MEMORANDUM

TO: Durham/York Project Team

DATE: January 2, 2007 – Revised April 19, 2007

FROM: Jim McKay, Jacques Whitford Limited
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RE: York Region – Audit of Town of Markham's Post-Diversion Residual Waste Materials collected at Curbside

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The following memo has been prepared to document the results of the residual waste materials audit performed between the dates of December 5, 2006 and December 8, 2006 on the Town of Markham's post-diversion residual waste.

Methodology

The following outlines the methodology for undertaking an audit of the residual waste material that remains after at-source diversion from single-family residential neighbourhoods in the Town of Markham to determine the detailed waste composition and characteristics and corresponding energy values.

WASTE COLLECTION:

The method for identifying sample areas and collecting materials was as follows:

Step 1 – Identify routes within the subject municipality that is deemed representative of the greater area.
Step 2 – Have collection vehicles collect waste as they normally would during a routine day and deliver to transfer station.
Step 3 – Isolate the load of residual waste at the transfer station.
Step 4 – Sort as much waste as possible within the given time frame for auditing (3 days).

Only post-diversion residual waste was collected and analyzed as part of this audit.

WASTE SORTING:

The waste sorting methodology is consistent with that used by Stewardship Ontario in the auditing of single family residential waste streams and is as follows:

Step 1 – Place residual waste onto a "sort table" and sort material by material type into blue box bins and garbage pails each identified according to a specific waste stream/material type. Waste categories used for sorting were consistent with those outlined in Stewardship Ontario's Single Family Residential Waste Audit Protocol.

Step 2 - As containers fill, weight measurements were taken using a digital scale and recorded according to material type. Once all waste has been sorted, each container was weighed, recorded and emptied.

Step 3 – Following the audit, data was entered into a Microsoft Excel 2000 Spreadsheet for analysis.

Waste Composition Results

The following provides results of the audit completed between December 5, 2006 and December 8, 2006 on the Town of Markham's post-diversion residual waste.

TABLE 1: WASTE AUDIT RESULTS

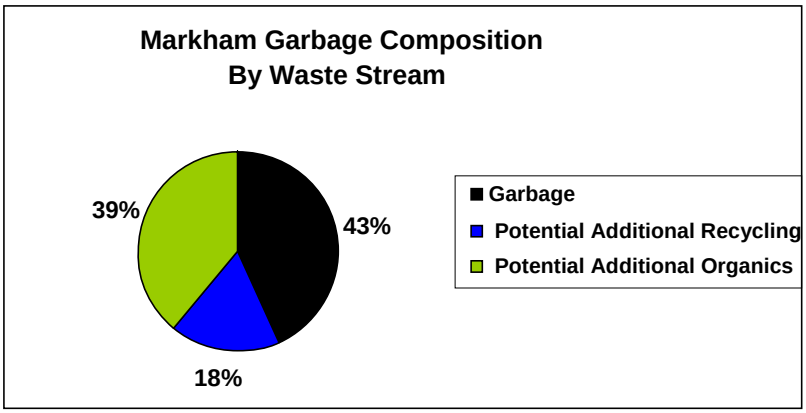
Waste Categories	Current Diversion Opportunity	Quantity per Tonne of Waste (kg)	Percentage of Total Waste Stream (%)	Garbage %	Potential Additional Diversion (Recycling) %	Potential Additional Diversion (Organics) %
1. PAPER						
Newspaper – Dailys and Weeklys	Recycling	7.30	0.73%		0.73%	
Newspaper – Other	Recycling	10.00	1.00%		1.00%	
Telephone Books / Directories	Recycling	0.00	0.00%		0.00%	
Magazines & Catalogues	Recycling	10.60	1.06%		1.06%	
Mixed Fine Paper	Recycling	34.60	3.46%		3.46%	
Books	Recycling	2.20	0.22%		0.22%	
Other Paper	Organics	0.00	0.00%			
Total Paper		**64.70**	**6.48%**	**0.00%**	**6.48%**	**0.00%**
2. PAPER PACKAGING						
Corrugated Wine Bag in Box	Recycling	0.00	0.00%		0.00%	
Other Corrugated	Recycling	9.80	0.98%		0.98%	
Corrugated Total		**9.80**	**0.98%**	**0.00%**	**0.98%**	**0.00%**
Kraft Paper	Recycling	6.10	0.61%		0.61%	
Boxboard / Cores	Recycling	27.50	2.75%		2.75%	
Molded Pulp	Organics	1.00	0.10%			0.10%
Paper Cups and Paper Ice-Cream Containers	Organics	1.90	0.19%			0.19%
Laminated Paper Packaging		5.30	0.53%	0.53%		
Composite Cans		1.50	0.15%	0.15%		
Gable Top Cartons	Recycling	1.50	0.15%		0.15%	
Aseptic Alcohol 750 ml and Over	Recycling	0.00	0.00%		0.00%	
Aseptic Alcohol <750 ml	Recycling	0.00	0.00%		0.00%	
Aseptic Other Containers	Recycling	1.00	0.10%		0.10%	
Aseptic Containers Total		**1.00**	**0.10%**	**0.00%**	**0.10%**	**0.00%**
Tissue/Toweling	Organics	36.10	3.61%			3.61%
Total Paper Packaging		**91.70**	**9.16%**	**0.68%**	**4.59%**	**3.89%**
3. PLASTICS						
PET Beer Bottles 750 ml and Over	Recycling	0.00	0.00%		0.00%	
PET Beer Bottles <750 ml	Recycling	0.00	0.00%		0.00%	
PET Other Alcohol Bottles 750 ml and Over	Recycling	0.00	0.00%		0.00%	
PET Other Alcohol Bottles <750 ml	Recycling	0.00	0.00%		0.00%	
PET Other Beverage Bottles	Recycling	1.90	0.19%		0.19%	

Waste Categories	Current Diversion Opportunity	Quantity per Tonne of Waste (kg)	Percentage of Total Waste Stream (%)	Garbage %	Potential Additional Diversion (Recycling) %	Potential Additional Diversion (Organics) %
PET Beverage Bottles Total		**1.90**	**0.19%**	**0.00%**	**0.19%**	**0.00%**
PET Other Bottles & Jars	Recycling	2.30	0.23%		0.23%	
PET Other Packaging	Recycling	1.50	0.15%		0.15%	
HDPE Beverage Bottles	Recycling	0.50	0.05%		0.05%	
HDPE Other Bottles & Jugs	Recycling	3.10	0.31%		0.31%	
PVC Bottles & Jars	Recycling	0.00	0.00%		0.00%	
Other Bottles, Jars & Jugs	Recycling	1.90	0.19%		0.19%	
Polystyrene Packaging	Recycling	12.40	1.24%		1.24%	
Wide Mouth Tubs & Lids	Recycling	2.00	0.20%		0.20%	
Large HDPE & PP Pails & Lids	Recycling	0.70	0.07%		0.07%	
Polyethylene Plastic Bags & Film – Packaging		46.50	4.65%	4.65%		
Polyethylene Plastic Bags & Film - Non-Packaging		12.70	1.27%	1.27%		
Laminated Pouches & Bag in Box Liners for Alcohol		0.30	0.03%	0.03%		
Laminated/Other Plastic Film and Bags		18.00	1.80%	1.80%		
Laminated/Other Plastic Film and Bags Total		**18.30**	**1.83%**	**1.83%**	**0.00%**	**0.00%**
Other Rigid Plastic Packaging		11.90	1.19%	1.19%		
Durable Plastic Products		41.90	4.19%	4.19%		
Total Plastics		**157.60**	**15.77%**	**13.13%**	**2.64%**	**0.00%**
4. METALS						
Aluminum Alcohol Cans	Recycling	0.00	0.00%		0.00%	
Aluminum Food & Other Beverage Cans	Recycling	1.10	0.11%		0.11%	
Aluminum Food & Beverage Cans Total		**1.10**	**0.11%**	**0.00%**	**0.11%**	**0.00%**
Aluminum Foil & Foil Trays	Recycling	3.50	0.35%		0.35%	
Other Aluminum Containers	Recycling	0.00	0.00%		0.00%	
Steel Alcohol Cans	Recycling	0.00	0.00%		0.00%	
Steel Food & Other Beverage Cans	Recycling	5.70	0.57%		0.57%	
Steel Food & Beverage Cans Total		**5.70**	**0.57%**	**0.00%**	**0.57%**	**0.00%**
Steel Aerosol Cans	Recycling	1.20	0.12%		0.12%	
Steel Paint Cans	Recycling	0.00	0.00%		0.00%	
Other Metal		20.40	2.04%		2.04%	
Total Metals		**31.90**	**3.18%**	**0.00%**	**3.18%**	**0.00%**
5. GLASS						
Clear Glass Beer 750 ml and Over	Recycling	0.00	0.00%		0.00%	
Clear Glass Beer <750 ml	Recycling	0.00	0.00%		0.00%	
Clear Glass Other Alcohol 750 ml and Over	Recycling	0.00	0.00%		0.00%	
Clear Glass Other Alcohol <750 ml	Recycling	0.00	0.00%		0.00%	
Clear Glass Alcohol Beverage Total		**0.00**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
Coloured Glass Beer 750 ml and Over	Recycling	0.00	0.00%		0.00%	

Waste Categories	Current Diversion Opportunity	Quantity per Tonne of Waste (kg)	Percentage of Total Waste Stream (%)	Garbage %	Potential Additional Diversion (Recycling) %	Potential Additional Diversion (Organics) %
Coloured Glass Beer <750 ml	Recycling	0.00	0.00%		0.00%	
Coloured Glass Other Alcohol 750 ml and Over	Recycling	2.60	0.26%		0.26%	
Coloured Glass Other Alcohol <750 ml	Recycling	0.00	0.00%		0.00%	
Coloured Glass Alcohol Beverage Total		**2.60**	**0.26%**	**0.00%**	**0.26%**	**0.00%**
Clear Glass Other Beverage and Food	Recycling	4.90	0.49%		0.49%	
Coloured Glass Other Beverage and Food	Recycling	0.00	0.00%		0.00%	
Other Glass		7.80	0.78%	0.78%		
Total Glass		**15.30**	**1.53%**	**0.78%**	**0.74%**	**0.00%**
6. HOUSEHOLD SPECIAL WASTE						
Batteries		1.00	0.10%	0.10%		
Paint & Stain		0.00	0.00%	0.00%		
Motor Oil		0.10	0.01%	0.01%		
Other HSW liquids		2.50	0.25%	0.25%		
Other HSW		5.10	0.51%	0.51%		
Total HSW		**8.70**	**0.87%**	**0.87%**	**0.00%**	**0.00%**
7. ORGANICS						
Food Waste	Organics	327.00	32.70%			32.70%
Yard Waste	Organics	3.60	0.36%			0.36%
Pet waste	Organics	3.00	0.30%			0.30%
Total Organics		**333.60**	**33.36%**	**0.00%**	**0.00%**	**33.36%**
8. OTHER MATERIALS						
Diapers and Sanitary Products	Organics	19.70	1.97%			1.97%
Textiles		80.10	8.01%	8.01%		
Carpeting		9.40	0.94%	0.94%		
Construction & Renovation		25.80	2.58%	2.58%		
Computer / IT Equipment		2.90	0.29%	0.29%		
Telecom Equipment		1.00	0.10%	0.10%		
TV & Audio Equipment		0.00	0.00%	0.00%		
Small Kitchen Appliances		1.90	0.19%	0.19%		
Other Electronics		9.70	0.97%	0.97%		
Tires and Other Rubber		3.60	0.36%	0.36%		
Ceramics		6.80	0.68%	0.68%		
Furniture		0.00	0.00%	0.00%		
Mattresses		92.10	9.21%	9.21%		
Other Large Bulky Items		26.30	2.63%	2.63%		
Other Waste		17.10	1.71%	1.71%		
Total Other Materials		**296.40**	**29.65%**	**27.68%**	**0.00%**	**1.97%**
Grand Total		**1000.00**	**100.00%**	**43.14%**	**17.64%**	**39.22%**

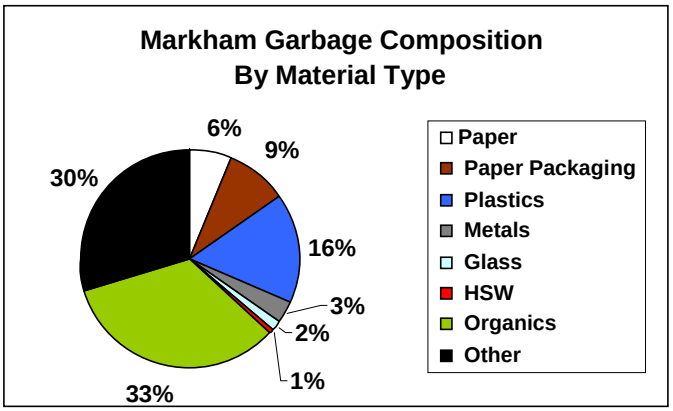
The audited waste represents only the residual waste stream (Post Diversion). According to this waste audit 57% of the post diverted waste could have been diverted through current diversion programs (39% of the waste is organic material and 18% is recyclable material).

FIGURE 1: MARKHAM RESIDUAL WASTE COMPOSITION AND POTENTIAL ADDITIONAL DIVERSION



The following figure shows Markham's Post Diversion Garbage composition by material type.

FIGURE 2: COMPOSITION BY MAJOR MATERIAL TYPE



Application of Energy Values

Once the results of the waste audit were completed, energy values were assigned to each waste component. Energy values for the waste as collected were obtained from the textbook entitled "Integrated Solid Waste Management – Engineering Principles and Management Issues" by Tchobanoglous/Theisen/Vigil, 1993. Using the energy values for each waste group, the overall energy value for the entire waste composition was calculated. The average material energy value was calculated by dividing the total energy content by the total material mass. In this case, it was found to be about 12.4 MJ/kg (5,300 BTU/lb). It should be noted that this waste audit was completed in December when the waste is drier resulting in a higher energy value. The average energy values tend to fluctuate throughout the year but a typical range is between 5,000 and 5,300 BTU/lb.