Bulk Items																			0	0.00
Electronics	5.5	5.05																	0.45	0.12
Household Haz	6.7	5.15																	1.55	0.42
Soil	9.8	5.05																	4.75	1.28
Textiles	12.75	5.05						5.05											7.7	2.07
TOTAL																			371.1	100.00
Number of MI Deposits	0																			
Types of Electronics	None																			

Site 4: Covanta																					
Truck 6 (#14)																					
Date: 6/9/2015				Total Wt.: 69,940 lbs									Communities Served: Byron Center								
Weather: Sunny				Vehicle Wt.: 46,640 lbs									Vehicle Type: Packer (1265)								
Vehicle #: 14				Load Wt.: 23,300 lbs									Route Type: Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	25.9	5.05		17.4	5.05		5.8	4.95			5.05								34.05	9.60
Newsprint	7.25	5.05			5.05														2.2	0.62
Corrugated	13.75	5.05		9.25	4.95		8.9	5.05		7.35	4.95								19.25	5.43
Plastic	17.4	5.05		9.25	5.15														16.45	4.64
Plastic Bags	6.8	5.05			5.05														1.75	0.49
Plastic Packaging	12.45	5.05		9.35	5.15														11.6	3.27
PET Beverage	6.05	5.05																	1	0.28
MI Deposit	6.05	5.05																	1	0.28
Polystyrene	5.7	5.05																	0.65	0.18
Yard Waste		5.05																	0	0.00
Food Waste	21.15	5.25																	15.9	4.48
Wood	27.1	4.6																	22.5	6.34
Other Organics	8.35	4.4																	3.95	1.11
Ferrous	8.15	5.15			5.05														3	0.85
Aluminum	10.65	5.25																	5.4	1.52
Glass	6.05	5.15																	0.9	0.25
Other Inorganics	22.35	5.05		14.85	5.05		20.6	4.95		193.05	29.8								206	58.08
Bulk Items																			0	0.00
Electronics	9	4.95																	4.05	1.14
Household Haz		5.15																	0	0.00
Soil		5.05																	0	0.00
Textiles	10.1	5.05																	5.05	1.42
TOTAL																			354.7	100.00
Number of MI Deposits	11																			
Types of Electronics	1 Industrial Fan																			

Site 4: Covanta							Truck 7 (#17)													
Date: 6/9/2015				Total Wt.: 66,240 lbs						Communities Served: Grand Rapids										
Weather: Sunny				Vehicle Wt.: 44,620 lbs						Vehicle Type: Packer (1045)										
Vehicle #: 17				Load Wt.: 21,620 lbs						Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	20.8	5.05		9.45	5.05			5.05											20.15	5.90
Newsprint	6.35	5.05			5.05														1.3	0.38
Corrugated	11.35	5.05		22.9	4.95			5.15											24.25	7.10
Plastic	16.95	5.05		8.45	5.05			5.15											15.3	4.48
Plastic Bags	11.35	5.05		11.1	5.05						5.05								12.35	3.62
Plastic Packaging	12.2	4.95		10.45	5.05			5.05											12.65	3.70
PET Beverage	9.55	5.05																	4.5	1.32
MI Deposit	5.5	5.15																	0.35	0.10
Polystyrene	8.35	5.05																	3.3	0.97
Yard Waste	64.8	5.05						5.05											59.75	17.50
Food Waste	45.85	5.15					6.15	5.15											41.7	12.21
Wood	53.2	4.6					21.6	4.6											65.6	19.21
Other Organics	13.65	4.4		6.7	5.05			4.4											10.9	3.19
Ferrous	26.1	5.15						5.25											20.95	6.14
Aluminum	6.05	5.25																	0.8	0.23
Glass	11.45	5.15																	6.3	1.85
Other Inorganics	27.65	5.05		13.3	5.05														30.85	9.03
Bulk Items																			0	0.00
Electronics	7.25	5.05																	2.2	0.64
Household Haz		5.15																	0	0.00
Soil		5.05																	0	0.00
Textiles	13.3	5.05																	8.25	2.42
TOTAL																			341.45	100.00
Number of MI Deposits	6																			
Types of Electronics	1 Power Strip, 3 Light Bulbs, 1 Cord																			

Site 4: Covanta										Truck 8 (#18)											
Date: 6/9/2015				Total Wt.: 71,460 lbs						Communities Served: Grand Rapids											
Weather: Cloudy				Vehicle Wt.: 45,580 lbs						Vehicle Type: Packer (1376)											
Vehicle #: 18				Load Wt.: 25,880 lbs						Route Type: Commercial											
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	18.4	5.05		9	5.05		14.1	5.05											26.35	7.85
Newsprint	9.45	5.05			5.05														4.4	1.31
Corrugated	18.95	5.05		16.6	4.95		14.1	5.05			4.95								34.6	10.31
Plastic	10.25	5.05			5.05														5.2	1.55
Plastic Bags	13.2	5.05			5.05		9.7	5.05											12.8	3.81
Plastic Packaging	13.1	4.95		14.1	5.05		15.1	5.05											27.25	8.12
PET Beverage	9.25	5.05																	4.2	1.25
MI Deposit				6.25	5.05														1.2	0.36
Polystyrene	6.7	5.05																	1.65	0.49
Yard Waste	27.1	5.05						4.95											22.05	6.57
Food Waste	46.8				5.25		26.65	5.25											68.2	20.32
Wood	34.5	4.6					13.2	4.6		14.75	4.6								48.65	14.50
Other Organics	14.55	4.4			5.05														10.15	3.02
Ferrous				12.45	5.25														7.2	2.15
Aluminum	5.7	5.25																	0.45	0.13
Glass	8.8	5.15																	3.65	1.09
Other Inorganics	32.6	5.05		8.25	5.05		8	4.95											33.8	10.07
Bulk Items																			0	0.00
Electronics	12.2	5.05																	7.15	2.13
Household Haz	5.25	5.15																	0.1	0.03
Soil					4.95														0	0.00
Textiles	16.85	5.05					9.8	5.05											16.55	4.93
TOTAL																			335.6	100.00
Number of MI Deposits	4																			
Types of Electronics	Cords																			

Site 4: Covanta							Truck 9 (#22)													
Date: 6/9/2015				Total Wt.: 63,580 lbs						Communities Served: Wyoming										
Weather: Cloudy				Vehicle Wt.: 42,080 lbs						Vehicle Type: Packer (1775)										
Vehicle #: 22				Load Wt.: 21,500 lbs						Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	26.45	5.05		7.7	5.05														24.05	10.13
Newsprint	5.8	5.05			5.05														0.75	0.32
Corrugated	15.2	5.15		9.8	4.95														14.9	6.28
Plastic	7.35	5.15		9.9	5.05														7.05	2.97
Plastic Bags	14.85	5.05			5.05														9.8	4.13
Plastic Packaging	15.85	5.15		8.8	5.15														14.35	6.04
PET Beverage	7.8	5.05																	2.75	1.16
MI Deposit	6.05	5.05																	1	0.42
Polystyrene	7.45	5.05																	2.4	1.01
Yard Waste	39.1	5.05																	34.05	14.34
Food Waste	51.8	5.25																	46.55	19.61
Wood	7.8	4.6																	3.2	1.35
Other Organics	23.25	4.5		13.65	5.05														27.35	11.52
Ferrous	10.45	5.25																	5.2	2.19
Aluminum	6.6	5.4																	1.2	0.51
Glass		5.25																	0	0.00
Other Inorganics	34.5	4.95																	29.55	12.45
Bulk Items																			0	0.00
Electronics	5.25	5.05																	0.2	0.08
Household Haz	5.4	5.15																	0.25	0.11
Soil		5.05																	0	0.00
Textiles	17.85	5.05																	12.8	5.39
TOTAL																			237.4	100.00
Number of MI Deposits	11																			
Types of Electronics	1 Coaxial Cable																			

Site 4: Covanta																					
Date: 6/9/2015				Total Wt.: 52,500 lbs									Truck 10 (#24)								
Weather: Cloudy				Vehicle Wt.: 35,640 lbs									Communities Served: Grandville, Wyoming								
Vehicle #: 24				Load Wt.: 16,860 lbs									Vehicle Type: Packer (1932)								
													Route Type: Residential								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	23.35	5.05		13.55	5.05														26.8	14.62
Newsprint	7.15	4.95			5.05														2.2	1.20
Corrugated	8.9	5.15			4.95														3.75	2.05
Plastic	8.45	5.15			5.15														3.3	1.80
Plastic Bags	10.8	5.05		5.4	5.05														6.1	3.33
Plastic Packaging	13.1	5.15		10.65	5.15														13.45	7.34
PET Beverage	7.25	5.05																	2.2	1.20
MI Deposit	5.5	5.05																	0.45	0.25
Polystyrene	6.15	5.05																	1.1	0.60
Yard Waste	43.5	5.05																	38.45	20.97
Food Waste	45.05	5.25																	39.8	21.71
Wood	6.85	4.6																	2.25	1.23
Other Organics	17.85	4.5			5.05														13.35	7.28
Ferrous	6.9	5.25																	1.65	0.90
Aluminum	6.25	5.4																	0.85	0.46
Glass	7.9	5.25																	2.65	1.45
Other Inorganics	22	5.05			5.05														16.95	9.24
Bulk Items																			0	0.00
Electronics	7.35	5.05																	2.3	1.25
Household Haz		5.15																	0	0.00
Soil		5.05																	0	0.00
Textiles	10.8	5.05																	5.75	3.14
TOTAL																			183.35	100.00
Number of MI Deposits	4																			
Types of Electronics	1 iPhone Cord, Alarm clock/Casette Player, Bag of Cords, Power Board																			

Site 5: Elk Run																					
Truck 1																					
Date: 6/11/2015				Total Wt.: 35,200 lbs									Communities Served: Presque Isle County								
Weather: Sunny				Vehicle Wt.: 27,620 lbs									Vehicle Type: Rearload Compactor (PAC6)								
Vehicle #: -				Load Wt.: 7,580 lbs									Route Type: Mixed								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	37.35	5.05		24.55	5.05		15.95	5.05			5.05								62.7	21.44
Newsprint	6.9	5.05																	1.85	0.63
Corrugated	30.2	5.05		17.15	5.05		14.1	5.05			4.95								46.3	15.83
Plastic	8.9	5.15			5.05														3.75	1.28
Plastic Bags	9.45	5.05					11.75	5.05											11.1	3.79
Plastic Packaging	14.65	5.15		15.75	5.05		13.65	5.15		10.65	5.05								34.3	11.73
PET Beverage	8.55	5.05																	3.5	1.20
MI Deposit	5.6	4.95																	0.65	0.22
Polystyrene	7.05	5.05																	2	0.68
Yard Waste	31.5	5.05																	26.45	9.04
Food Waste	29.75	5.15																	24.6	8.41
Wood	17.95	4.6																	13.35	4.56
Other Organics	32.05	4.5		11	5.05														33.5	11.45
Ferrous	11	5.15																	5.85	2.00
Aluminum	6.25	5.25																	1	0.34
Glass	10.25	5.25																	5	1.71
Other Inorganics	15.3	4.95			5.05														10.35	3.54
Bulk Items																			0	0.00
Electronics	5.8	4.95																	0.85	0.29
Household Haz		5.15																	0	0.00
Soil																			0	0.00
Textiles	10.45	5.05																	5.4	1.85
TOTAL																			292.5	100.00
Number of MI Deposits	14																			
Types of Electronics	2 Calculators, 1 Solar Light, Light Bulb, 1 Power Source																			

Site 5: Elk Run							Truck 2													
Date: 6/11/2015				Total Wt.: 37,000 lbs									Communities Served: Cheboygan County							
Weather: Sunny				Vehicle Wt.: 26,520 lbs									Vehicle Type: Rearload Compactor (PAC11)							
Vehicle #: -				Load Wt.: 10,480 lbs									Route Type: Mixed							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	40	4.95		17.7	5.05														47.7	11.74
Newsprint		5.05																	0	0.00
Corrugated	19.7	5.05		6.8	4.95														16.5	4.06
Plastic	8.45	5.05			5.15														3.4	0.84
Plastic Bags	5.7	5.05																	0.65	0.16
Plastic Packaging	12.65	5.05		6.8	5.05														9.35	2.30
PET Beverage	5.6	5.05																	0.55	0.14
MI Deposit	5.25	4.95																	0.3	0.07
Polystyrene	5.15	4.95																	0.2	0.05
Yard Waste		5.05																	0	0.00
Food Waste	9.35	5.15																	4.2	1.03
Wood	40.45	4.6		26.2	4.6		9.7	4.6											62.55	15.39
Other Organics	13.4	4.5			4.95														8.9	2.19
Ferrous	9.25	5.15																	4.1	1.01
Aluminum	5.5	5.25																	0.25	0.06
Glass	6.8	5.05																	1.75	0.43
Other Inorganics	20.7	4.85		34.6	5.05		42.2	4.95		35.9	4.95		57.75	4.95		48.7	5.05		210.05	51.69
Bulk Items																			0	0.00
Electronics		4.95																	0	0.00
Household Haz		5.15																	0	0.00
Soil																			0	0.00
Textiles	40.85	4.95																	35.9	8.83
TOTAL																			406.35	100.00
Number of MI Deposits	2																			
Types of Electronics	None																			

Site 5: Elk Run							Truck 3													
Date: 6/11/2015				Total Wt.: 54,100 lbs									Communities Served: Cheboygan County							
Weather: Sunny				Vehicle Wt.: 37,560 lbs									Vehicle Type: Rearload (R2047)							
Vehicle #: -				Load Wt.: 16,540 lbs									Route Type: Residential							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	14.95	5.05		14.1	4.95														19.05	8.67
Newsprint	13.85	5.05																	8.8	4.01
Corrugated	12.2	5.05		6.7	4.9			5.05											8.95	4.07
Plastic	5.5	5.05		11.35	5.05														6.75	3.07
Plastic Bags	14.4	5.05																	9.35	4.26
Plastic Packaging	13.3	5.15		11.2	5.15					10.35	5.05								19.5	8.88
PET Beverage	7.25	5.05																	2.2	1.00
MI Deposit	7.45	5.05																	2.4	1.09
Polystyrene	6.8	5.05																	1.75	0.80
Yard Waste	12.75	5.05																	7.7	3.50
Food Waste	52.9	5.15																	47.75	21.73
Wood	16.6	4.7																	11.9	5.42
Other Organics	28.75	4.4			5.15														24.35	11.08
Ferrous	10.1	5.15																	4.95	2.25
Aluminum	7.7	5.25																	2.45	1.12
Glass	11.75	5.15																	6.6	3.00
Other Inorganics	13.4	5.05		13	5.05		9.55	5.05											20.8	9.47
Bulk Items																			0	0.00
Electronics	11.65	5.05																	6.6	3.00
Household Haz	5.95	5.15																	0.8	0.36
Soil																			0	0.00
Textiles	12.1	5.05																	7.05	3.21
TOTAL																			219.7	100.00
Number of MI Deposits	24																			
Types of Electronics	1 Leaf Blower, 1 Car Charger, 1 Light Bulb, 1 Battery																			

Site 5: Elk Run							Truck 4													
Date: 6/11/2015				Total Wt.: 39,380 lbs									Communities Served: Cheboygan County							
Weather: Sunny				Vehicle Wt.: 30,420 lbs									Vehicle Type: Rearload Compactor (PAC10)							
Vehicle #: -				Load Wt.: 8,960 lbs									Route Type: Mixed							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	24	5.05		7.8	5.05														21.7	12.16
Newsprint	8.7	4.95																	3.75	2.10
Corrugated	7.6	5.05		9.7	4.95														7.3	4.09
Plastic	12.1	5.05		10.65	5.05														12.65	7.09
Plastic Bags	6.7	5.05																	1.65	0.92
Plastic Packaging	7.7	5.15			5.05														2.55	1.43
PET Beverage		5.05																	0	0.00
MI Deposit		5.05																	0	0.00
Polystyrene	5.15	5.05																	0.1	0.06
Yard Waste	5.8	4.95																	0.85	0.48
Food Waste	8.35	5.25																	3.1	1.74
Wood	19.5	4.6																	14.9	8.35
Other Organics	9.9	4.5			5.05														5.4	3.03
Ferrous	7.35	4.95																	2.4	1.34
Aluminum	6.05	5.25																	0.8	0.45
Glass	12.1	5.25																	6.85	3.84
Other Inorganics	23.35	4.85		16.95	5.05														30.4	17.04
Bulk Items	48.05	5.05																	43	24.10
Electronics	10	5.05																	4.95	2.77
Household Haz	5.7	5.05																	0.65	0.36
Soil																			0	0.00
Textiles	20.5	5.05																	15.45	8.66
TOTAL																			178.45	100.00
Number of MI Deposits	0																			
Types of Electronics	1 Keyboard, 2 Light Bulbs, Calculator Clipboard, Alarm Clock, 1 Small Speaker, 1 Power Cord																			

Site 5: Elk Run																				
Truck 5																				
Date: 6/11/2015				Total Wt.: 19,480 lbs						Communities Served: Antrim County										
Weather: Partly Cloudy				Vehicle Wt.: 10,400 lbs						Vehicle Type: Rearload (CQ)										
Vehicle #: -				Load Wt.: 9,080 lbs						Route Type: -										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	29.5	5.15		12.75	5.05														32.05	19.63
Newsprint	5.15	5.05																	0.1	0.06
Corrugated	5.5	5.15			4.95														0.35	0.21
Plastic	12.65	5.15			5.15														7.5	4.59
Plastic Bags	9.8	4.95																	4.85	2.97
Plastic Packaging	9.9	5.25		8	5.05														7.6	4.65
PET Beverage	6.15	5.05																	1.1	0.67
MI Deposit	5.4	5.15																	0.25	0.15
Polystyrene	5.6	5.15																	0.45	0.28
Yard Waste	6.05	4.95																	1.1	0.67
Food Waste	47.8	4.95																	42.85	26.24
Wood	7.6	4.7																	2.9	1.78
Other Organics	26	4.5			5.15														21.5	13.17
Ferrous	8.55	5.15																	3.4	2.08
Aluminum	5.7	5.4																	0.3	0.18
Glass	13.1	5.15																	7.95	4.87
Other Inorganics	21.9	4.95		13	5.05														24.9	15.25
Bulk Items																			0	0.00
Electronics	5.15	4.95																	0.2	0.12
Household Haz		5.05																	0	0.00
Soil																			0	0.00
Textiles	8.9	4.95																	3.95	2.42
TOTAL																			163.3	100.00
Number of MI Deposits	9																			
Types of Electronics	1 Microphone, 1 Mouse, 5 Charger Cords, 1 Car Charger, 1 Spotlight, 1 Car CD Adapter																			

Site 5: Elk Run							Truck 6													
Date: 6/11/2015				Total Wt.: 66,360 lbs						Communities Served: Cheboygan County										
Weather: Partly Cloudy				Vehicle Wt.: 43,400 lbs						Vehicle Type: Frontload Compactor (R1262)										
Vehicle #: -				Load Wt.: 22,960 lbs						Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	18.25	5.05		5.7	5.05														13.85	6.69
Newsprint	5.7	4.95																	0.75	0.36
Corrugated	10.9	5.05		7.9	5.05						5.05								8.7	4.20
Plastic	17.85	5.05																	12.8	6.18
Plastic Bags	8.7	5.05																	3.65	1.76
Plastic Packaging	9.45	5.15		6.9	5.05														6.15	2.97
PET Beverage	5.4	5.05																	0.35	0.17
MI Deposit		5.05																	0	0.00
Polystyrene	6.7	4.95					5.4	5.05											2.1	1.01
Yard Waste	36.9	5.05																	31.85	15.39
Food Waste	54.65	5.25					21.8	5.25											65.95	31.86
Wood		4.6																	0	0.00
Other Organics		4.5		15.95	5.05														10.9	5.27
Ferrous	12.3	5.15																	7.15	3.45
Aluminum	5.5	5.25																	0.25	0.12
Glass	7.25	5.25																	2	0.97
Other Inorganics	14.75	5.05		12.55	5.05		10.25	5.05			5.15								22.4	10.82
Bulk Items																			0	0.00
Electronics	10.65	5.05																	5.6	2.71
Household Haz	16.05	5.15																	10.9	5.27
Soil																			0	0.00
Textiles	6.6	4.95																	1.65	0.80
TOTAL																			207	100.00
Number of MI Deposits	0																			
Types of Electronics	1 Coffee Maker, 1 Light Switch, 1 Charger Cord																			

Site 5: Elk Run						Truck 7													
Date: 6/11/2015				Total Wt.: 66,460 lbs					Communities Served: Cheboygan County										
Weather: Partly Cloudy				Vehicle Wt.: 45,500 lbs					Vehicle Type: Frontload Compactor (R1211)										
Vehicle #: -				Load Wt.: 20,960 lbs					Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	38.1	4.95		15.1	4.95														43.3	22.30
Newsprint	6.8	5.05																	1.75	0.90
Corrugated	10.35	5.05																	5.3	2.73
Plastic	8.55	5.05			5.05														3.5	1.80
Plastic Bags	19.05	4.95																	14.1	7.26
Plastic Packaging	13.1	5.05		11	5.15														13.9	7.16
PET Beverage	11	4.95																	6.05	3.12
MI Deposit	5.25	5.05																	0.2	0.10
Polystyrene	5.6	5.05																	0.55	0.28
Yard Waste	37.35	4.95																	32.4	16.68
Food Waste	23.25	5.15																	18.1	9.32
Wood	6.05	4.5																	1.55	0.80
Other Organics	24.25	4.4		6.5	5.05														21.3	10.97
Ferrous	9.9	5.05																	4.85	2.50
Aluminum	7.35	5.15																	2.2	1.13
Glass	10.55	5.15																	5.4	2.78
Other Inorganics	18.15	4.95			5.05														13.2	6.80
Bulk Items																			0	0.00
Electronics	8.55	4.95																	3.6	1.85
Household Haz	5.25	5.15																	0.1	0.05
Soil																			0	0.00
Textiles	7.8	4.95																	2.85	1.47
TOTAL																			194.2	100.00
Number of MI Deposits	7																			
Types of Electronics	Part of a TV, 1 Portable DVD Player, 1 Flashlight																			

Site 5: Elk Run						Truck 8													
Date: 6/11/2015			Total Wt.: 39,700 lbs			Communities Served: Presque Isle County													
Weather: Cloudy			Vehicle Wt.: 26,520 lbs			Vehicle Type: Rearload Compactor (PAC11)													
Vehicle #: -			Load Wt.: 13,180 lbs			Route Type: Residential													
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	32.05	4.95		23.1	4.95														45.25	18.66
Newsprint	12.1	4.95																	7.15	2.95
Corrugated	21.25	5.05		19.7	4.95														30.95	12.76
Plastic	12.3	5.05		6.05	5.05														8.25	3.40
Plastic Bags	14.4	5.05																	9.35	3.86
Plastic Packaging	13.55	5.15		13.55	5.05														16.9	6.97
PET Beverage	7.9	5.05																	2.85	1.18
MI Deposit	5.6	4.95																	0.65	0.27
Polystyrene	6.35	5.05																	1.3	0.54
Yard Waste	7.8	4.95																	2.85	1.18
Food Waste	43.2	5.25																	37.95	15.65
Wood	7.15	4.7			4.95														2.45	1.01
Other Organics	13.3	4.4																	8.9	3.67
Ferrous	16.05	5.05																	11	4.54
Aluminum	5.95	5.15																	0.8	0.33
Glass	8.25	5.15		30.85	4.95														29	11.96
Other Inorganics	23	4.95																	18.05	7.44
Bulk Items																			0	0.00
Electronics	1.1																		1.1	0.45
Household Haz	6.05	4.7																	1.35	0.56
Soil																			0	0.00
Textiles	11.45	5.05																	6.4	2.64
TOTAL																			242.5	100.00
Number of MI Deposits	6																			
Types of Electronics	Christmas Lights, 1 Car Phone Charger																			

Site 5: Elk Run							Truck 9													
Date: 6/11/2015				Total Wt.: 64,800 lbs						Communities Served: Cheboygan County										
Weather: Cloudy				Vehicle Wt.: 46,760 lbs						Vehicle Type: Frontload Compactor (R2307)										
Vehicle #: -				Load Wt.: 18,040 lbs						Route Type: Residential										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	20.35	5.05		21.9	5.05														32.15	15.73
Newsprint	7.15	5.05																	2.1	1.03
Corrugated	8.55	5.15		7.8	4.95														6.25	3.06
Plastic	8.8	5.05			5.05														3.75	1.83
Plastic Bags	13.9	5.05																	8.85	4.33
Plastic Packaging	11.75	5.15		12.55	5.05		8.8	5.05											17.85	8.73
PET Beverage	5.6	5.05																	0.55	0.27
MI Deposit	5.15	5.05																	0.1	0.05
Polystyrene	7.8	4.95																	2.85	1.39
Yard Waste	9.25	4.95																	4.3	2.10
Food Waste	45.95	5.25																	40.7	19.91
Wood	11.55	4.6																	6.95	3.40
Other Organics	37.65	4.5		17.15	4.95														45.35	22.19
Ferrous	10.1	5.15																	4.95	2.42
Aluminum	5.95	5.25																	0.7	0.34
Glass	13.2	5.15																	8.05	3.94
Other Inorganics	15.4	4.95		8.7	5.05														14.1	6.90
Bulk Items																			0	0.00
Electronics																			0	0.00
Household Haz	5.25	5.05																	0.2	0.10
Soil																			0	0.00
Textiles	9.7	5.05																	4.65	2.27
TOTAL																			204.4	100.00
Number of MI Deposits	3																			
Types of Electronics	Part of a Small Speaker																			

Site 6: Oakland Heights							Truck 1 (#1)													
Date: 6/16/2015				Total Wt.: 57,300 lbs						Communities Served: Auburn Hills										
Weather: Overcast				Vehicle Wt.: 45,880 lbs						Vehicle Type: Front Loader (1247)										
Vehicle #: 1				Load Wt.: 11,420 lbs						Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	13.65	3.95																	9.7	4.58
Newsprint	5.25	5.05																	0.2	0.09
Corrugated	15.75	3.95		15.95	3.85														23.9	11.29
Plastic	11.1	5.15		6.15	3.95														8.15	3.85
Plastic Bags	8.25	3.95																	4.3	2.03
Plastic Packaging	11.45	5.05		7.35	3.95														9.8	4.63
PET Beverage	7.7	5.15																	2.55	1.20
MI Deposit	5.25	4.95																	0.3	0.14
Polystyrene	5.4	5.15																	0.25	0.12
Yard Waste	31.5	3.85																	27.65	13.06
Food Waste	37	4.7																	32.3	15.26
Wood	7.45	4.6																	2.85	1.35
Other Organics	32.15	3.85		21.15	3.95														45.5	21.49
Ferrous	4.5	3.85																	0.65	0.31
Aluminum	4.25	3.95																	0.3	0.14
Glass	6.9	4.6																	2.3	1.09
Other Inorganics	11.6	3.95		21.15	3.85														33.95	16.04
Bulk Items																			0	0.00
Electronics																			0	0.00
Household Haz																			0	0.00
Soil																			0	0.00
Textiles	11	3.95																	7.05	3.33
TOTAL																			211.7	100.00
Number of MI Deposits	4																			
Types of Electronics	None																			
Types of Bulk Items	None																			

Site 6: Oakland Heights							Truck 2 (#2)													
Date: 6/16/2015				Total Wt.: 64,520 lbs						Communities Served: Commerce Township										
Weather: Overcast				Vehicle Wt.: 41,540 lbs						Vehicle Type: Side Load (2401)										
Vehicle #: 2				Load Wt.: 22,980 lbs						Route Type: Residential										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	27.55	3.85		11.35	3.7														31.35	9.85
Newsprint	10.35	5.05																	5.3	1.67
Corrugated	9.45	3.95		7.7	3.85														9.35	2.94
Plastic	11.2	5.15			3.95														6.05	1.90
Plastic Bags	14.75	3.85																	10.9	3.43
Plastic Packaging	14.1	4.95		12.55	3.95														17.75	5.58
PET Beverage	7.05	5.15																	1.9	0.60
MI Deposit	5.5	4.85																	0.65	0.20
Polystyrene	11.1	5.05																	6.05	1.90
Yard Waste	51.65	3.7																	47.95	15.07
Food Waste	50	4.7																	45.3	14.24
Wood	31.6	4.6																	27	8.49
Other Organics	31.45	3.85																	27.6	8.68
Ferrous	6.8	3.6																	3.2	1.01
Aluminum	5.5	3.85																	1.65	0.52
Glass	11	4.5																	6.5	2.04
Other Inorganics	47.8	3.7		17.1	3.7														57.5	18.07
Bulk Items	5.7	0																	5.7	1.79
Electronics	7.25	4.85																	2.4	0.75
Household Haz																			0	0.00
Soil		4.85																	0	0.00
Textiles	8	3.95																	4.05	1.27
TOTAL																			318.15	100.00
Number of MI Deposits	13																			
Types of Electronics	1 Cord, 1 Computer Mouse, 1 Toothbrush, 1 Remote Control, 1 Toy																			
Types of Bulk Items	1 Couch Cushion																			

Site 6: Oakland Heights							Truck 3 (#3)													
Date: 6/16/2015				Total Wt.: 82,400 lbs						Communities Served: Oakland Township										
Weather: Sunny				Vehicle Wt.: 48,840 lbs						Vehicle Type: Frontload (2372)										
Vehicle #: 3				Load Wt.: 33,560 lbs						Route Type: Residential										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	27.45	3.85		22	3.95														41.65	14.38
Newsprint	8.25	5.05																	3.2	1.10
Corrugated	17.85	3.85		11.65	3.85														21.8	7.53
Plastic	7.45	5.15		6.25	3.85														4.7	1.62
Plastic Bags	10.45	3.85																	6.6	2.28
Plastic Packaging	16.75	4.95			3.85														11.8	4.07
PET Beverage	6.8	5.05																	1.75	0.60
MI Deposit	5.15	4.85																	0.3	0.10
Polystyrene	6.6	5.25																	1.35	0.47
Yard Waste	5.4	3.85																	1.55	0.54
Food Waste	41	4.7																	36.3	12.53
Wood	6.25	4.6																	1.65	0.57
Other Organics	17.4	3.85		4.85	3.95														14.45	4.99
Ferrous	6.05	3.7																	2.35	0.81
Aluminum	5.15	3.95																	1.2	0.41
Glass	5.45	4.6																	0.85	0.29
Other Inorganics	15.3	3.85		18.05	3.85														25.65	8.85
Bulk Items	87.65	0																	87.65	30.26
Electronics	8.55	4.6																	3.95	1.36
Household Haz																			0	0.00
Soil		4.95																	0	0.00
Textiles	24.9	3.95																	20.95	7.23
TOTAL																			289.7	100.00
Number of MI Deposits	6																			
Types of Electronics	1 Gameboy, 1 Fan, 1 Cord																			
Types of Bulk Items	Carpet																			

Site 6: Oakland Heights							Truck 4 (#5)													
Date: 6/16/2015				Total Wt.: 67,520 lbs						Communities Served: Rochester Hills										
Weather: Sunny				Vehicle Wt.: 42,360 lbs						Vehicle Type: Side Load (2480)										
Vehicle #: 5				Load Wt.: 25,160 lbs						Route Type: Residential										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	31.4	3.7		14.85	3.85		7.9	3.85											42.75	13.12
Newsprint	5.4	5.05																	0.35	0.11
Corrugated	12.2	3.85		13.75	3.7			3.85											18.4	5.65
Plastic	16.05	5.05		11.75	3.85		6.7	5.15			3.85								20.45	6.28
Plastic Bags	8.45	3.95																	4.5	1.38
Plastic Packaging	12.75	5.05		7.35	3.85		6.35	5.05											12.5	3.84
PET Beverage	7.15	5.05																	2.1	0.64
MI Deposit	5.25	4.85																	0.4	0.12
Polystyrene	6.25	5.05																	1.2	0.37
Yard Waste	71.55	3.85					8.25	3.85											72.1	22.13
Food Waste	41.2	4.85					9.55	4.85											41.05	12.60
Wood	32.7	4.5					11.9	4.7											35.4	10.87
Other Organics	8.15	3.85			3.7														4.3	1.32
Ferrous	9.7	3.85																	5.85	1.80
Aluminum	6.15	3.85																	2.3	0.71
Glass	9.7	4.7																	5	1.53
Other Inorganics	26.65	3.7		24.65	3.85			3.85											43.75	13.43
Bulk Items																			0	0.00
Electronics	11.35	4.85																	6.5	2.00
Household Haz																			0	0.00
Soil		4.85																	0	0.00
Textiles	10.8	3.95																	6.85	2.10
TOTAL																			325.75	100.00
Number of MI Deposits	5																			
Types of Electronics	1 Clock, 1 Power Strip, 1 Router																			
Types of Bulk Items	None																			

Site 6: Oakland Heights																				
Date: 6/16/2015				Total Wt.: 63,640 lbs									Truck 5 (#9)							
Weather: Sunny				Vehicle Wt.: 42,940 lbs									Communities Served: Rochester Hills							
Vehicle #: 9				Load Wt.: 20,700 lbs									Vehicle Type: Side Load (2379)							
													Route Type: -							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	13.1	3.95		16.4	3.95		21.7	3.85											39.45	10.00
Newsprint	5.5	5.05																	0.45	0.11
Corrugated	12.65	3.85		8.45	3.85			3.95											13.4	3.40
Plastic	10.8	5.05			3.85														5.75	1.46
Plastic Bags	10	3.85																	6.15	1.56
Plastic Packaging	13.1	4.95		14.65	3.95														18.85	4.78
PET Beverage	6.15	4.95																	1.2	0.30
MI Deposit	5.15	4.85																	0.3	0.08
Polystyrene	8.9	4.95					7.6	5.05											6.5	1.65
Yard Waste	18.15	3.85					50.7	4.15											60.85	15.43
Food Waste	51	4.85					29.5	5.05											70.6	17.90
Wood	25.75	4.7					5.15	4.6											21.6	5.48
Other Organics	48.35	3.85		6.7	3.85														47.35	12.01
Ferrous	17.6	3.85																	13.75	3.49
Aluminum	5.5	3.95																	1.55	0.39
Glass	8.9	4.7																	4.2	1.06
Other Inorganics	14.75	3.95		23.1	3.85		20.9	4.15											46.8	11.87
Bulk Items	20.9	0																	20.9	5.30
Electronics	14.55	4.85																	9.7	2.46
Household Haz																			0	0.00
Soil		4.85																	0	0.00
Textiles	9	3.95																	5.05	1.28
TOTAL																			394.4	100.00
Number of MI Deposits	6																			
Types of Electronics	1 Solar Light, 1 Timer Attached to a Light																			
Types of Bulk Items	1 Trash Can																			

Site 6: Oakland Heights																					
Truck 6 (#12)																					
Date: 6/16/2015				Total Wt.: 75,060 lbs									Communities Served: Pontiac, Keego Harbor, Bloomfield								
Weather: Sunny				Vehicle Wt.: 45,800 lbs									Vehicle Type: Frontload (1221)								
Vehicle #: 12				Load Wt.: 29,260 lbs									Route Type: Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6					
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%	
Mixed Paper	38.35	3.85		24	3.85			3.85											54.65	12.40	
Newsprint	12.75	5.05																	7.7	1.75	
Corrugated	18.95	3.85		17.4	3.95		38.8	4.15		15.85	4.15		29.3	3.85		24.1	7.9		116.55	26.45	
Plastic	12.45	5.05		5.95	3.85														9.5	2.16	
Plastic Bags	11.2	3.85																	7.35	1.67	
Plastic Packaging	16.6	5.05		17.3	3.85														25	5.67	
PET Beverage	6.25	5.15																	1.1	0.25	
MI Deposit	9.35	4.85																	4.5	1.02	
Polystyrene	5.4	4.95																	0.45	0.10	
Yard Waste	39.35	3.85																	35.5	8.06	
Food Waste	48.35	4.85																	43.5	9.87	
Wood		4.6																	0	0.00	
Other Organics	50.25	3.7		61.9	3.95														104.5	23.71	
Ferrous	6.5	3.7																	2.8	0.64	
Aluminum	4.95	4.05																	0.9	0.20	
Glass	12.2	4.6																	7.6	1.72	
Other Inorganics	9	3.85			3.7														5.15	1.17	
Bulk Items																			0	0.00	
Electronics	6.8	4.85																	1.95	0.44	
Household Haz																			0	0.00	
Soil		4.85																	0	0.00	
Textiles	15.95	3.95																	12	2.72	
TOTAL																			440.7	100.00	
Number of MI Deposits	37																				
Types of Electronics	1 Pencil Sharpener																				
Types of Bulk Items	None																				

Site 6: Oakland Heights																						
Truck 7 (#13)																						
Date: 6/16/2015				Total Wt.: 69,480 lbs									Communities Served: Auburn Hills, Orion Township									
Weather: Sunny				Vehicle Wt.: 45,980 lbs									Vehicle Type: Frontload (1224)									
Vehicle #: 13				Load Wt.: 23,500 lbs									Route Type: Commercial									
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6					
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%		
Mixed Paper	20.8	3.85		13	3.95														26	12.39		
Newsprint	6.15	5.05																	1.1	0.52		
Corrugated	18.4	3.85		11.55	3.85		7.8	3.85		20.05	3.85								42.4	20.20		
Plastic	15.75	5.25		13.85	4.05		8.35	5.15			3.85								23.5	11.20		
Plastic Bags	13	3.95																	9.05	4.31		
Plastic Packaging	14.75	5.05		5.7	3.85														11.55	5.50		
PET Beverage	7.45	5.15																	2.3	1.10		
MI Deposit	6.05	5.05																	1	0.48		
Polystyrene	5.25	5.05																	0.2	0.10		
Yard Waste	4.05	3.85																	0.2	0.10		
Food Waste	34.7	4.6																	30.1	14.34		
Wood	10.65	4.7																	5.95	2.83		
Other Organics	9.7	3.95		17.05	4.05														18.75	8.93		
Ferrous	11.35	3.85																	7.5	3.57		
Aluminum	4.05	3.95																	0.1	0.05		
Glass		4.85																	0	0.00		
Other Inorganics	9	3.95		22.45	3.85		10.25	3.7											30.2	14.39		
Bulk Items																			0	0.00		
Electronics		4.95																	0	0.00		
Household Haz																			0	0.00		
Soil																			0	0.00		
Textiles		3.85																	0	0.00		
TOTAL																			209.9	100.00		
Number of MI Deposits	18																					
Types of Electronics	None																					
Types of Bulk Items	None																					

Site 6: Oakland Heights																						
Truck 8 (#14)																						
Date: 6/16/2015				Total Wt.: 61,020 lbs									Communities Served: Sterling Heights									
Weather: Sunny				Vehicle Wt.: 45,840 lbs									Vehicle Type: Frontload (1220)									
Vehicle #: 14				Load Wt.: 15,180 lbs									Route Type: Commercial									
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6					
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%		
Mixed Paper	12.3	3.85		12.55	3.85					28.1	3.95								41.3	21.67		
Newsprint	5.7	5.05																	0.65	0.34		
Corrugated	16.05	3.5		14.1	3.5		4.4	3.85			3.85								23.7	12.43		
Plastic	7.7	4.95		5.7	3.95														4.5	2.36		
Plastic Bags	7.7	3.85																	3.85	2.02		
Plastic Packaging	11	5.05		8.45	3.95														10.45	5.48		
PET Beverage	7.45	4.95																	2.5	1.31		
MI Deposit	5.15	4.95																	0.2	0.10		
Polystyrene	7.8	4.95																	2.85	1.50		
Yard Waste	8.45	3.7																	4.75	2.49		
Food Waste	35.25	4.85																	30.4	15.95		
Wood	5.95	4.6																	1.35	0.71		
Other Organics	15.5	3.5		18.05	3.5														26.55	13.93		
Ferrous	7.15	3.85																	3.3	1.73		
Aluminum	5.05	3.85																	1.2	0.63		
Glass	14.4	4.6																	9.8	5.14		
Other Inorganics	16.2	3.85		10.25	3.85														18.75	9.84		
Bulk Items																			0	0.00		
Electronics		4.6																	0	0.00		
Household Haz																			0	0.00		
Soil																			0	0.00		
Textiles	8.45	3.95																	4.5	2.36		
TOTAL																			190.6	100.00		
Number of MI Deposits	5																					
Types of Electronics	None																					
Types of Bulk Items	None																					

Site 6: Oakland Heights																					
Truck 9 (#15)																					
Date: 6/16/2015				Total Wt.: 55,740 lbs									Communities Served: Rochester Hills								
Weather: Sunny				Vehicle Wt.: 42,140 lbs									Vehicle Type: Side Load (2402)								
Vehicle #: 15				Load Wt.: 13,600 lbs									Route Type: Residential								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	22.25	3.85		40.65	3.85			3.85		14.5	3.85								65.85	19.93
Newsprint	6.15	4.95																	1.2	0.36
Corrugated	10.25	3.85		4.6	3.85														7.15	2.16
Plastic	9.35	5.15			3.85														4.2	1.27
Plastic Bags	7.8	3.95																	3.85	1.17
Plastic Packaging	10.45	4.95		6.5	3.95														8.05	2.44
PET Beverage	5.4	5.05																	0.35	0.11
MI Deposit	5.05	4.95																	0.1	0.03
Polystyrene	6.7	4.85																	1.85	0.56
Yard Waste	38.8	3.85																	34.95	10.58
Food Waste	50.8	4.85					23.35	4.85											64.45	19.51
Wood	6.1	4.6																	1.5	0.45
Other Organics	26.3	3.85		8.7	3.95														27.2	8.23
Ferrous	8.45	3.85																	4.6	1.39
Aluminum		3.95																	0	0.00
Glass	7.7	4.5																	3.2	0.97
Other Inorganics	62.5	3.85		18.4	3.85		7.15	3.7											76.65	23.20
Bulk Items																			0	0.00
Electronics	8.45																		8.45	2.56
Household Haz																			0	0.00
Soil		4.85																	0	0.00
Textiles	20.6	4.05					4.05	3.85											16.75	5.07
TOTAL																			330.35	100.00
Number of MI Deposits	12																			
Types of Electronics	1 Extension Cord, 1 Clarinex Tablet, 1 Cord, 1 Light																			
Types of Bulk Items	None																			

Site 6: Oakland Heights																						
Truck 10 (#16)																						
Date: 6/16/2015				Total Wt.: 66,380 lbs						Communities Served: Birmingham, Auburn Hills, Rochester Hills												
Weather: Sunny				Vehicle Wt.: 45,880 lbs						Vehicle Type: Frontload (1247)												
Vehicle #: 16				Load Wt.: 20,500 lbs						Route Type: Commercial												
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6			All Bins	%		
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re				
Mixed Paper	22.7	3.85		25.1	3.95		30.3	3.85		17.5	3.95								80	24.35		
Newsprint	9.55	4.5																	5.05	1.54		
Corrugated	20.5	3.85		11.1	3.85														23.9	7.28		
Plastic	8.45	4.95		6.5	3.95														6.05	1.84		
Plastic Bags	15.5	3.85																	11.65	3.55		
Plastic Packaging	10.65	4.7		5.7	3.7														7.95	2.42		
PET Beverage	8.35	5.05																	3.3	1.00		
MI Deposit	6.35	4.5																	1.85	0.56		
Polystyrene	7.25	4.95																	2.3	0.70		
Yard Waste	40.45	3.7					17.5	3.85											50.4	15.34		
Food Waste	50.45	4.85																	45.6	13.88		
Wood	5.25	4.6																	0.65	0.20		
Other Organics	19.8	3.95			3.95														15.85	4.82		
Ferrous	12.3	3.85																	8.45	2.57		
Aluminum	4.25	3.85																	0.4	0.12		
Glass	6.5	4.6																	1.9	0.58		
Other Inorganics	15.65	3.85		21.15	3.7														29.25	8.90		
Bulk Items																			0	0.00		
Electronics	8.15	4.85																	3.3	1.00		
Household Haz																			0	0.00		
Soil																			0	0.00		
Textiles	33.5	3.95					5.05	3.95											30.65	9.33		
TOTAL																			328.5	100.00		
Number of MI Deposits	9																					
Types of Electronics	1 Extension Cord, Part of a Printer, 1 Face Ex-Foliator																					
Types of Bulk Items																						

Site 7: Central Sanitary Landfill																				
Date: 6/23/2015				Total Wt.: 46,000 lbs									Truck 1 (#1)							
Weather: Sunny				Vehicle Wt.: 42,520 lbs									Communities Served: Kent County							
Vehicle #: 1				Load Wt.: 3,480 lbs									Vehicle Type: Rearload (2128)							
													Route Type: Residential							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	24.9	5.05		24.25	5.05														39.05	13.84
Newsprint	14.4	5.05			4.95														9.35	3.31
Corrugated	21.15	4.85		20.6	4.95		5.8	5.15			4.85								32.6	11.55
Plastic	9.55	5.05		8.25	4.85														7.9	2.80
Plastic Bags	10.45	4.7		5.6	5.05														6.3	2.23
Plastic Packaging	12.55	5.05		11.35	5.05		13.3	5.05											22.05	7.81
PET Beverage	7.25	4.6																	2.65	0.94
MI Deposit	5.4	4.95																	0.45	0.16
Polystyrene	6.8	4.85																	1.95	0.69
Yard Waste	25.75	4.85																	20.9	7.41
Food Waste	36.7	3.6					31.7	3.6											61.2	21.69
Wood	13.55	4.85																	8.7	3.08
Other Organics	20.15	5.15		6.35	5.05														16.3	5.78
Ferrous	9.7	4.95																	4.75	1.68
Aluminum	8.15	4.95																	3.2	1.13
Glass	20.5	4.85																	15.65	5.55
Other Inorganics	21.8	4.85			4.85														16.95	6.01
Bulk Items																			0	0.00
Electronics	8.35	5.05																	3.3	1.17
Household Haz	5.4	4.95																	0.45	0.16
Soil	4.6	3.7																	0.9	0.32
Textiles	12.65	5.05																	7.6	2.69
TOTAL																			282.2	100.00
Number of MI Deposits	4																			
Types of Electronics	1 Lamp																			

Site 7: Central Sanitary Landfill																					
Truck 2 (#2)																					
Date: 6/23/2015				Total Wt.: 68,140 lbs									Communities Served: Newaygo								
Weather: Sunny				Vehicle Wt.: 42,400 lbs									Vehicle Type: ASL (2414)								
Vehicle #: 2				Load Wt.: 25,740 lbs									Route Type: Residential								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	14.75	5.25		6.8	5.15														11.15	5.63
Newsprint		5.25																	0	0.00
Corrugated	18.25	5.25		14.1	4.7			5.15											22.4	11.31
Plastic	10.65	5.15		6.6	4.7														7.4	3.74
Plastic Bags	11.1	5.05			4.95														6.05	3.06
Plastic Packaging	17.4	5.25		12.75	5.05		12.55	5.05		11.45	5.05								33.75	17.05
PET Beverage	8	5.05																	2.95	1.49
MI Deposit	7.05	4.95																	2.1	1.06
Polystyrene	6.15	4.85																	1.3	0.66
Yard Waste	5.5	4.95																	0.55	0.28
Food Waste	36.7	3.7					15.75	3.6											45.15	22.80
Wood	5.4	5.05																	0.35	0.18
Other Organics	29.95	5.4			4.95														24.55	12.40
Ferrous	9.35	5.05																	4.3	2.17
Aluminum	6.6	4.95																	1.65	0.83
Glass		4.85																	0	0.00
Other Inorganics	21.45	4.7			4.95														16.75	8.46
Bulk Items																			0	0.00
Electronics		4.95																	0	0.00
Household Haz	17.7	4.85																	12.85	6.49
Soil		3.85																	0	0.00
Textiles	9.8	5.05																	4.75	2.40
TOTAL																			198	100.00
Number of MI Deposits	11																			
Types of Electronics	None																			

Site 7: Central Sanitary Landfill							Truck 3 (#6)													
Date: 6/23/2015				Total Wt.: 70,040 lbs						Communities Served: Isabella County										
Weather: Sunny				Vehicle Wt.: 42,680 lbs						Vehicle Type: Frontload (1311)										
Vehicle #: 6				Load Wt.: 27,360 lbs						Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	17.95	5.05		7.45	5.05														15.3	4.97
Newsprint	7.8	5.25																	2.55	0.83
Corrugated	14.7	5.25		14.4	4.95		17.3	5.05		13.4	4.85		38.5	10					68.2	22.16
Plastic	18.6	5.05		4.8	4.7		12	5.05											20.6	6.69
Plastic Bags	11.35	4.95		5.25	4.95														6.7	2.18
Plastic Packaging	23.25	5.05		11.35	5.05					5.5	5.05		9.1	5.05					29	9.42
PET Beverage	5.8	4.85																	0.95	0.31
MI Deposit	4.95	4.85																	0.1	0.03
Polystyrene	6.15	4.95					6.35	4.85											2.7	0.88
Yard Waste	8.25	4.85																	3.4	1.10
Food Waste	16.95	3.6																	13.35	4.34
Wood	10.55	5.05																	5.5	1.79
Other Organics	50.4	5.15			4.95														45.25	14.71
Ferrous	28.3	5.05																	23.25	7.56
Aluminum	5.25	4.95																	0.3	0.10
Glass	6.8	5.05																	1.75	0.57
Other Inorganics	21.25	4.95			4.5														16.3	5.30
Bulk Items																			0	0.00
Electronics	5.7	5.05																	0.65	0.21
Household Haz	24.1	4.95																	19.15	6.22
Soil	31.5	3.95																	27.55	8.95
Textiles	10.1	4.95																	5.15	1.67
TOTAL																			307.7	100.00
Number of MI Deposits	3																			
Types of Electronics	1 Outlet, 1 Cord, 1 Bulb																			

Site 7: Central Sanitary Landfill																				
Truck 4 (#9)																				
Date: 6/23/2015				Total Wt.: 52,800 lbs						Communities Served: Montcalm County										
Weather: Sunny				Vehicle Wt.: 40,640 lbs						Vehicle Type: Rearload (2009)										
Vehicle #: 9				Load Wt.: 12,160 lbs						Route Type: Residential										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	32.4	5.15		16.75	4.95					14.3	4.85								48.5	18.55
Newsprint	6.25	5.25																	1	0.38
Corrugated	11	5.15			4.85														5.85	2.24
Plastic	12.75	5.05			4.7														7.7	2.94
Plastic Bags	8.15	4.85		6.35	4.95														4.7	1.80
Plastic Packaging	13.95	4.95		11.75	4.85		12.65	5.05			5.05								23.5	8.99
PET Beverage	6.9	4.85																	2.05	0.78
MI Deposit	4.95	4.85																	0.1	0.04
Polystyrene	6.6	4.85																	1.75	0.67
Yard Waste	8.55	4.85																	3.7	1.41
Food Waste	30.95	3.7					24.65	3.6											48.3	18.47
Wood		4.95																	0	0.00
Other Organics	39.1	5.15			4.95		14.15	5.25											42.85	16.39
Ferrous	10.65	5.05																	5.6	2.14
Aluminum	6.05	4.85																	1.2	0.46
Glass	10.35	4.85																	5.5	2.10
Other Inorganics	16.05	4.85		23.35	4.6		11.35	4.85			4.7								36.45	13.94
Bulk Items	6.9																		6.9	2.64
Electronics	10.45	4.95																	5.5	2.10
Household Haz		5.15																	0	0.00
Soil		3.95																	0	0.00
Textiles	15.3	4.95						4.85											10.35	3.96
TOTAL																			261.5	100.00
Number of MI Deposits	2																			
Types of Electronics	1 Speaker, 1 Camera, 1 Smoke Detector, 1 Toaster																			

Site 7: Central Sanitary Landfill																				
Truck 5 (#13)																				
Date: 6/23/2015				Total Wt.: 71,560 lbs									Communities Served: Newaygo							
Weather: Sunny				Vehicle Wt.: 45,280 lbs									Vehicle Type: Frontload (1307)							
Vehicle #: 13				Load Wt.: 26,280 lbs									Route Type: Commercial							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	17.4	5.15		13.4	4.95														20.7	10.61
Newsprint	8.35	5.05																	3.3	1.69
Corrugated	18.6	5.15		8.25	4.85														16.85	8.64
Plastic	11.55	5.05		12.3	4.7														14.1	7.23
Plastic Bags	9.35	4.85			4.95														4.5	2.31
Plastic Packaging	11	5.05		10.25	4.95														11.25	5.77
PET Beverage	9.1	4.85																	4.25	2.18
MI Deposit	6.25	4.85																	1.4	0.72
Polystyrene	5.95	4.85																	1.1	0.56
Yard Waste	5.25	4.85																	0.4	0.21
Food Waste	24.95	3.7																	21.25	10.89
Wood	6.8	4.95																	1.85	0.95
Other Organics	20.15	5.15			4.95														15	7.69
Ferrous	13.55	4.95																	8.6	4.41
Aluminum	5.25	4.85																	0.4	0.21
Glass	11.1	4.85																	6.25	3.20
Other Inorganics	20.6	4.85		23.65	4.7		19.6	4.85			4.6								49.45	25.35
Bulk Items																			0	0.00
Electronics	16.05	4.95																	11.1	5.69
Household Haz		5.15																	0	0.00
Soil		3.85																	0	0.00
Textiles	8.25	4.95																	3.3	1.69
TOTAL	17.4	5.15		13.4	4.95														195.05	100
Number of MI Deposits	14																			
Types of Electronics	1 Printer																			

Site 7: Central Sanitary Landfill																				
Truck 6 (#1)																				
Date: 6/24/2015				Total Wt.: 65,160 lbs									Communities Served: Mecosta County							
Weather: Sunny				Vehicle Wt.: 42,980 lbs									Vehicle Type: Frontload (1235)							
Vehicle #: 1				Load Wt.: 22,180 lbs									Route Type: Commercial							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	31.3	5.15		15.95	5.05														37.05	18.96
Newsprint	5.95	5.15																	0.8	0.41
Corrugated	18.7	5.25		16.2	4.85		16.5	5.25			4.85								36.05	18.45
Plastic	10	5.15			4.85														4.85	2.48
Plastic Bags	10.1	4.95			4.95														5.15	2.64
Plastic Packaging	13.95	5.05		9.25	4.95														13.2	6.76
PET Beverage	6.5	4.95																	1.55	0.79
MI Deposit	4.95	4.85																	0.1	0.05
Polystyrene	7.05	4.85																	2.2	1.13
Yard Waste	5.05	4.85																	0.2	0.10
Food Waste	36.15	3.7					24.45	3.6											53.3	27.28
Wood	6.05	4.95																	1.1	0.56
Other Organics	15.65	5.25			4.95														10.4	5.32
Ferrous	5.7	4.95																	0.75	0.38
Aluminum	5.4	4.95																	0.45	0.23
Glass	5.95	4.85																	1.1	0.56
Other Inorganics	23.65	4.85			4.85														18.8	9.62
Bulk Items																			0	0.00
Electronics		4.95																	0	0.00
Household Haz	7.15	5.05																	2.1	1.07
Soil		3.95																	0	0.00
Textiles	11.2	4.95																	6.25	3.20
TOTAL																			195.4	100.00
Number of MI Deposits	3																			
Types of Electronics	None																			

Site 7: Central Sanitary Landfill							Truck 7 (#2)													
Date: 6/24/2015				Total Wt.: 58,160 lbs						Communities Served: Kent County										
Weather: Sunny				Vehicle Wt.: 40,120 lbs						Vehicle Type: Frontload (1312)										
Vehicle #: 2				Load Wt.: 18,040 lbs						Route Type: Commercial										
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	20.15	5.05		15.95	4.95														26.1	15.34
Newsprint	7.35	5.15																	2.2	1.29
Corrugated	15.3	5.05		13.55	4.85														18.95	11.14
Plastic	18.7	5.05			4.7														13.65	8.02
Plastic Bags	9	4.85			4.95														4.15	2.44
Plastic Packaging	12.75	5.05		11.1	4.95														13.85	8.14
PET Beverage	7.9	4.95																	2.95	1.73
MI Deposit		4.85																	0	0.00
Polystyrene	7.8	4.85																	2.95	1.73
Yard Waste	5.05	4.85																	0.2	0.12
Food Waste	30.75	3.6																	27.15	15.96
Wood	5.8	4.85																	0.95	0.56
Other Organics	19.5	5.05		14.3	5.05														23.7	13.93
Ferrous	8.45	4.85																	3.6	2.12
Aluminum	5.25	4.85																	0.4	0.24
Glass	13.75	4.85																	8.9	5.23
Other Inorganics	14.2	4.85		11.35	4.7														16	9.40
Bulk Items																			0	0.00
Electronics	7.25	4.95																	2.3	1.35
Household Haz	6.8	4.95																	1.85	1.09
Soil		3.6																	0	0.00
Textiles	5.25	4.95																	0.3	0.18
TOTAL																			170.15	100.00
Number of MI Deposits	None																			
Types of Electronics	1 Light Bulb, 1 Charger																			

Site 7: Central Sanitary Landfill																					
Truck 8 (#4)																					
Date: 6/24/2015				Total Wt.: 68,660 lbs									Communities Served: Newaygo County								
Weather: Sunny				Vehicle Wt.: 45,280 lbs									Vehicle Type: Frontload (1307)								
Vehicle #: 4				Load Wt.: 23,380 lbs									Route Type: Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	20.25	5.15		16.2	4.95														26.35	14.42
Newsprint	8.9	5.15																	3.75	2.05
Corrugated	24.45	5.15		7.9	4.85														22.35	12.23
Plastic	12.65	5.05		10.8	4.7														13.7	7.50
Plastic Bags	10.55	4.85																	5.7	3.12
Plastic Packaging	17.45	4.95		12.3	4.95														19.85	10.86
PET Beverage	6.8	4.95																	1.85	1.01
MI Deposit	4.85	4.7																	0.15	0.08
Polystyrene	5.25	4.85																	0.4	0.22
Yard Waste	10.35	4.95																	5.4	2.96
Food Waste	22	3.7																	18.3	10.02
Wood	9.25	4.95																	4.3	2.35
Other Organics	18.8	5.25		14.3	4.95														22.9	12.53
Ferrous	23.9	4.95																	18.95	10.37
Aluminum	5.15	4.95																	0.2	0.11
Glass	5.8	4.85																	0.95	0.52
Other Inorganics	11.35	4.85		9	4.7														10.8	5.91
Bulk Items																			0	0.00
Electronics	5.15	4.95																	0.2	0.11
Household Haz		5.05																	0	0.00
Soil		3.95																	0	0.00
Textiles	11.55	4.95																	6.6	3.61
TOTAL	20.25	5.15		16.2	4.95														182.7	100.00
Number of MI Deposits	2																			
Types of Electronics	1 Toothbrush																			

Site 7: Central Sanitary Landfill																				
Truck 9 (#5)																				
Date: 6/24/2015				Total Wt.: 69,640 lbs									Communities Served: Ionia County							
Weather: Sunny				Vehicle Wt.: 45,560 lbs									Vehicle Type: Frontload (1309)							
Vehicle #: 5				Load Wt.: 24,080 lbs									Route Type: Commercial							
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	26.2	5.15			5.05														21.05	9.34
Newsprint	14.55	5.15																	9.4	4.17
Corrugated	11.45	5.15		10.35	4.6														12.05	5.35
Plastic	11	5.05		5.7	4.85														6.8	3.02
Plastic Bags	9	4.85																	4.15	1.84
Plastic Packaging	14.75	5.05		11.1															20.8	9.23
PET Beverage	5.7	4.7																	1	0.44
MI Deposit	5.05	4.6																	0.45	0.20
Polystyrene	5.7	4.7																	1	0.44
Yard Waste	20.6	4.95																	15.65	6.94
Food Waste		3.6																	0	0.00
Wood	12.85	4.95																	7.9	3.50
Other Organics	13.75	5.05			4.85														8.7	3.86
Ferrous	11.2	4.95																	6.25	2.77
Aluminum	5.05	4.95																	0.1	0.04
Glass	8.7	4.85																	3.85	1.71
Other Inorganics	22.9	4.85		15.3	4.7														28.65	12.71
Bulk Items																			0	0.00
Electronics	19.95	4.85																	15.1	6.70
Household Haz		4.95																	0	0.00
Soil	64.15	3.95																	60.2	26.71
Textiles	7.25	4.95																	2.3	1.02
TOTAL																			225.4	100.00
Number of MI Deposits	None																			
Types of Electronics	1 Box Fan, 1 Kids Toy																			

Site 7: Central Sanitary Landfill																					
Truck 10 (#10)																					
Date: 6/24/2015				Total Wt.: 61,420 lbs									Communities Served: Montcalm County								
Weather: Sunny				Vehicle Wt.: 42,340 lbs									Vehicle Type: ASL (2412)								
Vehicle #: 10				Load Wt.: 19,080 lbs									Route Type: Residential								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	17.7	5.25		22.25	4.95		25.75	5.15											50.35	20.57
Newsprint	5.95	5.15																	0.8	0.33
Corrugated	12	5.15		10.55	4.85						4.85								12.55	5.13
Plastic	9.8	5.05		4.95	4.4														5.3	2.17
Plastic Bags	8.15	4.85																	3.3	1.35
Plastic Packaging	12.45	5.15		11.9	5.05		17.4	5.05											26.5	10.83
PET Beverage	10.45	5.05																	5.4	2.21
MI Deposit	6.25	4.85																	1.4	0.57
Polystyrene	8.35	4.85																	3.5	1.43
Yard Waste	13.4	4.95																	8.45	3.45
Food Waste	25.9	3.6					16.95	3.7											35.55	14.52
Wood	9.9	4.85																	5.05	2.06
Other Organics	17.6	5.05		7.25	4.95														14.85	6.07
Ferrous	12.2	4.95																	7.25	2.96
Aluminum	5.8	4.85																	0.95	0.39
Glass	11.35	4.85																	6.5	2.66
Other Inorganics	19.95	4.7		23.45	4.7		15.4	4.85			4.7								44.55	18.20
Bulk Items																			0	0.00
Electronics	6.15	4.95																	1.2	0.49
Household Haz		5.05																	0	0.00
Soil		3.95																	0	0.00
Textiles	13.65	4.95					7.6	4.95											11.35	4.64
TOTAL																			244.8	100.00
Number of MI Deposits	16																			
Types of Electronics	2 Smoke Detectors, 1 Remote Control, 1 Light Bulb, 1 Wrist Watch																			

Site 8: North Kent Transfer Station																					
Truck 1 (#1)																					
Date: 6/25/2015				Total Wt.: 66,040 lbs									Communities Served: Comstock Park, Alpine Township								
Weather: Cloudy				Vehicle Wt.: 44,440 lbs									Vehicle Type: Packer (9576)								
Vehicle #: 1				Load Wt.: 21,600 lbs									Route Type: Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	20.6	5.05		24	4.85														34.7	13.69
Newsprint		4.95			4.95														0	0.00
Corrugated	21.7	5.05			4.95														16.65	6.57
Plastic	15.95	5.05		12.65	5.15		9.8	5.05		6.5	5.15								24.5	9.67
Plastic Bags	10.1	5.15																	4.95	1.95
Plastic Packaging	16.75	5.05		16.2	5.4														22.5	8.88
PET Beverage	6.35	4.95																	1.4	0.55
MI Deposit	5.5	4.85																	0.65	0.26
Polystyrene	8.15	4.85																	3.3	1.30
Yard Waste	6.15	5.15																	1	0.39
Food Waste	13.3	5.05																	8.25	3.26
Wood	6.9	4.6																	2.3	0.91
Other Organics	27.2	4.5		5.4	5.05														23.05	9.10
Ferrous	39	5.05																	33.95	13.40
Aluminum	5.5	5.25																	0.25	0.10
Glass	6.9	5.25																	1.65	0.65
Other Inorganics	32.15	4.95		38.2	4.95														60.45	23.86
Bulk Items																			0	0.00
Electronics	9.1	4.95																	4.15	1.64
Household Haz	6.15	5.25																	0.9	0.36
Soil		4.95																	0	0.00
Textiles	13.85	5.05																	8.8	3.47
TOTAL																			253.4	100.00
Number of MI Deposits	7																			
Types of Electronics	1 Iron, 1 Crockpot, 1 TV Remote Control																			

Site 8: North Kent Transfer Station																					
													Truck 2 (#4)								
Date: 6/25/2015													Total Wt.: 59,140 lbs								
													Communities Served: Ada, Beltline Area, Grand Rapids								
Weather: Cloudy													Vehicle Wt.: 41,840 lbs								
													Vehicle Type: Packer (0915)								
Vehicle #: 4													Load Wt.: 17,300 lbs								
													Route Type: Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	33.15	5.05		24.35	5.05														47.4	27.39
Newsprint	6.15	5.05																	1.1	0.64
Corrugated	13	5.15		12.55	5.05														15.35	8.87
Plastic	6.05	5.05			5.15														1	0.58
Plastic Bags	11.75	5.05																	6.7	3.87
Plastic Packaging	9	4.95		10.1	5.25														8.9	5.14
PET Beverage	6.6	4.95																	1.65	0.95
MI Deposit	5.15	5.05																	0.1	0.06
Polystyrene	5.95	5.05																	0.9	0.52
Yard Waste		4.95																	0	0.00
Food Waste	33.15	5.15																	28	16.18
Wood		4.6																	0	0.00
Other Organics	32.5	4.4			4.95														28.1	16.24
Ferrous	11.2	5.4																	5.8	3.35
Aluminum	5.5	5.25																	0.25	0.14
Glass	11.45	5.25																	6.2	3.58
Other Inorganics	11.55	5.05		6.7	5.05														8.15	4.71
Bulk Items																			0	0.00
Electronics	10.8	4.95																	5.85	3.38
Household Haz		5.25																	0	0.00
Soil																			0	0.00
Textiles	12.65	5.05																	7.6	4.39
TOTAL	33.15	5.05		24.35	5.05														173.05	100.00
Number of MI Deposits	2																			
Types of Electronics	1 Stereo Remote, 1 Lamp, 1 Router																			

Site 8: North Kent Transfer Station																				
Date: 6/25/2015				Total Wt.: 29,880 lbs																
Weather: Cloudy				Vehicle Wt.: 21,180 lbs																
Vehicle #: 5				Load Wt.: 8,700 lbs																
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	22.35	5.15		23.25	4.95														35.5	15.52
Newsprint	10.8	4.95																	5.85	2.56
Corrugated	11.35	5.05																	6.3	2.75
Plastic	16.6	5.05			5.05														11.55	5.05
Plastic Bags	13.1	5.15																	7.95	3.47
Plastic Packaging	12.75	5.05		13.3	5.15														15.85	6.93
PET Beverage	6.6	5.05																	1.55	0.68
MI Deposit	6.15	5.15																	1	0.44
Polystyrene	6.35	5.05																	1.3	0.57
Yard Waste		5.05																	0	0.00
Food Waste	45.7	5.15																	40.55	17.72
Wood	4.85	4.6																	0.25	0.11
Other Organics	37.35	4.5			5.05														32.85	14.36
Ferrous	8	5.4																	2.6	1.14
Aluminum	6.05	5.25																	0.8	0.35
Glass	27.1	5.25																	21.85	9.55
Other Inorganics	43.5	5.05			5.05														38.45	16.81
Bulk Items																			0	0.00
Electronics	5.8	5.05																	0.75	0.33
Household Haz	5.7	5.15																	0.55	0.24
Soil																			0	0.00
Textiles	8.35	5.05																	3.3	1.44
TOTAL																			228.8	100.00
Number of MI Deposits	10																			
Types of Electronics	1 Power Converter, 2 Flashlights, 1 Light Bulb																			

Site 8: North Kent Transfer Station																				
Date: 6/25/2015				Total Wt.: 29,980 lbs												Communities Served: Rockford, Belmont				
Weather: Cloudy				Vehicle Wt.: 20,500 lbs												Vehicle Type: Packer (1428)				
Vehicle #: 7				Load Wt.: 9,480 lbs												Route Type: Mixed Residential/Commercial				
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	19.4	5.05		25.1	5.05														34.4	9.74
Newsprint	8.25	5.05																	3.2	0.91
Corrugated	15.85	5.15		15.4	4.95														21.15	5.99
Plastic	13.85	5.15		15.4	5.05														19.05	5.40
Plastic Bags	9.9	5.05																	4.85	1.37
Plastic Packaging	11.45	4.95		9.45	5.25														10.7	3.03
PET Beverage	7.35	5.15																	2.2	0.62
MI Deposit	5.6	5.05																	0.55	0.16
Polystyrene	5.6	5.05																	0.55	0.16
Yard Waste		5.05																	0	0.00
Food Waste	18.5	5.25																	13.25	3.75
Wood	11.45	4.6																	6.85	1.94
Other Organics	30.2	4.4			5.25														25.8	7.31
Ferrous	17.85	5.4																	12.45	3.53
Aluminum	5.6	5.4																	0.2	0.06
Glass	9.7	5.25																	4.45	1.26
Other Inorganics	74.6	5.05		48.05	4.95		63.05	5.15											170.55	48.31
Bulk Items																			0	0.00
Electronics	18.95	5.05																	13.9	3.94
Household Haz	5.4	5.25																	0.15	0.04
Soil																			0	0.00
Textiles	13.85	5.05																	8.8	2.49
TOTAL																			353.05	100.00
Number of MI Deposits	3																			
Types of Electronics	1 VCR and DVD Player, 2 Ball Toys, 1 Cord, 1 Roll of Cord																			

Site 8: North Kent Transfer Station																					
Date: 6/25/2015				Total Wt.: 61,760 lbs															Communities Served: Rockford, Plainfield Township, Comstock Park		
Weather: Cloudy				Vehicle Wt.: 44,440 lbs															Vehicle Type: Packer (9576)		
Vehicle #: 8				Load Wt.: 17,320 lbs															Route Type: Commercial		
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	12.2	5.05			5.05														7.15	5.79
Newsprint	5.7	5.05																	0.65	0.53
Corrugated	19.25	5.25		19.7	4.95		11.75	4.95											35.55	28.77
Plastic	6.6	5.05		5.4	5.05														1.9	1.54
Plastic Bags	8.15	5.15																	3	2.43
Plastic Packaging	6.9	5.05		6.7	5.15														3.4	2.75
PET Beverage	5.6	5.15																	0.45	0.36
MI Deposit	5.25	5.05																	0.2	0.16
Polystyrene	5.4	5.05																	0.35	0.28
Yard Waste	9.55	5.05																	4.5	3.64
Food Waste	18.45	5.15																	13.3	10.76
Wood	8.35	4.6																	3.75	3.04
Other Organics	9.35	4.5																	4.85	3.93
Ferrous	7.05	5.25																	1.8	1.46
Aluminum	5.4	5.25																	0.15	0.12
Glass		5.25																	0	0.00
Other Inorganics	16.5	5.05		18.25	5.05														24.65	19.95
Bulk Items																			0	0.00
Electronics	5.95	4.95																	1	0.81
Household Haz		5.15																	0	0.00
Soil	19.4	4.95																	14.45	11.70
Textiles	7.6	5.15																	2.45	1.98
TOTAL																			123.55	100.00
Number of MI Deposits	2																			
Types of Electronics	1 Light, 1 Power Cord																			

Site 8: North Kent Transfer Station																					
Truck 6 (#9)																					
Date: 6/25/2015				Total Wt.: 49,560 lbs									Communities Served: Ravenna, Grant, Sparta, Conklin								
Weather: Cloudy				Vehicle Wt.: 33,820 lbs									Vehicle Type: Packer (1485)								
Vehicle #: 9				Load Wt.: 15,740 lbs									Route Type: Mixed Residential/Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	21.35	5.05		21.35	4.95		13.55	4.95											41.3	15.09
Newsprint	7.05	4.95																	2.1	0.77
Corrugated	12.45	5.15		10.65	4.95		8.9	4.95											16.95	6.19
Plastic	8.35	5.05			5.05														3.3	1.21
Plastic Bags	9.1	4.95																	4.15	1.52
Plastic Packaging	12	5.05		14.85	5.25		13.7	5.05		23.1	5.05								43.25	15.80
PET Beverage	9.7	5.15																	4.55	1.66
MI Deposit	5.6	5.05																	0.55	0.20
Polystyrene	7.25	4.85																	2.4	0.88
Yard Waste		5.05																	0	0.00
Food Waste	29.2	5.15																	24.05	8.79
Wood	10.1	4.6																	5.5	2.01
Other Organics	48.8	4.4		5.25	5.05														44.6	16.30
Ferrous	14.2	5.25																	8.95	3.27
Aluminum	6.5	5.25																	1.25	0.46
Glass	10.55	5.25																	5.3	1.94
Other Inorganics	24.55	5.15		14.2	5.05		19.05	4.95											42.65	15.59
Bulk Items																			0	0.00
Electronics	5.6	4.95																	0.65	0.24
Household Haz	14.1	5.15																	8.95	3.27
Soil																			0	0.00
Textiles	18.25	5.05																	13.2	4.82
TOTAL																			273.65	100.00
Number of MI Deposits	4																			
Types of Electronics	1 Flashlight, 1 Computer Mouse, 1 Phone Jack, 1 Phone Cord																			

Site 8: North Kent Transfer Station																					
Truck 7 (#10)																					
Date: 6/25/2015				Total Wt.: 48,540 lbs									Communities Served: Sparta								
Weather: Cloudy				Vehicle Wt.: 36,480 lbs									Vehicle Type: Packer (1371)								
Vehicle #: 10				Load Wt.: 12,060 lbs									Route Type: Mixed Residential/Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	23.65	5.05		12.65	5.05		20.25	5.05											41.4	17.61
Newsprint	8.35	5.05																	3.3	1.40
Corrugated	22.7	5.05		17.05	4.95					10.1	5.05								34.8	14.81
Plastic	12.85	5.15		10.8	5.15														13.35	5.68
Plastic Bags	9.1	5.05																	4.05	1.72
Plastic Packaging	10.9	5.15		11.35	5.15		10.9	5.05			5.25								12.55	5.34
PET Beverage	9.8	5.05																	4.75	2.02
MI Deposit	6.05	5.15																	0.9	0.38
Polystyrene	7.7	5.05																	2.65	1.13
Yard Waste	5.5	5.15																	0.35	0.15
Food Waste	38.55	5.25																	33.3	14.17
Wood	8.7	4.7																	4	1.70
Other Organics	16.85	4.5			4.85		12.55	4.4											20.5	8.72
Ferrous	11.2	5.25																	5.95	2.53
Aluminum	6.7	5.4																	1.3	0.55
Glass	8.55	5.4																	3.15	1.34
Other Inorganics	19.7	5.05		18.95	5.05		16.75	5.05			5.05								35.2	14.98
Bulk Items																			0	0.00
Electronics	9	5.15																	3.85	1.64
Household Haz	6.9	5.15																	1.75	0.74
Soil																			0	0.00
Textiles	13.1	5.15																	7.95	3.38
TOTAL																			235.05	100.00
Number of MI Deposits	4																			
Types of Electronics	1 Flashlight, 1 Kid's Toy Tablet, 1 Crockpot Plug, 1 Thermostat, 1 Cord																			

Site 8: North Kent Transfer Station																					
Truck 8 (#11)																					
Date: 6/25/2015				Total Wt.: 23,820 lbs									Communities Served: Rockford								
Weather: Cloudy				Vehicle Wt.: 20,420 lbs									Vehicle Type: Packer (1366)								
Vehicle #: 11				Load Wt.: 3,400 lbs									Route Type: Residential								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	5.05	5.05		22.8	5.05														17.75	7.53
Newsprint	8.15	5.05																	3.1	1.32
Corrugated	13.55	5.05		16.85	4.95		6.15	5.05		13	4.95								29.55	12.54
Plastic	7.9	5.05		6.5	5.05														4.3	1.82
Plastic Bags	8	5.05																	2.95	1.25
Plastic Packaging	10.9	4.95		10.1	5.15		10.9	4.95											16.85	7.15
PET Beverage	7.6	5.05																	2.55	1.08
MI Deposit		5.05																	0	0.00
Polystyrene	6.6	4.95																	1.65	0.70
Yard Waste	14.75	5.05																	9.7	4.12
Food Waste	40.75	5.15																	35.6	15.10
Wood	5.4	4.4																	1	0.42
Other Organics	42.1	4.4			4.95														37.7	15.99
Ferrous	10.25	5.15																	5.1	2.16
Aluminum	6.05	5.15																	0.9	0.38
Glass	12.65	5.25																	7.4	3.14
Other Inorganics	21.85	4.95		33.8	5.05					9.25	5.05								49.85	21.15
Bulk Items																			0	0.00
Electronics	11.1	4.95																	6.15	2.61
Household Haz	5.25	5.15																	0.1	0.04
Soil																			0	0.00
Textiles	8.55	5.05																	3.5	1.48
TOTAL																			235.7	100.00
Number of MI Deposits	None																			
Types of Electronics	Christmas Lights, 1 Boom Box, 1 Light Bulb																			

Site 8: North Kent Transfer Station																					
Truck 9 (#1)																					
Date: 6/26/2015				Total Wt.: 61,920 lbs									Communities Served: Grand Rapids, Rockford								
Weather: Sunny				Vehicle Wt.: 44,040 lbs									Vehicle Type: Packer (1819)								
Vehicle #: 1				Load Wt.: 17,880 lbs									Route Type: Commercial								
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	20.15	4.95		25.45	4.95														35.7	21.17
Newsprint	5.15	5.05																	0.1	0.06
Corrugated	13	5.15					16.3	5.15		11.35	4.95								25.4	15.07
Plastic	8.9	5.05		7.7	5.05														6.5	3.86
Plastic Bags	9.25	4.95																	4.3	2.55
Plastic Packaging	9.7	4.95		7.9	5.25														7.4	4.39
PET Beverage	6.05	5.05																	1	0.59
MI Deposit		5.05																	0	0.00
Polystyrene	5.5	4.95																	0.55	0.33
Yard Waste	13.2	4.85																	8.35	4.95
Food Waste	8.35	4.95																	3.4	2.02
Wood	9	4.6																	4.4	2.61
Other Organics	22	4.4		11.55	4.95														24.2	14.35
Ferrous	5.25	5.15																	0.1	0.06
Aluminum	5.25	5.15																	0.1	0.06
Glass	5.4	5.25																	0.15	0.09
Other Inorganics	24	5.15		18.8	5.05		19.4	5.05											46.95	27.85
Bulk Items																			0	0.00
Electronics		4.95																	0	0.00
Household Haz		5.05																	0	0.00
Soil																			0	0.00
Textiles		5.05																	0	0.00
TOTAL																			168.6	100.00
Number of MI Deposits	0																			
Types of Electronics	None																			

Site 8: North Kent Transfer Station																				
Date: 6/26/2015				Total Wt.: 46,740 lbs																
Weather: Sunny				Vehicle Wt.: 33,820 lbs																
Vehicle #: 3				Load Wt.: 12,920 lbs																
	Bin 1			Bin 2			Bin 3			Bin 4			Bin 5			Bin 6				
	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re	Gross	Tare	Re-weigh	Gross	Tare	Re	All Bins	%
Mixed Paper	16.95	5.15		12.2	5.05														18.95	7.57
Newsprint	6.25	5.05																	1.2	0.48
Corrugated	17.3	5.15		20.35	5.15		10.45	5.4		5.25	4.7								32.95	13.16
Plastic	9.1	5.05			5.05														4.05	1.62
Plastic Bags	9.45	5.05																	4.4	1.76
Plastic Packaging	12.2	5.05		14.85	5.15		9	5.05											20.8	8.31
PET Beverage	7.8	5.05																	2.75	1.10
MI Deposit	12.1	5.05																	7.05	2.82
Polystyrene	10.45	4.95																	5.5	2.20
Yard Waste	6.35	4.95																	1.4	0.56
Food Waste	32.95	5.05																	27.9	11.14
Wood	13.45	4.6																	8.85	3.54
Other Organics	32.25	4.5			4.95														27.75	11.08
Ferrous	12.45	5.25																	7.2	2.88
Aluminum	5.95	5.15																	0.8	0.32
Glass	13.85	5.25																	8.6	3.44
Other Inorganics	49.7	5.05		11.1	5.05		17.4	4.95											63.15	25.22
Bulk Items																			0	0.00
Electronics	5.15	4.85																	0.3	0.12
Household Haz	7.15	5.15																	2	0.80
Soil																			0	0.00
Textiles	9.8	5.05																	4.75	1.90
TOTAL																			250.35	100.00
Number of MI Deposits	20																			
Types of Electronics	1 Flashlight																			

Truck 10 (#3)

Communities Served: Sparta, Cedar Springs

Vehicle Type: Packer (1485)

Route Type: Mixed Residential/Commercial

APPENDIX B

- Governing Protocol
- In-field adjustments
- Site Plan Template
- Protocol for Measuring the Composition of Unprocessed Municipal Solid Waste

GOVERNING PROTOCOL FOR WASTE SORT SAMPLES						
Governing component	Alpha	t*	Precision	s	x-bar	Number of Trucks per Site
Newsprint	0.1	1.6935	0.2	0.07	0.1	36
	0.1	1.721	0.25	0.07	0.1	24
	0.1	1.751	0.3	0.07	0.1	17
Corrugated	0.1	1.761	0.2	0.06	0.14	15
	0.1	1.812	0.25	0.06	0.14	10
	0.1	1.86	0.3	0.06	0.14	8
Plastic	0.1	1.833	0.2	0.03	0.09	10
	0.1	1.943	0.25	0.03	0.09	7
	0.1	2.015	0.3	0.03	0.09	6
Source: ASTM D5231-92 (2008) Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste.						

IN-FIELD ADJUSTMENTS TO PROTOCOL	
Site	Adjustments Recorded
Muskegon Landfill (Site 1)	Miscellaneous classifications governed by Organic/Compostable, not Combustible. Kitty Litter and Poop: Goes in Other Organic Things that look like household plants or natural decorations go into Other Organic, rather than yard waste Plastic Packaging: This is anything that something else came in (includes McDonalds plastic things, food containers, toy packaging, etc.) This is compared to just Plastic, which is really anything plastic that you are not sure what to do with. An individual plastic red cup could go in here… Pizza boxes: Corrugated Coffee Grounds: Other Organic Mops: Inorganic Candles/Wax: Inorganic
South Kent Landfill (Site 3)	A truckload of farm waste needed to be passed up Clarification with the scalehouse re: "communities served" & whether commercial, residential info needed to be specifically communicated prior to sort & captured for each truck. Bubble wrap - went into plastic Tarps - went into non-organic Packaging straps - went into plastic Pillows - went into non-organic Black garbage bags - went into plastic bags Ziploc - plastic bags Saran wrap - non-organic Ribbons - either textile or inorganic Make sure we have a representative sample binned & weighed when there is significant material/weight left on a tarp Make sure to separate food packaging
Kent County Waste To Energy (Site 4)	Loads that were obviously too big were randomly divided in half when the count reached between 200 and 300 lbs in order to finish in a timely manner

Protocol for Measuring the Composition of Unprocessed Municipal Solid Waste

West Michigan Sustainable Business Forum Project

May 15, 2015
Project No. G140550

FTC&H

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LIST OF ABBREVIATIONS AND ACRONYMS

ASTM	American Society for Testing and Materials
FTCH	Fishbeck, Thompson, Carr & Huber, Inc.
in	inch(es)
kg	kilogram(s)
lb	pound(s)
MDEQ	Michigan Department of Environmental Quality
Mm	millimeter(s)
MSW	municipal solid waste
P2	Pollution Prevention (Grant Program)

Scope

This Protocol describes procedures for measuring the composition of unprocessed MSW by employing manual sorting for the WMSBF Project, funded by the MDEQ through the Pollution Prevention Grant Program (P2). This protocol includes procedures for the collection of a representative sorting sample[1] of unprocessed waste, manual sorting of the waste into individual waste components, and data reduction. This method will be applied at seven select landfill sites, as determined by WMSBF.

This protocol does not address all of the safety considerations or issues associated with its use. A project Health & Safety Plan has been developed for the appropriate safety and health practices.

Apparatus

Containers: Metal, plastic, or fiber sufficient for storing and weighing each waste component. Containers will be labeled according to the Sort Classifications described in Table 1. For components with a substantial moisture content (e.g., food waste), metal or plastic containers are recommended to avoid absorption of moisture by the container and subsequently the need for multiple weight measurements to maintain an accurate tare weight for the container.

Scale: Mechanical or electronic scale, with a capacity of at least 200 lb (91 kg) and a precision of at least 0.1 lb (0.045 kg).

Other Equipment: Heavy-duty tarps, shovels, rakes, push brooms, dust pans, hand brooms, magnets, sorting table, first aid kit, miscellaneous small tools, traffic cones, traffic vests, leather or puncture-resistant gloves, hardhats, safety glasses, and leather/steel-toed boots (minimum 6”).

Table 1 – Waste Sort Categories

Category	Description
Mixed paper	Office paper, computer paper, magazines, glossy paper, waxed paper, and other paper not fitting the categories of newsprint and corrugated
Newsprint	Newspaper
Corrugated	Corrugated medium, corrugated boxes or cartons, and brown (kraft) paper (that is, corrugated) bags
Plastic	All plastics (**segregate deposit beverage containers**)
Polystyrene	Styrofoam
Yard waste	Branches, twigs, leaves, grass, and other plant material
Food waste	All food waste except bones
Wood	Lumber, wood products (except furniture), pallets,
Other Organics/Combustibles	Textiles, rubber, leather, carpet
Ferrous	Iron, steel, tin cans, and bi-metal cans
Aluminum	Aluminum, aluminum cans, and aluminum foil (**segregate deposit beverage containers**)
Glass	All glass (**segregate deposit beverage containers**)
Other Inorganics/Non-Combustibles	Rock, sand, dirt, ceramics, plaster, non-ferrous nonaluminum metals (copper, brass, etc.), and bones
Furniture	Household and office furniture
Electronics	TVs; computers & peripheral items; toys & games (include per unit count for CRT screens)
Household Hazardous Waste	Batteries; Mercury Lamps; Paint Cans; Oil Filters

[1] Sorting sample = vehicle load. The determination of a ‘representative sample’ is described later in this protocol.

Hazards

Review the hazards and procedures with operating and sorting personnel prior to conducting field activities.

Sharp objects (i.e., nails, razor blades, hypodermic needles, and pieces of glass) can be present in solid waste. Personnel should be instructed of this danger, and they should use a brush to move waste particles aside while sorting rather than projecting their hands with force into the mixture. Personnel handling and sorting solid waste should wear appropriate protection, such as heavy leather gloves, dust masks, hardhats, safety glasses, and safety boots.

During the unloading of waste from collection vehicles and its handling with heavy equipment, projectiles may issue from the mass of waste. The projectiles can include flying glass particles from breaking glass containers and metal lids from plastic or metal containers that burst under pressure when run over by heavy equipment. The problem is particularly severe when the waste handling surface is of high compressive strength, for example, concrete. Personnel should be informed of this danger, remain at an appropriate distance during the unloading process, and wear eye and head protection when in the vicinity of the collection vehicle unloading point and/or heavy equipment. Additionally, sorting personnel must remain vigilant and aware of vehicle traffic and vehicle movement around the facility.

Select a location for the discharge of designated loads, manual sorting activities, and weighing operations which is flat, level, has adequate ventilation, and is away from the normal waste handling and processing areas.

Containers of liquids, or other potentially dangerous wastes, shall be put aside and handled by facility personnel only.

Calibration

All weigh scale equipment shall be calibrated according to the manufacturer's instructions. Take appropriate corrective action if the readings are more than 5% different from those of the calibration weights.

Weigh storage containers each day, or more frequently, if necessary, to maintain an accounting of the tare weight.

Loss of mass from the sorting sample can occur through the evaporation of water. Therefore, samples should be sorted as soon as possible after collection.

Procedure for Determining the Number of Samples

200 to 300 lb (91 to 136 kg) of unprocessed solid waste will be used for sorting samples, when possible. The number of sorting samples **for each sample site** will be pre-determined by FTCH using the methodology described in this section. One sorting sample is chosen per vehicle load.

Number of Vehicles per Day

For a sampling period of k days[2], the number of vehicles sampled each day shall be approximately n/k, where n is the total number of vehicle loads to be selected for the determination of waste composition.

[2] At this time, the number of samples days for each facility is assumed to be two or three. This value may change based upon the historical data requested from each facility.

Number of 200 to 300-lb (91 to 136-kg) Samples

The number of sorting samples) (*n*) required to achieve a desired level of measurement precision is a function of the component(s) under consideration and the confidence level. The governing equation for *n* is as follows:

$$n = (t^* s/e \cdot \bar{x})^2$$

where:

t^*	=	Student *t* statistic corresponding to the desired level of confidence
s	=	estimated standard deviation
e	=	desired level of precision
$\bar{x}$	=	estimated mean

Suggested values of *s* and $\bar{x}$ for waste components are listed in Table 2. Values of Student t^* are given in Table 3 for 90% confidence level, which is the selected confidence level for this study.

Estimate the number of samples (*n'*) for the selected conditions –that is, precision (e) and level of confidence (90%). For the purposes of estimation, select from Table 3 the t^* value for $n = \infty$ for the 90% level of confidence. As the required number of samples will vary among the components for a given set of conditions, a compromise will be required in terms of selecting a sample size – that is, the number of samples that will be sorted. The component that is chosen to **govern** the precision of the composition measurement (and therefore the number of samples required for sorting) is termed the "governing component" for the purposes of this method[3].

After determining the governing component and its corresponding number of samples (*no*), return to Table 3 and select the student *t* statistic (t^*o) corresponding to *no*. Recalculate the number of samples (that is *n*') using t^*o.

Compare *no* to the new estimate of *n* (that is *n*'), which was calculated for the governing component. If the values differ by more than 10 %, repeat the calculations.

If the values are within 10 %, select the larger value as the number of samples to be sorted. Refer to ASTM D5231-92 (2008) - *Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste* for a sample calculation of *n*.

Component Composition

The component composition of solid waste is reported on the basis of the mass fraction (expressed as a decimal) – or percent of waste component *i* – in the solid waste mixture. The reporting is on the basis of wet weight - that is the weight of materials immediately after sorting.

[3] WMSBF has selected the "governing component" of **newsprint paper** to guide the calculation process.

Table 2 - Values of Standard Deviation (s) and Mean ($\bar{x}$) for Within-Week Sampling to Determine MSW Component Composition[4]

Component	Standard Deviation (s)	Mean ($\bar{x}$)
Newsprint Paper	0.07	0.10
Corrugated	0.06	0.14
Plastic	0.03	0.09
Yard Waste	0.14	0.04
Food Waste	0.03	0.10
Wood	0.06	0.06
Other Organics	0.06	0.05
Ferrous	0.03	0.05
Aluminum	0.004	0.01
Glass	0.05	0.08
Other Inorganics	0.03	0.06

Table 3 - Values of t Statistics (t*) as a Function of the Number of Samples at Confidence Interval 90%[5]

No. of Samples	90%	No. of Samples	90%
2	6.314	25	1.711
3	2.92	26	1.708
4	2.353	27	1.706
5	2.132	28	1.703
6	2.015	29	1.701
7	1.943	30	1.699
8	1.895	31	1.697
9	1.86	36	1.69
10	1.833	41	1.684
11	1.812	46	1.679
12	1.796	51	1.676
13	1.782	61	1.671
14	1.771	71	1.667
15	1.761	81	1.664
16	1.753	91	1.662
17	1.746	101	1.66
18	1.74	121	1.658
19	1.734	141	1.656
20	1.729	161	1.654
21	1.725	189	1.653
22	1.721	201	1.653
23	1.717	∞	1.645
24	1.714		

[4] Values from ASTM D5231-92 (2008) *Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste*

[5] Values from ASTM D5231-92 (2008) *Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste*

Procedure for Waste Sorting

There will be no sorting during precipitation events.

The facility will identify a secure, flat and level area for discharge of the vehicle load. Pursuant to the MDEQ guidance for this project, the area must be paved or within the solid waste boundary. The surface should be swept clean or covered with a clean, durable tarp prior to discharge of the load.

Position the scale on a clean, flat, level surface and adjust the level of the scale if necessary. Determine the accuracy and operation of the scale with a known (e.g., reference) weight.

Weigh all empty storage containers and record the tare weights.

Vehicles for sampling shall be selected at random during each day of the sampling event until the predetermined number of vehicles is reached for the particular landfill. The vehicles will be selected using a random list generator based on the expected average number of vehicles for the particular landfill.

The selected truck must be weighed upon arrival to the facility to determine the general size of the municipal solid waste load. Since the goal is to use 200 to 300 lb from each selected truck, it is imperative to know the weight of the full load. For instance, if the load is only 1,000 lb, then once discharged and quartered, a single quarter of the material will be sufficient for the sample sort; if the load is 3,000 lb, then once the material is quartered, only a third of the quarter-load will be used for the sample sort.

Direct the designated vehicle containing the load of waste to the area secured for discharge of the load and collection of the sorting sample.

Direct the vehicle operator to discharge the load onto the clean surface in one contiguous pile, that is, to avoid gaps in the discharged load and to facilitate collection of the samples. Collect any required information from the vehicle operator before the vehicle leaves the discharge area.

The material must be handled in a way that controls runoff. If the load has an appreciable amount of leachate, the team should forgo that particular truck and take the next truck.

Using a front-end loader with at least a 1 cubic yard (0.765 cubic meter) bucket, remove the material longitudinally along one entire side of the discharged load in order to obtain a representative cross-section of the material. The material shall be sufficient to form a mass of material which, on a visual basis, is at least four times the desired weight of the sorting sample (that is, approximately 1,000 lb [454 kg]). Mix, cone, and quarter the material; then select one quarter of the total amount to be the sorting sample, using a random method of selection[6] for the purpose of eliminating or minimizing biasing of the sample. If an oversize item (for example, water heater) composes a large weight percent of the sorting sample, add a notation on the data sheet and weigh it, if possible. Unprocessed solid waste is a heterogeneous mixture of materials; therefore, care must be taken during application of the random procedure for sample collection, ensuring a representative sample.

One sorting sample is selected from each collection vehicle load designated for sampling. All handling and manipulation of the discharged load and longitudinal and sorting samples shall be conducted on previously cleaned, flat, level surface. If necessary, remove the sorting sample to a secured manual sorting area. For convenience of the sorting personnel, the sorting sample may be placed on a clean table for sorting. A comprehensive list of waste components for sorting is presented in Table 1. A

[6] The random method of selection will conducted simply using two coins and assigning a quadrant to each combination (i.e., two heads = Q1; head1/tails2 = Q2; etc).

description of the waste component categories is given in Appendix 1. Label the storage containers accordingly.

Position the storage containers around the sorting sample. Empty all containers, in the sorting sample, of their contents (i.e., capped jars and paper or plastic bags.) Segregate each waste item and place it in the appropriate storage container.

In the case of composite items found in the waste, separate the individual materials where practical, and place the individual materials into the appropriate storage containers. Where impractical, segregate the composite items for classification by the crew chief according to the following procedure:

- If there are many identical composite items place those into the waste component containers corresponding to the materials present in the item, and in the approximate proportions according to the estimated mass fraction of each material in the item. EXAMPLE: Place plastic-sheathed aluminum electrical conductors in the designated container.
- If there are only a few of the identical composite item, place them in the storage container corresponding to the material that comprises, on a weight basis, the majority of the item. EXAMPLE: Place bi-metal beverage cans in the ferrous container.
- If composite items represent substantial weight percents of the sorting sample, a separate category should be established. EXAMPLE: Composite roofing shingles.
- If none of the situations above is appropriate, place the item(s) (or proportion it/them) in the storage container labeled **Other Non-Combustible** or **Other Combustible**, as appropriate.

Sorting continues until the maximum particle size of the remaining waste particles is approximately 0.5 inch (12.7 mm). At this point, apportion the remaining particles into the storage containers corresponding to the waste components represented in the remaining mixture. The apportionment shall be accomplished by making a visual estimate of the mass fraction of waste components represented in the remaining mixture.

Record the gross weights of the storage containers and of any waste items sorted, but not stored in containers. A data sheet, such as the example in the Reporting section of this Protocol, will require the user to record both gross and tare weights.

After recording the gross weights, empty the storage containers and weigh them again, if appropriate. Re-weighing is important and necessary if the containers become moisture-laden, i.e., from wet waste.

Prohibited wastes (e.g., returnable beverage containers; household hazardous wastes; etc.) must be segregated out after sampling and properly handled by the facility team.

Clean the sorting site and the load discharge area of all waste materials.

SITE PLAN

MSW SORT

Name of Site

	MSW SORT SITE DETAILS		
ADDRESS			
SITE PHONE			
KEY CONTACTS			
PHONE/E-MAIL			
DATES			
TRUCK ORDER	DAY 1	DAY 2	DAY 3
	Truck no.	Truck no.	Truck no.
	0 0 0 0 00 00 00 00 00 00	0 0 0 00 00 00 00 00 00 00	0 0 0 0 0 00 00 00 00 00
TEAM ARRIVAL			
TRANSPORTATION			
INSTRUCTIONS FOR PAPERWORK			
SITE SAFETY REQUIREMENTS			
QUARTERING	HH= NW HT= NE TH= SW TT= SE		
SITE LEADER			
SCALE 1			
BACKUP SCALE			
BULK ITEMS	@ site (transferred by Grant)		
SMALL ITEMS	Michael has scale & board, Angela has tub & backup, - need to get cones off Scribner		
MEDIA NOTES			
ACCOMMODATIONS			
OTHER			