FINAL REPORT

Broome County, New York Recyclable Materials Characterization Study

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Stearns & Wheler
Broome County Recyclable Materials Characterization Study

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Section 1
STUDY DESIGN

1.1 Introduction

Section 1 of this report outlines the study design used by R. W. Beck for the Broome County (County) Recyclable Materials Characterization Study (Study). The Study design included the following steps:

- Determine material categories;
- Conduct pre-sort site assessment;
- Formulate materials sorting protocol;
- Conduct sampling and sorting event;
- Compile and review collected data; and
- Complete statistical modeling.

1.2 Determine Material Categories

The material categories selected for the Study were based on discussions with County staff and R. W. Beck's waste and recycling characterization experience.

Twenty-two (22) categories were selected for this study and are listed below. The definitions of each of these categories are included in Appendix A for reference.

Table 1-1
Recyclable Materials Category List
Broome County, NY

PAPER
1. Newspaper
2. Household Office Paper & Mail
3. Magazines/Catalogs
4. Phone Books
5. Uncoated Cardboard & Brown Paper Bags
6. Boxboard
7. Beer, Pop & Water Boxes
8. Other (Milk/Juice Cartons, Frozen Pizza Boxes)
PLASTIC
9. #1 PET Containers & Bottles
10. #1 PET Deposit Bottles
11. #2 HDPE Containers & Bottles
12. #3-#7 Plastic Containers
METALS
13. Aluminum Beverage Containers
14. Aluminum Deposit Beverage Containers
15. Ferrous Food & Beverage Containers
16. Other Aluminum (alum. pans, tin foil)
GLASS
17. Glass Bottles & Jars
18. Glass Deposit Bottles & Jars
NON-TARGETED MATERIALS
19. Other Paper Trash
20. Plastic Bags & Other Film Plastic
21. Other Trash
FINES
22. Fines

The materials numbered 1 through 18 in Table 1-1 are currently accepted for recycling in the County's recycling program. Items numbered 19 through 21 represent the material that is not accepted or targeted in the County's program.

Recyclable materials are collected from residents and businesses in Broome County using two collection methods: single-stream in which all materials are commingled together, and dual-stream in which fiber and containers are separated into two streams.

The collection method is determined by the hauler and/or processor. There are five recyclable materials processors in the region:

1. WM Recycle America in Binghamton, NY. This facility accepts recyclable materials commingled (single-stream) and transfers the materials to their materials recovery facility (MRF) in Syracuse where the loads are sorted, processed and marketed. The County has a contract with WM Recycle America for recyclable materials processing, however haulers and municipalities are not mandated to use this MRF.
2. Broome Recycling, Inc. in Binghamton, NY. This facility accepts recyclable materials in two streams (fiber and containers) and processes/markets the material at its Binghamton location.
3. A&W Recycling in Chenango Bridge, NY. This facility accepts materials in two streams (fiber and containers) and processes/markets the material at its Chenango Bridge location.
4. Taylor Garbage & Recycling in Owego, NY (Tioga County). This facility accepts recyclable materials in two streams (fiber and containers) and processes/markets the material at its Owego location.
5. Empire Recycling Corporation in Johnson City. This facility is a branch of Empire Recycling's main facility in Utica. They accept scrap paper and shredded paper, exclusively from commercial accounts. The materials are baled and marketed to end users from the Johnson City location.

The residential recyclable materials collected in Broome County are delivered to WM Recycle America, Broome Recycling, Inc. and A&W Recycling. Commercial recyclables are taken to any of the five facilities.

From the tonnage data reported to the County, it was determined that approximately 65 percent of the total amount of recyclable materials collected in Broome County is delivered to WM Recycle America's MRF in Binghamton, and an estimated 35 percent is delivered to Broome Recycling and A&W Recycling facilities combined. (Taylor and Empire did not report any recycling tonnages to the County in 2007.)

For this Study, the recyclable materials sorting event took place at WM Recycle America's MRF in Binghamton. Because nearly two-thirds of the County's recyclables are received at WM's facility and based on the geographic areas represented by the haulers listed in Table 1-2, it is R. W. Beck's opinion that the Study results are representative of the composition of the County's recyclable materials stream.

All of the materials that were sorted for this Study were collected via the single-stream collection method and were delivered by the municipalities and hauling companies listed below in Table 1-2.

Table 1-2
List of Haulers and Municipalities Whose Loads Were Randomly Selected for the Study
Broome County, NY

Hauling Company/Municipality	Method of Collection
Town of Union	Single-stream
Village of Endicott	Single-stream
Binghamton University	Single-stream
Village of Johnson City	Single-stream
Waste Management	Single-stream
Broome County Landfill	Single-stream via Drop-Off
City of Binghamton	Single-stream
Joe's Disposal	Single-stream

Table 1-2 is not a full list of WM Recycle America's customers; it is a list of haulers that collect recyclable materials in Broome County in a single-stream which, according to WM, make up approximately 65 to 70 percent of the tonnage received at the MRF. The MRF also receives loads containing materials collected from outside of Broome County, as well as loads of dedicated material such as old corrugated cardboard (OCC) and shredded paper from private companies, that were not considered for this Study.

The loads for sampling were randomly chosen, as explained in detail in Section 1.5 of this report.

1.3 Complete Pre-Sort Site Assessment

Prior to initiating the sorting event, a site assessment was conducted at the WM Recycle America MRF[1] in Binghamton. The purpose of the site assessment was two-fold: 1) to introduce R. W. Beck staff to WM staff and garner cooperation for the sorting events; and 2) gather MRF transaction data and site information needed to develop a sampling and sorting plan.

The transaction data was reviewed to identify the average daily and weekly quantities of materials received at the MRF, the customers (private haulers and municipalities) using the facility, and an overview of the scope of the activity at the Binghamton site.

[1] The facility is referred to as a MRF, however it is more of a transfer facility. Recyclable materials delivered to WM Recycle America's facility in Binghamton are not sorted at the facility, rather they are loaded into transfer trailers and transported to WM's MRF in Syracuse, NY where the materials are then sorted, processed and marketed.

1.4 Formulate Materials Sorting Protocol

Upon completing the pre-sort site assessment, development of a materials sorting protocol was essential to obtain consistent and representative recyclable material characterization data. The critical aspects of the sampling and sorting plan relating to the materials sort protocol are discussed below. These include the following:

- Seasonality;
- Generator types; and
- Frequency of sampling.

1.4.1 Seasonality

Based on data provided by WM Recycle America, seasonal differences in the recyclable material accepted at the MRF are not statistically substantial. As a result, all of the field data was collected the last week in September of 2008 as part of one sorting and sampling event.

1.4.2 Generator Types

The recyclable materials delivered to the MRF are generated by the residential sector (including both single-family and multi-family residences) and by the industrial/commercial/institutional (ICI) sector. Through our data assessment, we determined that only limited data was available on the proportion of residential versus ICI materials received at the MRF because many haulers collect both residential and ICI accounts in the same truck. Loads containing both residential and ICI materials were documented as "mixed" generator types during the sorting event.

To gather data, R. W. Beck relied on the sampling randomization inherent in the N^{th} truck approach. The N^{th} truck approach is based on the number of vehicles expected each day and the number of samples required for the Study to yield statistically sound results. Due to limited data regarding the breakdown of residential versus ICI material in incoming loads, R. W. Beck selected for sampling approximately every other truck entering the MRF each day. Based on an interview with the driver, the contents of the truck were assigned to the residential, ICI or mixed sector. The random selection of the vehicle loads dictated the ultimate mix of generator type samples actually sorted. Provided below is a discussion of the issues associated with each of the generator types that was considered when establishing the protocol for identifying the generator types.

Residential Recyclable Materials. Public and private haulers typically serve residential accounts using compactor trucks that collect recyclable materials from multiple households. The recyclable materials from these households are thoroughly mixed during the collection and tipping process. R. W. Beck's opinion is that, as long as samples are captured from vehicles serving a variety of geographical and demographic areas, it is feasible to obtain representative samples of residential materials. This conclusion is based on our overall opinion that:

- Residential recyclables composition does not differ materially based on the time of day it is collected; and
- Residential recyclables composition does not differ materially based on the day of the week it is collected.

ICI Recyclable Materials. The ICI sector typically has the greatest variation in recyclable materials composition from sample to sample. Recyclable materials collected from restaurants, retail establishments, office buildings, institutions, manufacturing establishments, and other businesses all vary considerably. For example, a restaurant/bar may have a high percentage of glass in its recyclables compared to an office building, whose recyclables may contain a high percentage of paper.

Of the 34 randomly selected vehicles chosen for the sampling, only one contained 100 percent ICI materials. A sample from this load was sorted, however the results are not included in the Study because that one load was considered an outlier when included with the residential and mixed generator type loads.

In addition, because the primary focus of the Study was to quantify the County's recyclables by material type, the sampling protocol excluded loads that could be clearly identified as homogeneous, such as shredded paper and OCC. Vehicles hauling exclusively shredded paper or OCC were excluded from the vehicle count and sampling scheme.

Mixed Recyclable Materials. The mixed recyclables sector was composed of loads delivered to the MRF originating from both the residential and ICI sectors. R. W. Beck utilized the information gathered from the sampled vehicles' drivers to classify loads as mixed recyclables.

It should be noted that a majority of the mixed loads contained a larger percentage of residential material than ICI material.

1.4.3 Frequency of Sampling

The sampling approach taken resulted in an adequate number of representative samples being sorted that provided statistically meaningful results. The approach selected included a four-day sorting event during a "typical" week at the MRF. In total, thirty-four (34) samples were selected and sorted at the MRF.

1.5 Conduct Sampling and Sorting Event

The sorting event was conducted at the MRF the last week in September of 2008. A total of 34 samples representing 5,426 pounds of recyclable material were sorted.

The selection of vehicles to secure recyclable materials for sampling was based upon the MRF transaction data provided by WM and the N^{th} truck approach with driver interviews to determine generator types - residential, ICI, and mixed.

From the randomly selected loads, a minimum of 100 pound samples were taken for sorting. The average sample weighed approximately 160 pounds. One hundred to one

hundred fifty pound samples are considered the appropriate size to provide representative results per accepted industry standards. The various samples were randomly selected from within each selected load.

Table 1-3 below depicts the sampling mix resulting from using the N^{th} truck approach to randomly select loads for sampling.

Table 1-3
Sample Types and Quantities Sorted
Broome County, NY

Number of Samples				
Total	Residential	ICI	Mixed	Quantities Sorted
34	16	1	17	5,426 lbs

Once each sample was selected, the materials were pre-sorted for any hazardous or infectious wastes. (A Health and Safety Plan was developed by R. W. Beck prior to initiating the field work and was reviewed with the sorting crew before the actual sorting began.) The materials were then sorted by the R. W. Beck sorting crew and the items were placed into individual containers representing the various 22 material categories (Figure 1-1).

Figure 1-1. Sorting Recyclable Materials Into Various Categories.

Then, each container was weighed to determine the quantity of materials by material type for each sample (Figure 1-2).

Figure 1-2. Weighing Each Material Category.

These weights were recorded on individual data sheets to document the sorting process. The data were then forwarded to R. W. Beck's analytical staff for review and analysis.

1.6 Review Collected Data

Upon completing the sampling and sorting event, the data sheets for each sample were reviewed to ensure the following:

- Individual entries were legible;
- Generator types were clearly identified and consistent with the types of materials recorded on the data form;
- A description of the likely origin of the recyclable materials was included;
- Specific comments on the unusual aspects of the sample were legible and understandable;
- A minimum of 100 pounds was sorted for each sample; and
- Homogeneous loads were excluded from the analysis.

The tare weight of the individual material's container and the weight of the individual materials were recorded on the actual data sheets for all materials weighed. These two sets of quantitative data for each material and each sample are critical to conducting the statistical analysis.

1.7 Complete Statistical Modeling

All of the data were entered into R. W. Beck's specially-designed solid waste/recyclable materials composition statistical model (Model). This Model has been developed in Microsoft Excel for easy accessibility and use. The Model statistically manipulates the data to calculate the mean, 90% confidence intervals, and standard deviation for individual material categories and generator type. In addition, the Model is structured to identify where specific samples could be considered statistical outliers.

The mean represents the mathematical average or average percent of material composing the recyclable materials 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 recyclable materials received at the MRF 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 and recycling composition studies. In general, the more samples that are sorted, the narrower the confidence interval becomes for a given level of confidence. The narrower the intervals, the less variability in the data.

The standard deviation represents how widely spread the values are in a data set. For example, if the majority of the data points are close to the mean, then the standard deviation is small; if the majority of data points are far from the mean, then the standard deviation is large.

Overall, the outputs of the Model provide multiple measures for evaluating the results. It is critical when comparing the recyclable materials composition results that the confidence intervals are considered along with the mean percentages. The results are provided by generator type for each material type on a weight basis.

Section 2
STUDY RESULTS

2.1 Overview

This section presents the results of the statistical modeling of the quantitative data gathered during the recyclable materials sampling and sorting event held the last week in September of 2008 at WM Recycle America's MRF in Binghamton. The specific steps of the analysis are summarized below:

- Step 1 – Generator Type: R. W. Beck calculated the composition of the Residential and Mixed recyclable streams based on the samples obtained. No ICI results are provided because of the lack of samples containing only ICI recyclable materials.
- Step 2 – Aggregate Results: The aggregate results are the results of all the loads sampled during the recyclable materials sorting event, with the exception of the one pure ICI load.

The following assumptions and limitations should be considered upon reviewing the Study results:

- The sorting event was performed the last week in September of 2008. Although the results are considered representative, it is possible that some bias may exist because the study involved only one field event, rather than several sorting events throughout the year.
- There were no holidays or special events taking place in the County during the week of the sorting event influencing the results.
- The statistical results represent projections for the individual generators and the entire County. The generator results have reasonable confidence intervals. As the number of samples decreases, the confidence intervals tend to widen.

Based on data reported to the County, the quantity of materials collected in Broome County and recycled in calendar year 2007 was approximately 20,976 tons[1]. Of the total amount recycled, approximately 65 percent was delivered to WM Recycle America's MRF and 35 percent was delivered to A&W Recycling and Broome Recycling facilities combined.

[1] Recycling tons were reported by WM Recycle America, Broome Recycling, Inc. and A&W Recycling. Taylor Garbage & Recycling and Empire Recycling did not report 2007 tons. This does not include tonnage from items such as scrap metal, appliances, electronics, tires, yard waste, etc. It does include the typical residential and commercial recyclable materials such as paper, plastic, metal containers and glass.

R. W. Beck believes that the data depicted here provides a reasonable snapshot of the composition of recyclable materials collected in Broome County.

2.2 Recyclable Materials Composition

Tables 2-1 and 2-2 provide the County's recyclable materials composition by generator types – residential and mixed. Table 2-3 provides the aggregated data for the residential and mixed samples. These results were calculated by using the samples for the applicable generator to identify the mean and confidence intervals for the various material categories.

The measures provided include the mean, standard deviation, and lower and upper bounds of the composition for each of the material categories. The lower and upper bounds represent a 90% confidence interval for the various material means.

In all the tables included in this section, the totals may not sum due to rounding.

Table 2-1
Residential Recyclable Materials Composition (by weight)
Broome County, NY

Material	Average Percent Comp.	Standard Deviation	90% Confidence Interval	
			Lower Bound	Upper Bound
Total Paper	76.87%	10.30%	72.24%	81.20%
Newspaper	34.50%	14.09%	27.86%	41.45%
Household Office Paper & Mail	9.28%	12.29%	5.67%	13.66%
Magazines/Catalogs	9.13%	6.31%	6.23%	12.52%
Phone Books	0.82%	1.28%	0.33%	1.54%
Uncoated OCC & Brown Paper Bags	15.02%	6.22%	12.42%	17.82%
Boxboard	4.76%	1.99%	3.79%	5.84%
Beer, Pop & Water Boxes	2.09%	3.44%	1.11%	3.38%
Other (Milk/Juice Cartons, Froz. Pizza Boxes)	1.27%	0.94%	0.94%	1.66%
Total Plastics	7.55%	3.40%	6.15%	9.09%
#1 PET Bottles	2.78%	1.12%	2.31%	3.29%
#1 PET Deposit Bottles	0.12%	0.14%	0.07%	0.20%
#2 HDPE Bottles	3.90%	2.19%	3.03%	4.86%
#3-#7 Plastic Containers	0.76%	0.50%	0.52%	1.03%
Total Metals	3.48%	2.05%	2.74%	4.30%
Aluminum Beverage Containers	0.07%	0.08%	0.03%	0.12%
Aluminum Deposit Beverage Containers	0.06%	0.08%	0.02%	0.10%
Ferrous Food and Beverage Containers	3.26%	2.00%	2.54%	4.07%
Other Aluminum (Alum. pans, tin foil)	0.09%	0.11%	0.04%	0.16%
Total Glass	5.50%	3.77%	3.72%	7.59%
Glass Bottles & Jars	5.35%	3.74%	3.60%	7.42%
Glass Deposit Bottles & Jars	0.15%	0.38%	0.04%	0.33%
Total Non-Targeted Materials	4.85%	4.98%	3.16%	6.87%
Other Paper Trash	0.64%	0.38%	0.46%	0.84%
Plastic Bags & Other Film Plastic	1.05%	2.04%	0.51%	1.76%
Other Trash	3.16%	3.78%	1.97%	4.63%
Total Fines	1.76%	1.89%	1.07%	2.62%
Fines	1.76%	1.89%	1.07%	2.62%
GRAND TOTAL	100.00%			

Residential recyclables are relatively homogenous. Although there are some differences in generation depending on local demographics (i.e., income, education level, etc.), most households recycle similar types of materials. The composition of Broome County's residential recyclable materials, as shown above, is similar to other communities, as discussed further in Section 2.3.

Table 2-2
Mixed (Residential & Commercial) Recyclable Materials Composition (by weight)
Broome County, NY

Material	Average Percent Comp.	Standard Deviation	90% Confidence Interval	
			Lower Bound	Upper Bound
Total Paper	66.87%	13.40%	61.08%	72.42%
Newspaper	21.30%	11.12%	16.07%	27.05%
Household Office Paper & Mail	14.86%	9.59%	11.15%	19.00%
Magazines/Catalogs	10.62%	8.34%	7.18%	14.65%
Phone Books	0.92%	1.66%	0.30%	1.87%
Uncoated OCC & Brown Paper Bags	12.51%	9.87%	8.45%	17.25%
Boxboard	3.87%	1.63%	3.18%	4.63%
Beer, Pop & Water Boxes	1.55%	1.56%	0.90%	2.37%
Other (Milk/Juice Cartons, Froz. Pizza Boxes)	1.23%	0.84%	0.85%	1.68%
Total Plastics	10.64%	11.22%	7.05%	14.86%
#1 PET Bottles	6.14%	10.42%	3.34%	9.72%
#1 PET Deposit Bottles	0.18%	0.23%	0.08%	0.31%
#2 HDPE Bottles	3.35%	1.67%	2.70%	4.06%
#3-#7 Plastic Containers	0.98%	0.81%	0.68%	1.32%
Total Metals	4.71%	3.95%	3.38%	6.26%
Aluminum Beverage Containers	0.19%	0.22%	0.09%	0.32%
Aluminum Deposit Beverage Containers	0.16%	0.19%	0.08%	0.25%
Ferrous Food and Beverage Containers	4.23%	3.95%	2.92%	5.77%
Other Aluminum (Alum. pans, tin foil)	0.14%	0.14%	0.07%	0.23%
Total Glass	9.71%	7.10%	6.37%	13.67%
Glass Bottles & Jars	9.16%	6.87%	5.99%	12.91%
Glass Deposit Bottles & Jars	0.56%	0.83%	0.23%	1.02%
Total Non-Targeted Materials	6.35%	4.19%	4.63%	8.31%
Other Paper Trash	0.85%	0.76%	0.59%	1.16%
Plastic Bags & Other Film Plastic	0.70%	0.77%	0.46%	1.00%
Other Trash	4.79%	4.04%	3.14%	6.77%
Total Fines	1.71%	1.82%	1.11%	2.45%
Fines	1.71%	1.82%	1.11%	2.45%
GRAND TOTAL	100.00%			

Table 2-3
Aggregated Recyclable Materials Composition (by weight)
Broome County, NY

Material	Average Percent Comp.	Standard Deviation	90% Confidence Interval	
			Lower Bound	Upper Bound
Total Paper	71.72%	12.86%	67.85%	75.44%
Newspaper	27.70%	14.13%	23.14%	32.50%
Household Office Paper & Mail	12.15%	11.17%	9.41%	15.20%
Magazines/Catalogs	9.90%	7.35%	7.68%	12.36%
Phone Books	0.88%	1.46%	0.47%	1.41%
Uncoated OCC & Brown Paper Bags	13.73%	8.27%	11.22%	16.45%
Boxboard	4.30%	1.84%	3.72%	4.92%
Beer, Pop & Water Boxes	1.81%	2.61%	1.24%	2.49%
Other (Milk/Juice Cartons, Froz. Pizza Boxes)	1.25%	0.87%	1.00%	1.53%
Total Plastics	9.14%	8.41%	7.27%	11.21%
#1 PET Bottles	4.51%	7.60%	3.20%	6.03%
#1 PET Deposit Bottles	0.15%	0.19%	0.10%	0.22%
#2 HDPE Bottles	3.61%	1.93%	3.09%	4.17%
#3-#7 Plastic Containers	0.87%	0.67%	0.68%	1.08%
Total Metals	4.11%	3.19%	3.37%	4.93%
Aluminum Beverage Containers	0.13%	0.18%	0.08%	0.19%
Aluminum Deposit Beverage Containers	0.11%	0.16%	0.07%	0.16%
Ferrous Food and Beverage Containers	3.76%	3.15%	3.03%	4.56%
Other Aluminum (Alum. pans, tin foil)	0.12%	0.12%	0.07%	0.17%
Total Glass	7.67%	6.04%	5.78%	9.80%
Glass Bottles & Jars	7.31%	5.82%	5.51%	9.34%
Glass Deposit Bottles & Jars	0.36%	0.67%	0.18%	0.59%
Total Non-Targeted Materials	5.62%	4.58%	4.41%	6.97%
Other Paper Trash	0.75%	0.61%	0.59%	0.92%
Plastic Bags & Other Film Plastic	0.87%	1.51%	0.60%	1.19%
Other Trash	4.00%	3.94%	2.98%	5.17%
Total Fines	1.74%	1.82%	1.28%	2.26%
Fines	1.74%	1.82%	1.28%	2.26%
GRAND TOTAL	100.00%			

It is critical when evaluating the results to consider not only the mean composition but also the applicable confidence intervals. For example, Table 2-3 depicts the total paper material category with a mean of 71.72% and corresponding confidence intervals of 67.85% and 75.44%. The confidence intervals characterize the level of variability associated with the mean estimate of 71.72%. In other words, R. W. Beck is 90% confident that total paper comprises between 68% and 75% of the County's recyclable materials stream. Generally, the more samples taken, the narrower the confidence interval because the accuracy of the estimate is increasing. However,

some material types offer inherent variability and their confidence intervals may be wide regardless of the extent of the data used in the calculations.

Overall, the width of the confidence intervals for the many material categories in the Study is reasonable and consistent with other similar types of recyclable materials composition studies.

2.3 Composition Results Applied to 2007 Estimated Tons of Recyclable Materials Collected in Broome County

The New York State Solid Waste Regulations (Section 360.15.9 related to Comprehensive Solid Waste Management Planning) require that recyclable materials be quantified by material type. By applying the 2008 aggregated recyclable materials composition percentages to the County's 2007 estimated tons of recyclable material collected, the quantity by material type can be estimated, as shown below in Table 2-4. For purposes of this estimate, it is assumed the 2008 composition is similar to the 2007 composition.

Table 2-4
2008 Aggregated Recyclable Materials Composition Applied to
2007 Estimated Total Tons Collected
Broome County, NY

Material	Average Percent Comp.	2007 Tons
Total Paper	71.72%	15,044
Newspaper	27.70%	5,810
Household Office Paper & Mail	12.15%	2,549
Magazines/Catalogs	9.90%	2,076
Phone Books	0.88%	184
Uncoated OCC & Brown Paper Bags	13.73%	2,880
Boxboard	4.30%	902
Beer, Pop & Water Boxes	1.81%	380
Other (Milk/Juice Cartons, Froz. Pizza Boxes)	1.25%	262
Total Plastics	9.14%	1,918
#1 PET Bottles	4.51%	946
#1 PET Deposit Bottles	0.15%	32
#2 HDPE Bottles	3.61%	758
#3-#7 Plastic Containers	0.87%	182
Total Metals	4.11%	863
Aluminum Beverage Containers	0.13%	28
Aluminum Deposit Beverage Containers	0.11%	23
Ferrous Food and Beverage Containers	3.76%	789
Other Aluminum (Alum. pans, tin foil)	0.12%	24
Total Glass	7.67%	1,608
Glass Bottles & Jars	7.31%	1,533
Glass Deposit Bottles & Jars	0.36%	75
Total Non-Targeted Materials	5.62%	1,179
Other Paper Trash	0.75%	157
Plastic Bags & Other Film Plastic	0.87%	183
Other Trash	4.00%	840
Total Fines	1.74%	364
Fines	1.74%	364
GRAND TOTAL	100.00%	20,976

2.4 Recyclable Materials Composition Comparison

Because this is the County's first recyclable materials characterization study, it will serve as a baseline from which future recyclable materials sorting events can be benchmarked. As part of this Study, R. W. Beck has provided a comparison of Broome County's *residential* recyclable materials composition results to two other composition studies - Onondaga County Resource Recovery Agency's (OCRRA)

"2005 Onondaga County Waste Quantification and Characterization Study", and the City of Roseville, Minnesota's 2004 "Recycling Pilot Program Summary." This comparison will provide the County with an overview of how its residential recyclable materials composition compares to that of other counties/municipalities.

It should be noted that every solid waste and recyclable materials characterization study is specifically designed for a municipality/organization/jurisdiction and their particular goals and objectives, so comparing them can be challenging. Some things to keep in mind when comparing the data:

- The Broome County Study had 22 material categories, compared to 50 categories for OCRRA and only 14 categories for the City of Roseville. (OCRRA's study also included an MSW component, so the same 50 material categories were used for categorizing both the MSW and recyclable materials.) The fewer the number of sort categories, the more likely materials will end up in the "other waste" category.
- The number of loads sampled varied between studies. For the Broome County study, 34 loads were sampled, compared to 42 in the OCRRA study, and 8 in the Roseville study. Generally, the more samples taken, the higher the accuracy of the estimates.
- The material categories that made up the "Total Plastics" for each study had the following differences:
    - In the Broome County Study, Total Plastics included four categories: #1 PET (non-deposit), #1 PET Deposit Bottles, #2 HDPE Containers, and #3-7 Containers. In the OCRRA study, Total Plastics included twelve categories and in the City of Roseville study, Total Plastics included only one category - #1 and #2 plastic bottles. As a result, in the Roseville study, more plastics were categorized as "Non-Targeted Materials" compared to Broome and OCRRA.
    - In the Broome County and City of Roseville studies, "Plastic Bags & Other Film Plastic" was included with the Non-Targeted Materials, whereas in OCRRA's study, those materials are included in the overall Plastics results.
- The OCRRA study included flat glass and other glass, including ceramics, in the Glass total. In the County and the Roseville studies, any glass other than bottles and containers were considered Non-Targeted Materials.
- At the time of the Roseville study, beer, pop and water boxes ("wet-strength" carriers) were not recyclable in that market, so those items were included with Non-Targeted Materials. The "wet-strength" boxes *are* included in the County's recycling program, so those items were sorted during this Study and were included in the Total Paper results.
- Regarding the Roseville results, Minnesota is not a "Bottle Bill" state so there is no cash redemption opportunity for certain plastic, aluminum or glass beverage containers.

- The recyclable materials that were sorted for the Broome County and City of Roseville studies were collected via single-stream collection methods. The materials that were sorted for the OCRRA study were collected via both single-stream and dual-stream methods. In R. W. Beck's experience, there are typically more Non-Targeted Materials found in loads collected using the single-stream method compared to loads collected using the dual-stream collection method.

A comparison of the three studies' average percent composition for the major recyclable material groups is provided below in Table 2-5.

Table 2-5
Recyclable Materials Composition – Comparison to Other Studies
Broome County, NY

	Mean (by weight)		
Material Group	Broome County 2008 Residential	OCRRA 2005[1]	City of Roseville, MN 2004[2]
Total Paper	76.9%	73.8%	77.9
Old Newspaper (ONP)	*34.5*	*41.9*	*40.9*
Old Corrugated Cardboard (OCC)	*15.0*	*11.1*	*16.4*
Total Plastics	7.6	10.1	5.4
Total Metals	3.5	5.0	2.6
Total Glass	5.5	9.7	5.5
Total Non-Targeted Materials	4.9	0.6	7.9
Total Fines	1.8	0.8	0.6
GRAND TOTAL[3]	100%	100%	100%

[1] OCRRA's 2005 recyclables characterization study was based on residential materials only, collected via both single-stream and dual-stream collection methods.
[2] The City of Roseville conducted a pilot study in 2004 in which two residential routes were converted from dual-stream curbside collection to single-stream collection. The results are based on two months' of pilot study data.
[3] Totals may not sum due to rounding.

It should be noted that Table 2-5 provides a comparison of *means* and not *confidence intervals*. (The OCRRA study did not list confidence intervals for the major material groups, but did list them for individual material types.) Confidence intervals were compared for certain material types, as shown below. If the ranges of the lower and upper confidence intervals among the studies overlapped, the results were considered statistically similar, as shown below in the Newspaper, Total Metals and Total Glass categories.

Newspaper		Confidence Interval	
Study	Mean	Lower	Upper
Broome County	34.5%	27.9%	41.5%
OCRRA	41.9	26.9	56.8
City of Roseville	40.9	36.9	45.0

Total Metals		Confidence Interval	
Study	Mean	Lower	Upper
Broome County	3.5%	2.7%	4.3%
City of Roseville	2.6	2.2	3.1

Total Glass		Confidence Interval	
Study	Mean	Lower	Upper
Broome County	5.5%	3.7%	7.6%
City of Roseville	5.5	4.9	6.3

If the ranges of the lower and upper confidence intervals among the studies did not overlap, the results were considered statistically different. Broome County's confidence intervals for Non-Targeted Materials are slightly lower than the City of Roseville's, as shown below. (The County's upper confidence interval is equal to the City of Roseville's lower confidence interval.)

Non-Targeted Materials/Other Waste		Confidence Interval	
Study	Mean	Lower	Upper
Broome County	4.9%	3.2%	6.9%
OCRRA	0.6	n/a	n/a
City of Roseville	7.9	6.9	9.0

As mentioned previously, Roseville may have a higher mean for Non-Targeted Materials because more plastics were categorized as Non-Targeted Materials compared to the other two studies, and "wet-strength" boxes were also categorized as Non-Targeted Materials. OCRRA's study did not have an "other waste" category, however the mean percentages were summed for the following categories: food waste, textiles/leather, rubber, diapers, electronics, wood, rubble, yard waste, hazardous/paint, and miscellaneous. Confidence intervals were not available for these materials in the OCRRA study.

R. W. Beck provided the comparison data in Table 2-5 for the County to use as a general benchmark. Based on R. W. Beck's experience in working with municipal recyclable materials collection programs, the composition of Broome County's residential recyclable materials appears to be consistent with national averages of 70-75% paper and 25-30% containers.

Appendix A

Material Definitions and Category List

Appendix A
MATERIAL DEFINITIONS AND CATEGORY LIST

Paper Products	
Newspaper (ONP)	Printed "ground wood" newsprint, including glossy and semi glossy advertisements and inserts typically found in newspapers.
Household Office Paper and Mail (HOPM) - recyclable	Also referred to as "mixed paper" or "junk mail," paper that would be included in residential "mixed mail" or commercial "office" recycling programs, not including the grades identified above. Examples include "junk" mail, printer paper, envelopes of all types, file folders and notebooks, card stock, key punch cards and computer printouts, financial statements, annual reports, other report-like documents, books (other than phone books), brightly colored paper, calendars, tablets with colored glue bindings, shredded paper, fax paper, onion skin paper, and Post-It Notes.
Magazines/Catalogs (OMG)	Magazines, catalogs including any "seasonal circular" catalog clearly recognized as such from direct mail (e.g., LL Bean, Nordstrom's, etc.).
Phone Books	Clean telephone directories printed for or by telephone directory publishers.
Uncoated Old Corrugated Cardboard (OCC) and Brown Paper Grocery Bags	Uncoated cardboard with a wavy core and not contaminated with other materials such as wax, plastic coating, Styrofoam, or food, and all paper bags. Examples include large packing boxes, clean pizza delivery boxes, and paper bags (including brown Kraft bags).
Old Boxboard (OBB)	Chipboard boxes not coated with wax, plastic or metal. Examples include cereal boxes, other clean chipboard food containers, shirt boxes, and shoeboxes, egg cartons, and tissue roll cores.
Beer, Pop & Water Boxes	Also referred to as "carrier stock." Used as "wet-strength", coated boxboard. Includes 12-pack and 24-pack cartons used for cans of beer, pop, water, etc.
Other Paper Items	Includes those items currently collected by Broome County, such as milk and juice cartons, frozen pizza boxes and frozen food packaging.

Plastic	
#1 Polyethlylene Terephthalate (PET) Containers	Plastic containers and bottles coded #1 without a New York deposit label.
#1 PET Deposit Bottles	Plastic bottles coded #1 with a New York deposit label.
#2 High Density Polyethylene (HDPE) Containers	Plastic containers and bottles such as milk jugs, shampoo bottles, and laundry detergent bottles coded #2.
#3-7 Plastic Containers	Plastic containers coded #3, #4, #5, #6, #7.

Metals	
Aluminum Beverage Containers	All beverage containers made from aluminum without a New York deposit label.
Aluminum Deposit Beverage Containers	All beverage containers made from aluminum with a New York deposit label.
Ferrous Food and Beverage Containers	Food and beverage containers composed primarily of iron/steel.
Other Aluminum	Other aluminum items such as aluminum pans and clean foil.

Glass	
Glass Bottles and Jars	All glass food, beverage, wine, liquor and beer containers without a New York deposit label.
Glass Deposit Containers	All glass food, beverage, wine, liquor and beer containers with a New York deposit label.

Non-Targeted Materials (i.e., "trash" or "rejects" as collected)	
Other Paper Trash	All other non-recyclable paper; contaminated paper (i.e., paper used to dispose of chewing gum, soaked with food spills, sprayed with paint, covered in tape, OCC with Styrofoam attached); paper or boxboard coated with wax; tissue papers, napkins, cups, coffee filters, tea bags, wax paper, and cellophane, carbon paper, wallpaper, bathroom waste paper, photos, slides, and transparencies.
Plastic Bags and Other Film Plastic	Includes trash bags, grocery bags, storage bags, plastic wrap, film, etc.
Other Trash	All other non-recyclable items including other scrap metal (ferrous and non-ferrous), rope, string, twine, cotton balls, tape, cups, silverware, trays, and foam packaging. Includes "Non-Recyclable Glass/Ceramics" such as windowpanes, mirrors, bulbs of any type, dishes, glasses, pottery, and ceramics. Also includes "Non-Recyclable Plastics" such as plastic toys, clothes hangers, extruded pipes, etc., including anything not coded with a #1 - #7. Also includes "Non-Recyclable Cans" such as aerosol cans, paint cans, motor oil containers, and gasoline containers. Also includes "Medical Waste" such as sharps (e.g., needles/syringes, razors), medicine containers, etc.
Fines	Residuals on the sort table after the sample has been sorted. Includes dirt, broken glass, etc.