



*WASTE CHARACTERIZATION FOR
MEDINA COUNTY, OHIO*

REPORT
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EXECUTIVE SUMMARY

BACKGROUND AND GOALS

The purpose of this Medina County Solid Waste District (Medina County SWD) request for proposals is to develop a low-cost, high impact evaluation that identifies the current changes in the County waste stream and supports materials management planning. The value proposition of potential recyclables is evaluated to provide information about the revenue-generating potential of those recycled commodities.

This project has two discrete objectives outlined below.

- Objective 1 - Utilize existing data from Medina County SWD, State of Ohio information and any other relevant waste characterization studies to provide an accurate description of the present composition of residential and commercial municipal solid waste (MSW) that is disposed within the Medina County SWD.
- Objective 2 - Provide recommendations on recyclable materials to target for efficient and effective recovery activities.

HIGHLIGHTS AND FINDINGS

For the purposes of the study, a waste sector is identified by the particular generation characteristics that make it a unique portion of the total waste stream. Each state characterization that was reviewed has a different definition of what material was included in their studies based on their statutory definition and the types of solid waste and recycling program requirements. The characterizations from other states and communities identified 80 different categories of material that were evaluated, however not every category was evaluated within a specific state study. The development of a waste characterization for the Medina County is based a review of 40 statewide and municipal waste characterization studies from across the country. An issue that complicates the development of a waste characterization for the Medina County by utilizing previously conducted waste characterizations studies from other states and municipalities is the “evolving ton”, a term being used to describe the shift in the overall composition of the municipal solid waste stream over the past 20 years.

A comprehensive Waste Characterization profile can be found in Table 1.

Table 1: Waste Characterization of Statewide Disposed Waste

Material Type	TONS	PERCENT of TOTAL
Paper Subtotal	33,993	23.70%
Plastic Subtotal	21,108	14.72%
Metal Subtotal	7,817	5.45%
Glass Subtotal	4,853	3.38%
Electronics Subtotal	3,753	2.62%
Total Wood	9,347	6.52%
Yard Waste, Food Waste and Organic Subtotal	37,076	25.85%
Other Materials such as Textiles, Batteries, Carpet	12,024	8.38%
Other Non- Recyclable Materials	13,458	9.38%
Total	143,429	100.00%

ECONOMIC AND ENVIRONMENTAL IMPACTS OF RECYCLING

The analysis of the economic impact of recycling includes an evaluation of the current recyclable current market value of materials, market trends, and a discussion of the recycled commodity market drivers. The economic impact of potential recyclables provides information about the revenue-generating potential of those recycled commodities.

- Contractual Arrangements between a municipality and a Material Recovery facility (MRF) where the MRF operator rebates communities based on the value of recycle commodities using a blended commodities pricing index has become a common practice. The average commodity revenue (ACR) contract approach is one of the prevalent mechanisms for a community to hedge the risks of volatile swings in the value of recycled commodities.
- The majority of recycling revenue in a MRF comes from the denser suite of materials like fiber, which represents as much as 65 percent of the weight but about 48 percent of the value
- Beginning in 2014 the general trend in overall average commodity revenue has declined as global demand for all commodities, primarily driven by Chinese demand, has declined.
- It is difficult to project future prices for recycled commodities as the value is closely linked to global economic growth and is especially sensitive to the growth in industrialization of emerging markets such as China and India.

Waste and recyclables that end up in landfill is lost energy and materials. In a landfill site, organic residuals decomposing in anaerobic conditions produces landfill gas, approximately half of which is methane. When waste is recycled, landfill gas is not formed. In addition to landfill emissions, waste and contributes to greenhouse gas emissions also in other operations. When properly managed, recycling can affect emissions at all of these stages.

The overall benefit gained from recycling depends on a number of questions, such as what are the transport and pre-treatment requirements of the recycled materials, what kind of materials are produced and, above all, what kind of products are to be replaced by different products using new materials.

MUNICIPAL SOLID WASTE DEFINITIONS

The US EPA defines Municipal Solid Waste (MSW) as “discards from residential and commercial sources that does not contain regulated hazardous wastes.” (EPA, State Measurement Program Template, 2013) The EPA has provided a detailed description of materials that are considered MSW and those that are not, and the full table is appended to this document. Key considerations in the definition of MSW include:

- MSW excludes waste from industrial operations, manufacturing, construction and demolition, and transportation equipment (automobiles).
- MSW excludes sludges and combustion ash.

Although the State of Ohio has a broad definition of solid waste, the types of materials that Median County manages are typically considered to be residential and commercial wastes that do not include industrial wastes.

Recycling

Recycling is defined by the US EPA as “the series of activities by which discarded materials are collected, sorted, processed, and converted into raw material and returned to the economic mainstream by being used in the production of new products. It does not include the use of these materials as a fuel substitute or for energy production.” (EPA, State Measurement Program Template, 2013) Similar detail by material identifying the activities that are and are not considered recycling is excerpted from “Measuring Recycling: A Guide for State and Local Governments” and appended to this document. Key activities that are not considered recycling are:

- Combustion of material for energy recovery;
- Backyard (onsite) composting of food scraps and yard trimmings;
- Reuse (e.g. of refillable packaging, textiles, pallets, plastic products, etc.);
- Recycling of non-MSW such as waste from industrial processes; and
- Recycling of wood waste or yard trimmings from C&D debris.

Effectively, the EPA definition of MSW was used in this methodology, and is based on the historical management of municipal solid waste. Although it is common practice to landfill materials such as municipal sludge, nonhazardous industrial process wastes, and construction and demolition (C&D) debris along with MSW, these materials are not included in the standard scope of MSW or a recycling rate.

For the purposes of the study, a waste sector is identified by the particular generation characteristics that make it a unique portion of the total waste stream. This study is limited to analysis of the statutory definition of municipal residential and commercial solid waste (MSW or solid waste). Each state characterization that was reviewed has a different definition of what material was included in their studies based on their statutory definition and the types of solid waste and recycling program requirements. The characterizations from other states and communities identified 80 different categories of material that were evaluated, however not every category was evaluated within a specific state study.

DEVELOPMENT OF WASTE CHARACTERIZATION FOR MEDINA COUNTY

It is important to understand the types and quantities of materials generated, the generating sectors, the quantities that are potentially recoverable and those that are otherwise disposed to enable sound policy and program design, implementation and program analyses for both the public sector and private sector in Medina County. Many states and counties throughout the country conduct waste characterization studies at regular intervals to evaluate recycling program effectiveness, monitor changes in the disposed waste stream, confirm the effectiveness of landfill disposal bans, identify potential diversion opportunities, and otherwise help manage their waste streams. Generation data can be used for strategic planning; developing future legislative initiatives; evaluating effectiveness of current recovery efforts; targeting programs and educational efforts to advance recovery of commodities; providing guidance to state agencies and local governments; and aid in fulfilling the responsibilities required under the Governors Initiative.

The development of a waste characterization for the Medina County is based a review of statewide and municipal waste characterization studies from across the country. Additionally, the RRS completed a literature review for any new waste characterization studies. Resource Recycling Systems (RRS) developed a national landfill characterization estimation tool based on 40 different landfill characterization studies. These studies range from individual municipality studies to statewide studies. For each study, RRS standardized the list of materials and summarized the composition of the landfill by percentage of each material. The studies are categorized as coming from low-, medium-, or high-diversion communities, since as more material is diverted from the landfill the composition of the remaining material changes.

Each study was evaluated for inclusion in the tool to ensure compatibility with the existing studies. Based on the unique characteristics of the waste characterization studies the Project Team performed a statistical analysis of existing composition studies to quantify the effects of each. For example, the waste characterization for states with landfill bans (or strong policy promoting the diversion of organics) will be compared with those without to determine the deviation from the average. This analysis was completed for each of the factors to fully understand the effects of specific policies and conditions now present in Medina County.

Another consideration that complicates the use of waste characterizations studies for the development of a waste characterization for Medina County is the “evolving ton”, a term being used to describe the shift in the overall composition of the municipal solid waste stream over the past 20 years. One of the trends responsible for this evolution has been the light weighting of packaging, especially through the use of materials like plastics and aluminum that have displaced materials like glass and steel. More recently, even rigid plastic packaging formats have started to be displaced by rapidly growing formats in flexible packaging. But plastics are not alone in driving the waste shift: Electronic media have played a major role in changing the composition of our recycling stream by reducing the absolute volume of newspaper and office paper.

It’s also critical to understand that while more types of plastics are getting collected, complexity has increased even within the resin types the recycling system has traditionally handled. In response to growing pressure to recycle more, many companies are shifting to “recyclable” materials, often defining them as those accepted in community recycling programs. One of the best examples of this trend has been PET replacing PVC or PS thermoforms and heavier jar and container material like glass. The unforeseen consequence of this well-intentioned transition is the recent diversification of PET in the recycling stream, a phenomenon that has lowered the yield of usable materials (the PET used in clamshells, blisters and ketchup bottles is not the same as that used in a soda bottle).

Methodology

The studies were reviewed and evaluated on the basis of thoroughness and accuracy, date conducted, and relevance to the material types under consideration. Each study was assigned to a low, medium, or high diversion profile based on the characteristics of the states or communities represented in each study and the per capita amount of landfilled material. By averaging across several studies, generic profiles for low, medium, and high diversion states and communities were developed. The profiles were adjusted to take into account overall drops in landfill tonnage in recent years as a result of the economic downturn and the changing material mix. Each profile consists of an estimate of per capita generation, and the composition of this material, as well as residential and commercial generation and composition from studies that included separate characterizations of those sectors.

The Project Team reviewed recent landfill characterization studies from other states, including Pennsylvania, Illinois, Tennessee, and Nebraska. Only state studies that had specific characterizations for residential material were included. All four of these states have less than 15 percent diversion. The percentage of standard residential recyclables in the residential waste stream was on average 37 percent and ranged from 35 percent to 39 percent. Reviewing characterizations from states with medium diversion (15%–40% statewide) including California, Connecticut and Washington, the range is similar with California at the upper end of the diversion range and only 19 percent of the landfilled material was recyclable to Connecticut at 25 percent diversion and 24 percent material recyclable.

It should be noted that the national and world economy experienced the effects of a significant economic downturn in 2008-2009, with the effects impacting several of the studies that were reviewed. While it is beyond the scope of this study to quantify the impacts, it can be qualitatively asserted that waste generation patterns may have been affected and generation of specific types of material have changed for a number of reasons:

- Slow or negative business growth has resulted in absolute and per-capita decreases in waste generation.
- Construction was lower than average for both residential and non-residential projects.
- Markets for recycled materials, like many commodities markets, dropped precipitously during the recession.

The original approach was to generate three separate compositions: low, medium, and high diversion communities. Each of the studies was classified in one of these categories based on its diversion rate (less than 15% for low diversion and greater than 40% for high diversion). In this manner, the characterization would be applied to each county, based on the reported tons generated in that county in the most recent Landfill Report. An average residential composition would then be generated from this analysis for Medina County-generated material that does not include imported material.

An approach was developed that utilized the average of the low, medium, and high diversion compositions from the review of waste characterizations studies as well as a diversion categorizations for states with yard waste bans. Several studies also included a breakdown between residential and Institutional, Commercial, and Industrial (ICI) categories. The Project Team believes strongly that when a state is classified by its diversion rate, a credible estimation can be made of the percentage of materials that are recyclable and the value of that material relative to the Medina County. Separate characterizations were created specifically for states with a bottle bill.

Table 2 illustrates a sample of the comparison of the study results. The table for plastic shows the variability of studies for specific categories of material. These characterizations show that there is a

difference of 2.13% in the total plastics from the low estimate to the high estimate. The medium diversion characterization is very similar to the bottle bill diversion characterization.

Table 2: Percentage of Total Plastic Landfilled

	PET bottles and containers	HDPE Bottles Natural & Colored	Plastic bottles and #3-7 (general)	Plastic Bags/Film	All other Plastics and Packaging, Rigid containers and PP tubs	TOTAL
High Diversion - Residential and Commercial	0.92%	0.84%	0.83%	0.55%	11.37%	14.51%
Low Diversion - National Residential	1.40%	1.30%	0.47%	0.63%	10.08%	13.88%
Low Diversion - Residential and Commercial	1.27%	1.18%	0.34%	0.45%	11.50%	14.74%
Low Diversion - Great Lakes Residential	1.30%	1.07%	0.88%	0.63%	10.83%	14.72%
Low Diversion – Great Lakes Residential - Commercial	1.53%	1.16%	0.75%	0.63%	11.69%	15.76%
Low Diversion - Midwest Residential	1.77%	1.27%	1.27%	0.63%	11.07%	16.01%

All of the Great Lakes states that were evaluated have some type of organics or yard waste bans in place while other states and states with container deposit laws do not have comprehensive organics management programs or landfill bans. The higher percentage of organics in states without organics management programs is primarily driven by higher percentages of leaves and grass. Leaves and grass make up approximately 3.7-3.9 % of the total waste stream in the states without organics management programs.

Table 3 provides the characterization for all major categories of materials. The compositions provided in the table show that the average of states that were classified as a medium diversion, including both residential and commercial material, is very consistent with the characterization of states with deposit container programs. The other comparison that was calculated was to states in the Great Lakes region (Illinois, Indiana, Wisconsin, Iowa). These composition estimates were compared to select an appropriate composition to be applied to Medina County. A comprehensive table of the percentage allocation of all major categories of studies is included in Appendix V.

Table 3: Percentage of Categories of Landfilled Materials

	Paper subtotal	Plastic subtotal	Metal subtotal	Glass Subtotal	Electronics Subtotal	Total Wood	Organic Subtotal	Other Hard to Recycle	OTHER NON-RECYCLABLE MATERIAL
High Diversion - Residential and Commercial	22.29%	14.51%	4.84%	2.78%	1.18%	9.39%	35.24%	4.99%	4.43%
Low Diversion - National Residential	25.97%	11.63%	4.93%	2.00%	2.50%	11.87%	23.90%	0.27%	15.67%
Low Diversion - Residential and Commercial	31.32%	15.92%	7.48%	2.51%	2.40%	11.90%	20.07%	0.37%	6.33%
Low Diversion - Great Lakes Residential	23.70%	14.79%	4.68%	3.45%	2.10%	6.85%	18.78%	0.30%	10.95%
Low Diversion – Great Lakes Residential - Commercial	26.87%	12.11%	5.85%	1.73%	1.56%	10.17%	24.39%	0.05%	16.17%
Low Diversion - Midwest Residential	26.61%	13.39%	5.21%	2.32%	1.64%	11.46%	24.93%	0.05%	11.28%

The final step was to combine the over 80 categories of material that were identified in the characterization states into a classification system that typifies broader categories consistent with market specifications. The estimate of landfilled material was calculated by multiplying the quantity of total landfilled material by the average percent of material types selected as representative of Medina County. The national average from other characterization studies shows that residential waste is 47% of the waste stream. The data from Medina shows that 83% of the waste that is being managed is sourced from residential customers. In addition, based on the studies reviewed and the work that RRS has been conducting relative to flexible packaging and plastic films, RRS adjusted the selected characterization scenarios to include a category for **Plastic Bags/Film based on national averages**.

Table 4 provides a consolidated profile of the disposed waste stream. In addition, the current recovery of material was included for comparative purposes. It is our opinion that utilizing a low diversion residential allocation best represents Medina County. This characterization characterizations would present a useful approach for the Medina County because Medina County solid waste that is currently managed has a lower percentage of commercial waste than waste characterization studies that include both residential and commercial wastes.

RRS recommends utilizing Low Diversion based on Great Lakes States because it show a lower percentage of compostable/ soiled and all other paper that exhibit higher percentages when the commercial sector ids more representative in the overall mix.

Table 4: Medina County, OH Waste Characterization*

Material Type	Low Diversion – National Residential	Low Diversion – Midwest Residential	Low Diversion – Great Lakes Residential	FINAL PERCENTAGE Great Lakes Residential
High Grade - White and Colored Ledger	359	1,581	598	0.42%
Mixed/ unspecified Office	1,578	394	526	0.37%
Low Grade - general (OMG), Boxboard, Paper Bags, Phonebooks other recyclables	11,044	11,621	10,494	7.32%
ONP	5,498	6,063	5,163	3.60%
OCC	6,502	6,042	7,100	4.95%
Cartons, Aseptics and Poly-coated	622	161	215	0.15%
Compostable/ soiled and all other paper	11,642	12,303	9,897	6.90%
Paper Subtotal	37,244	38,167	33,993	23.70%
PET bottles and containers	2,008	2,535	1,865	1.30%
HDPE Bottles Natural & Colored	1,865	1,814	1,530	1.07%
Plastic bottles and #3-7 (general)	669	1,825	1,267	0.88%
All other Plastics and Packaging, LDPE, Polystyrene (foam), Durable and Rigid containers and PP tubs)	908	908	908	0.63%
Plastic Bags/Film	14,462	15,881	15,538	10.83%
Plastic Subtotal	19,913	22,964	21,108	14.72%
Aluminum cans	765	997	693	0.48%
Ferrous metals (includes Tin/Steel Cans, tin)	5,211	4,715	5,307	3.70%
Non-ferrous metals, Aluminum (foil) and Other Metal and Aerosol Cans	1,602	1,685	1,817	1.27%
Metal Subtotal	7,578	7,397	7,817	5.45%
Glass - general including containers	5,952	5,250	4,136	2.88%
Other Glass	574	617	717	0.50%
Glass Subtotal	6,526	5,866	4,853	3.38%
Electronics - general, computer related, CRT	3,084	2,829	3,753	2.62%
White goods (appliances)	-	-	-	0.00%
Electronics Subtotal	3,084	2,829	3,753	2.62%
Total Wood	8,893	7,150	9,347	6.52%
Yard waste - general	12,383	6,630	7,124	4.97%
Food	17,929	21,091	19,889	13.87%
Other R/C Organics, Branches and Stumps	11,952	7,548	10,064	7.02%
Yard Waste and Organic Subtotal	42,264	35,269	37,076	25.85%
Other Textiles, Batteries, Tires, Carpet, Light Bulbs	10,279	11,274	12,024	8.38%
Other Non- Recyclable Materials	7,649	12,512	13,458	9.38%
Total	143,429	143,429	143,429	100.00%

*Numbers may not total due to rounding errors

ECONOMIC IMPACT

The analysis of the economic impact of recycling includes an evaluation of the current recyclable current market value of materials, market trends, and a discussion of the recycled commodity market drivers. The economic and environmental impact of current and potential recyclables was calculated to provide information about the revenue-generating potential of those recycled commodities. All materials collected and ultimately processed in a recycling program are considered commodities. This means that in spite of market demand fluctuations and associated price increases or decreases, the total collected tonnages must yield a value to maintain a healthy, stable recycling programs.

Recycling opportunities vary from one municipality to the next. In Ohio, paper, corrugated, paperboard, plastics, glass, metal are generally collected, and several municipalities have also organized the collection of organics, cartons and energy waste. Collection points are property-based, or collection is organized regionally. Most municipalities in Ohio towns have reuse centers, flea markets or second-hand shops, which also help promote recycling and reuse.


Residents can take household waste electrical and electronic equipment free-of-charge to the collection points provided by major retailers or drop off locations operated by municipal governments. Used tires without rims can be taken to the local tire shop, again free-of-charge.

THE RECYCLING BUSINESS PROPOSITION

Arrangements with a MRF in which haulers rebate communities based on the cost per ton using a blended commodities pricing index has become a common practice. Taking competitive bids for commodities as they become available can maximize prices that municipalities can receive for the recycled commodities. Many municipalities do not operate a MRF but use a contractor to process and market its recyclables. Municipalities often manage residential refuse collection. Communities can choose to request MRF's to share in the market value of materials that are sold, as contracts are prepared. MRF operations are usually covered by the tipping fee and receive additional compensation based on the prices for recyclables.

This is a typical practice when separate contracts are awarded for collection and for processing and marketing of materials. A revenue sharing arrangement provides an incentive for both the MRF to maintain high quality and market standards and for the community to encourage residents to participate in the recycling program and educate residents how materials should be set out to maximize the benefit of the program. A market share arrangement generally includes an established floor price, which guarantees a minimum price per ton paid to the community for materials brought to the MRF. The floor price can be fixed based on the market value of a select number of items or the total mix of recyclable materials collected. When the market value of the recyclable tonnages exceeds the established floor price, the community and the MRF share in the value of the sold commodities, based upon an established percentage split.

The average commodity revenue (ACR) contract approach is one of the prevalent mechanisms for a community to hedge the risks of volatile swings in the value of recycled commodities. The approach provides flexibility and helps to maximize revenues. If a community wants a minimum guaranteed price, bidders would be tempering their bids with lower expectations in order to ensure that they're not incurring large losses in instances of a market depression. Some MRFs are requesting that glass be removed from the recycling stream due to its negative value.



In reviewing the Market Trend Data, the market demand and commodity prices for fiber, plastics, aluminum and steel have declined over the past few years. The commodity revenues associated with these materials have over time provided the financial foundation for most recycling programs, whether publicly or privately sponsored. Manufacturing techniques using post-consumer materials also have kept pace with technology and knowledge of the materials sorts. Mills have improved their equipment and systems to predict and adapt to a degree of contamination and to capture contaminants to minimize damage to equipment and maintain quality product standards.

End markets for even more materials, especially the #3-#7 plastics, has provided opportunities for Material Recovery Facilities (MRF's) to increase their list of accepted materials and collected volumes. In fact, the capabilities of both dual and single sort collection programs to easily add materials types to their collection programs has led to the expansion of recycling programs nationwide. Without these inherent flexibilities, the successful recycling of cartons, juice boxes, textiles, boxboard, and exotic plastics (#3 - #7) would not have grown as quickly over the last five to ten years.

Environmental concerns, lower commodity prices and increased regulation are making recycling increasingly difficult. While the recession reduced consumer demand for products in general, demand for products manufactured with recycled goods has risen over the past five years. Further, in the future demand will continue rising, as voluntary product stewardship requirements of the major retailer in the world, Walmart, require manufacturers to use more recycled content as inputs.

The recycling industry is a mature industry, understands and controls its cost structure and has well-established relationships with end markets and had expanded at an average annual rate of 4.4% until the recent downturn in global commodity demand. There is considerable volatility in recycled commodity prices, which dropped during the recession in response to slumping consumption. During 2009, recycled commodity prices were particularly low, resulting in lower revenues for the industry. Revenue volatility became a concern for industry players, and many sought to consolidate operations to become more stable and achieve greater economies of scale.

It is difficult to project future prices for recycled commodity as the value is closely linked to global economic growth and is especially sensitive to growth of industrialization of emerging markets such as China and India. Higher levels of government regulation and voluntary manufacturing and product requirements for recycled content will benefit the industry by pushing potential downstream customers to use recycled goods in manufacturing processes. This trend is expected to boost the overall market for recycled goods and help stabilize revenue volatility.

According to analysis by RRS related to the average commodity revenue per processed ton, a majority of recycling revenue comes from the denser suite of materials like fiber, which represents as much as 65 percent of the weight and about 48 percent of the value per processed ton generated at an average MRF (see Figure 6). Aluminum, which is about 1.1 percent of a process ton by weight, accounts for about 14.4 percent of the revenue. Plastics, mostly PET and HDPE, meanwhile, represent about 6.7 percent of the weight of a processed ton and about 20.8 percent of the revenue.

The graph was updated October 2016 and continually fluctuates with markets and recycling participation. Pulling from numerous recycling composition studies from across the U.S., RRS determined the average weight composition of incoming materials to MRFs, which is represented on the left side of this graph. The right side represents the average commodity revenue per ton of

processed material and excludes residue. MRF operators adapt their operations to respond to these numbers or risk missing out on revenue, regardless of equipment, techniques or contamination.

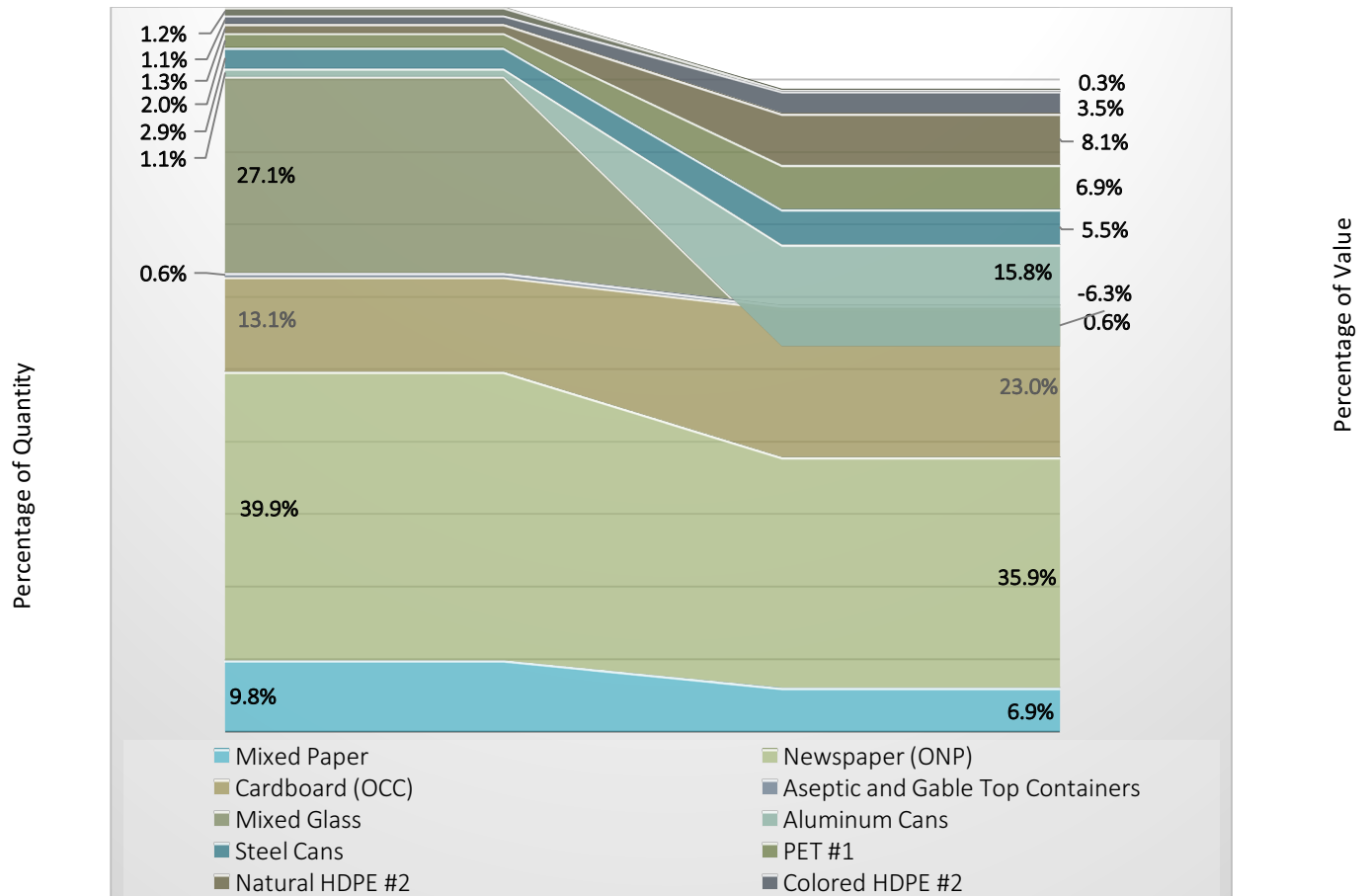


FIGURE 1: THE RECYCLING BUSINESS PROPOSITION

Based on the value proposition, RRS recommends that Median County focus on the materials that have high volumes with a strong market or a high value to weight ratio. This means that materials such as clean high value plastics (PET and HDPE) and high value materials with good value (Corrugated Cardboard) are good targets. Materials with a low value to weight ratio such as glass are not good targets unless there is a strong local market. Materials that are heavy can become a negative value proposition of the markets for those materials are farther distance from Median County. Transportation costs to move materials to market are the biggest risk for a recycling program.

APPENDICES

APPENDIX I: END MARKET COMMODITY TYPES AND MARKET INDICATOR

Acronym	Material	MARKET INDICATOR
ONP	Old Newspaper	OBM #8 CHICAGO HIGHSIDE
OMG	Old Magazines	OBM #8 CHICAGO HIGHSIDE
OCC	Old Corrugated Cardboard	OBM #11 CHICAGO HIGHSIDE
RMP	Residential Mixed Paper	OBM #1 CHICAGO HIGHSIDE
OTD		OBM #1 CHICAGO HIGHSIDE
PLASTIC HDPE NATURAL	High Density Polyethylene	Waste New 1st Issue of Month - Chicago Region
PLASTIC - HDPE PIG	High Density Polyethylene Pigmented	Waste New 1st Issue of Month - Chicago Region
PLASTIC - PET	Polyethylene terephthalate	Waste New 1st Issue of Month - Chicago Region
GLASS-CL	Clear	REGIONAL/LOCAL MARKET RATE
GLASS-BR	Brown	REGIONAL/LOCAL MARKET RATE
GLASS- GR	Green	REGIONAL/LOCAL MARKET RATE
ALUM	ALUMINUM	ALUMINUM METAL MARKET LOW - 1ST ISSUE OF MONTH
STEEL	Ferrous Steel and Iron	Average REGIONAL Monthly Sales

APPENDIX II: LIST OF REVIEWED WASTE CHARACTERIZATION STUDIES

Low-Diversion Profile

- Pennsylvania Department of Environmental Protection, *Statewide Municipal Waste Composition Study*, 2003.
http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/Waste_Comp/Study.htm
- Illinois Department of Commerce and Economic Opportunity/Illinois Recycling Association, *Illinois Commodity/Waste Generation and Characterization Study*, 2009.
<http://www.illinoisrecycles.org/pdffiles/ICWCGSReport052209.pdf>
- Georgia Department of Community Affairs, *Georgia Statewide Waste Characterization Study: Final Report*, 2005.
<http://www.dca.state.ga.us/development/EnvironmentalManagement/publications/GeorgiaMSWCharacterizationStudy.pdf>
- Indiana Department of Environmental Management, *Municipal Solid Waste Characterization Study for Indiana*, May, 2012
www.in.gov/idem/recycle/files/msw_characterization_study.pdf
- US EPA, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Detailed Tables and Figures for 2008*.
<http://www.epa.gov/wastes/nonhaz/municipal/pubs/msw2008data.pdf>
- Ada County Solid Waste, Boise, Idaho. *Ada County Waste Stream Analysis 2014*.
<https://adacounty.id.gov/Portals/Landfill/Documents/Waste-Stream-Analysis-2014.pdf?ver=2016-02-04-095456-053>.
- Solid Waste Division, Prince William County, Virginia. *Waste Composition Study Summary of 2013-2014 Results*. <http://gbbinc.com/gbbwp2013/wp-content/uploads/2013/10/PWC-Waste-Characterization-Final-Report.pdf>

Medium -Diversion Profile

- Wisconsin Department of Natural Resources, *Statewide Waste Characterization Study*, 2003.
<http://dnr.wi.gov/org/aw/wm/publications/recycle/wrws-finalrpt.pdf>
- Connecticut Department of Environmental Protection, *Connecticut Statewide Solid Waste Composition and Characterization Study*, 2010.
http://www.ct.gov/dep/lib/dep/waste_management_and_disposal/solid_waste/wastecharstudy/ctcompositioncharstudymay2010.pdf
- California Integrated Waste Management Board, *California 2008 Statewide Waste Characterization Study*, 2009. <http://www.calrecycle.ca.gov/publications/general/2009023.pdf>
- US EPA, see above
- Department of Sanitation – NYC, NY. *The New York City 2013 Residential Waste Characterization Study*
<http://www1.nyc.gov/assets/dsny/docs/2013-Waste-Characterization-Study.pdf>
- City of Durham, NC. *Waste Characterization Study*.
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APPENDIX III: COMPREHENSIVE CHARACTERIZATION CATEGORIES

Material Type	Residential and Commercial					Residential			
	Bottle Bill Diversion	Bottle Bill Diversion ADJUSTED	Low Diversion	Medium Diversion	High Diversion	Low Diversion	Medium Diversion	High Diversion	Bottle Bill Diversion
High Grade - general with White and Colored Ledger	1.37%	1.42%	0.35%	1.27%	0.48%	0.25%	1.17%	0.20%	0.80%
Mixed/ unspecified Office	0.68%	0.70%	2.37%	0.40%	0.23%	1.10%	0.57%	0.85%	0.57%
Low Grade - general (OMG), Boxboard, Paper Bags, Phonebooks other recyclable	5.37%	5.58%	7.63%	4.10%	5.22%	7.85%	6.00%	0.95%	4.70%
ONP	1.85%	1.92%	4.02%	1.73%	1.64%	4.70%	2.83%	1.87%	2.20%
OCC	5.47%	5.68%	10.12%	4.87%	2.68%	5.45%	2.60%	2.19%	3.07%
Cartons, Aseptics and Poly-coated	0.14%	0.14%	0.17%	0.07%	0.28%	0.25%	0.03%	0.17%	0.07%
Compostable/ soiled and all other paper	7.94%	8.24%	8.03%	8.87%	7.90%	7.70%	10.40%	12.62%	10.27%
Paper Subtotal	22.81%	23.69%	32.69%	21.30%	18.43%	27.30%	23.60%	18.85%	21.67%
PET bottles and containers	0.66%	0.68%	1.12%	0.67%	0.65%	1.30%	0.83%	1.10%	0.97%
HDPE Bottles Natural & Colored	0.54%	0.56%	0.99%	0.43%	0.54%	1.10%	0.73%	0.75%	0.77%
Plastic bottles and #3-7 (general)	0.30%	0.31%	0.42%	0.17%	0.70%	0.65%	0.40%	0.76%	0.70%
All other Plastics and Packaging, LDPE, Polystyrene, Durable /Rigid containers and PP tubs)	10.62%	11.03%	11.35%	10.37%	10.88%	9.70%	9.13%	9.49%	9.80%
Plastic Subtotal	12.11%	12.58%	13.88%	11.63%	12.77%	12.75%	11.10%	12.09%	12.23%
Aluminum cans	0.17%	0.17%	0.54%	0.20%	0.30%	0.55%	0.30%	0.37%	0.27%
Ferrous metals (includes Tin/Steel Cans)	4.29%	4.45%	3.75%	3.03%	2.30%	3.90%	2.67%	2.64%	2.77%
Non-ferrous metals, Aluminum (foil) and Other Metal and Aerosol Cans	1.40%	1.45%	1.04%	1.70%	2.20%	1.20%	1.60%	1.86%	1.33%
Metal Subtotal	5.85%	6.08%	5.33%	4.93%	4.80%	5.65%	4.57%	4.87%	4.37%
Glass - general including containers	1.27%	1.32%	2.91%	1.23%	1.93%	3.55%	1.70%	2.22%	1.60%
Other Glass	0.46%	0.47%	0.37%	0.77%	0.61%	0.40%	0.73%	0.58%	0.63%
Glass Subtotal	1.73%	1.79%	3.28%	2.00%	2.54%	3.95%	2.43%	2.80%	2.23%
Electronics - general, computer, and CRT	1.43%	1.48%	2.23%	2.13%	0.30%	2.15%	2.07%	0.37%	1.83%
White goods (appliances)	0.14%	0.14%	0.00%	0.37%	0.40%	0.00%	0.43%	0.00%	0.23%
Electronics Subtotal	1.56%	1.62%	2.23%	2.50%	0.70%	2.15%	2.50%	0.37%	2.07%
Total Wood	10.17%	10.57%	8.67%	11.87%	7.61%	6.35%	6.27%	3.77%	5.97%
Yard waste - general	6.49%	2.70%	3.12%	5.70%	2.55%	4.90%	7.87%	4.58%	9.83%
Food	14.53%	15.10%	12.46%	13.07%	26.58%	13.40%	17.50%	23.61%	17.57%
Other R/C Organics, Branches and Stumps	3.37%	3.50%	5.20%	5.13%	7.23%	7.55%	8.00%	4.35%	5.87%
Organic Subtotal	24.39%	21.30%	20.79%	23.90%	36.35%	25.85%	33.37%	32.54%	33.27%
Other Textiles, Tires, Carpet, Light Bulbs	5.22%	5.42%	6.23%	6.20%	4.56%	7.65%	7.70%	3.45%	8.03%
OTHER NON- RECYCLABLE MATERIAL	16.17%	16.95%	6.87%	15.67%	12.24%	8.30%	8.47%	21.28%	10.17%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%