

**Town of Markham Blue Box Lid Project  
E & E Project # 286  
Final Report**

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Prepared by:



**451 Ferndale Avenue, London ON**  
Mary Little Tel: 905-372-4994,  
Email: [mary@2cg.ca](mailto:mary@2cg.ca)

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## 1.0 Introduction

The Town of Markham (Town), through Stewardship Ontario, retained 2cg Inc. (2cg) to document the implementation of the Effectiveness and Efficiency Fund Project #286: “Markham Blue Box Lid Pilot”. This report provides an overview of the Project, including, project description, project implementation, monitoring results and conclusions. Information was gathered by 2cg from Town staff.

It should be noted that the Municipality of West Perth (population 9,000), located near Stratford, Ontario also received funding support from the E&E Fund to pilot a mesh lid for the Blue Box. The lid that West Perth tested, the Enviro-Net, is a simple mesh cover that fits over the top of the Blue Box and is held in place by a drawstring. The goal of the West Perth pilot was to determine if mesh lids are a cost effective way to provide additional recycling capacity and to control litter. In particular, West Perth reviewed the impact the lid had on high traffic areas such as busy roadways/highways where blowing Blue Box material is an issue. The results of the West Perth pilot are posted on Stewardship Ontario’s website at <http://www.stewardshipontario.ca/bluebox/eefund/projects.htm#289>.

In Quebec, at least two Montreal-area burrows have made the Enviro-Net available to their residents. In Outremont, one net was directly handed out to 150 households. Staff<sup>1</sup> indicated that the primary driver for the nets was litter control and that they were very effective in this sense. It was also indicated that a welcomed side-effect of using the nets was increased capacity. Although no quantitative monitoring was carried out, according to the collection contractor, residents who use the net put more material in their Blue Box. Notwithstanding this, the pilot was not carried forward because of the contractor’s position that the nets required additional work on their part, and their demand that the collection contract be augmented by 50 to 75% to account for this.

In Ville Mont-Royal, the same model of net was initially distributed directly to householders by summer students and subsequently made available to residents at City Hall. Although no data on the number of nets currently in use is available, the staff person<sup>2</sup> indicated that residents’ overall appreciation was positive. As in Outremont, the main driver for their use was litter control.

## 2.0 Background

The Town of Markham has a population of approximately 296,000 (77,878 households) representing the largest municipality within the Region of York and the 7<sup>th</sup> largest municipality in Ontario. The Town of Markham is comprised of the

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<sup>1</sup> Alain Leduc, Environmental Advisor, City of Montreal

<sup>2</sup> Christiane Séguin, Works Department, Ville Mont-Royal

municipalities of Unionville, Thornhill, Cornell, Milliken Mills, Buttonville, Berczy, Box Grove, Armadale, Cachet, German Mills, Mount Joy, and Markham Village.

The Town provides its residents (single and multi-residential) with a number of waste management services using both public (recycling drop off depot sites) and contracted services (collection). The Region of York provides single stream recycling processing service. Curbside recycling collection commenced in 1988. Since its inception, the Town has continued to promote Blue Box recycling with the most recent initiative, Mission Green Plan launched in 2006.

Waste management services provided by the Town under the Mission Green Plan include:

- Weekly expanded curbside blue box program that accepts comingled materials such as empty paint/aerosol cans, aluminum foil/food trays, all plastic bottles, metal containers, glass jars and paper fibres;
- Bi-weekly residential garbage collection (including bulky items);
- Weekly curbside green bin collection for kitchen organics;
- Seasonal leaf and yard waste collection;
- White Goods item collection (on a cost recovery basis);
- Four centralized recycling depot sites for bulky recyclables and reusable items (blue box items, toner cartridges, tires, polystyrene, scrap metal, plastic bags, electronic waste).
- Public space recycling program
- Re-use partnerships with Goodwill Industries, Salvation Army, and Ontario Federation of Cerebral Palsy

To date, the Town has reached an overall diversion rate of 70% from waste disposal.

Photo 1 depicts curbside placement of divertible materials for the Town of Markham.



**Photo 1 – Markham Curbside Diversion System**

Table 2.1 depicts the Town's diversion and waste tonnages since the implementation of the Mission Green Plan (2005 – 2007).



**Table 2.1 Recycling Tonnages from 2005 – 2007**

Year	Markham HHL'D's Served	Markham Blue Box Tonnes Collected Curb	Markham Organic Tonnes Collected (Food Waste)	Markham Garbage Tonnes Collected	Blue Box as a Percent of Total Waste*	York MRF Blue Box Residual Rate
2005	73,056	18,594	12,080	38,064	27%	9.03%
2006	74,629	24,536	23,080	27,504	33%	7.98%
2007	76,236	23,950	15,294	36,600	28%	9.70%

\* excluding leaf and yard, white goods, etc

The removal of LCBO glass resulted in a reduction of Blue Box tonnes collected in 2007. The green cart program was launched the middle of 2005 and experienced a full year of collection in 2006.

Table 2.2 depicts collection costs specific to the curbside blue box collection program from 2005 - 2007.

**Table 2.2 Blue Box Collection Costs from 2005 – 2007**

Year	Markham HHL'D's Served	Markham Blue Box Collection Costs	Gross Cost Per Household (Blue Box)	Gross Cost Per Tonne (Blue Box)
2005	73,056	\$2,073,061	\$28	\$111
2006	74,629	\$1,975,306	\$26	\$80
2007	76,236	\$2,001,479	\$26	\$83

Blue box collection costs per household have remained relatively steady since the initial launch of the Mission Green program in 2006. The Town faced fuel surcharges for the collection program but overall costs per household were dispersed over a greater number of units each year due to population growth within Markham.

In an effort to address the increasing amount of recyclable material put out at the curb by residents, the Town is using larger blue boxes (16 and 21 gallon boxes) and allows households to set out more than one blue box as well as other rigid plastic collection units (e.g. laundry baskets) for curbside collection. Photo 2 depicts typical curbside placement of blue box material. Note the use of an alternative curbside container (laundry basket) beside two blue boxes.





**Photo 2 – Overfilling of Markham Curbside Blue Boxes**

The Town is aware that Blue Boxes are an excellent mechanism to collect and promote recycling but Blue Boxes also have a limited and fixed volume. Markham's previous research has shown that residents dispose of recyclables when they cannot fit the material into their Blue Boxes. The Town anticipates that increasing recycling container volume could potentially increase the capture of recyclables. However, providing additional Blue Boxes has not been efficient from a timing perspective for the collection program.

Markham contracts its Blue Box recycling collection operations to Miller Waste Systems on a fixed cost per tonne basis. Blue Box recycling is co-collected with Green Bin organics in Markham on a weekly basis. Current collection estimates indicate that the collection driver averages 11-14 seconds per stop to empty 1-2 blue boxes and a green bin (snowy days increases time per stop) into the collection vehicle. Residents using three or more boxes, accompanied with alternative collection units such as laundry baskets as well as a green bin, can average 20-25 seconds per stop.

Markham has also discovered that "over-filling" or "over-stuffing" Blue Boxes is also not the answer to increasing recycling capacity and capture as excess recyclables often blow out of Blue Boxes and contributes to curbside litter. Blue Box recycling has been identified by Town staff as a significant source of litter in Markham and has also been noted by other Ontario municipalities (e.g. Region of Peel) in the surrounding area.

In the mid 1990's, Blue Box manufacturers responded to municipal requests for Blue Box litter reduction and produced rigid plastic lids to place on top of the box. Pricing ranged from \$2 to \$4 per lid, depending on the quantities ordered by the municipalities. Over time, the lids were either lost or cracked since they were not flexible or permanently fastened to the box. Consequentially, municipalities discovered that residents preferred using the lid covered box as a storage device for purposes other than recycling.



The Town reviewed other collection mechanisms that could address the issues of litter prevention and curbside capacity, such as blue bag recycling or wheeled recycling carts. However, York Region's MRF is not equipped to receive recyclables in blue bags and the *Markham's on A Roll!* pilot determined, at least at the time it was done (2001/2002), that cart collection is less efficient and more costly than manual Blue Box or Blue Bag collection.

The Town's continued search for recycling collection alternatives to control litter and increase blue box capacity without negatively impacting collection productivity and public acceptability has led to the Blue Box Lid Project.

### 3.0 Project Description

In 2004, the Town was approached by a local manufacturer, NUCOVE, based out of Aurora, Ontario, with a prototype lid for a blue box. From 2004 to 2006, Town staff worked with Paul Blanchard of NUCOVE to design a prototype lid to attach to existing Blue Boxes as a method to potentially expand Blue Box capacity and reduce litter, without altering the current collection system.

The Blue Box lid consists of flexible netting material between two rigid brackets. One side of the bracket is permanently affixed to the lip of the blue box with metal screws. On the other side of the netting is a bracket designed to clip onto the lip of the blue box for residents to secure the lid when the full box is set at the curb.

Photo 3 depicts how the netting is permanently screwed to the lip of the blue box.



Photo 3 – Permanent Attachment of Blue Box Lid

The netting is similar to that used for cargo netting in cars. The flexible lid stretches to accommodate the varying sizes and fullness of blue boxes. The clip side of the lid features a handle, enabling residents to carry a full blue box in one hand, allowing for a single trip to the curb with two blue boxes or a full box and a green cart.

Having the lid permanently screwed to the blue box reduces potential for loss or damage of the lid during collection, which the Town determined as critical to the public acceptance and participation during the pilot.

Photos 4, 5 and 6 depict the overall design of the blue box lid.



Photo 4 – Flexible Cargo Netting of the Blue Box Lid



Photo 5 – Clip and Handle of the Blue Box Lid



Photo 6 – Full Blue Box with Lid

The prototype lids that were produced for the pilot project were sewn by hand by NUCOVE. The prototype lids were labour intensive to produce with costs averaging \$9/lid plus applicable taxes. NUCOVE indicated to the Town that if larger orders were committed, there would be opportunities for equipment re-tooling to reduce manufacturing costs to approximately \$ 5/lid. For the purposes of the Project, the lids were issued free of charge to the residents and after the pilot completion period, residents were permitted to keep the lids.

Feedback from the collection contractor was an integral part of the blue box lid's design phase because the Town did not want to reduce collection driver efficiency during the lid removal process.

#### 4.0 Focus Group Research

Prior to project implementation, the Town requested formal feedback from residents in the form of focus group sessions conducted by Informa Market Research, a member of the Market Research and Intelligence Association of Canada. The focus group sessions were conducted at the Town municipal building and proceedings were recorded on DVD and audio tapes by Parashoot Productions. Town staff observed the sessions via closed circuit television, in an adjoining meeting room. Respondents were recruited by a professional recruiting firm, Sharper Insight, to ensure for quality participants. In return for their participation, respondents received a \$75 honorarium. The recruiting specifications for the focus group included the following:

- One group each, male and female;
- 10 people per group;
- Residents from across Town;
- Representing major decision makers;
- Plays role in recycling at home;

- Access to curbside collection;
- Representative of ethnicity of Town

The focus groups were asked a series of questions related to the Town's waste management program including the idea of testing a blue box lid. For the purposes of the focus group, the lid was referred to as "Blue Box Expander".

Most respondents reacted favourably to the Blue Box Expander prototype. As a point of interest, both focus groups indicated that litter reduction was the biggest benefit to be gained from the lid compared to the possibility of additional capacity. Respondents were not fully convinced that the Blue Box Expander would add substantially to the amount of materials that could be loaded into the blue box.

The female focus group expressed a preference for purchasing additional Blue Boxes instead of a Blue Box Expander as a mechanism to increase capture of material. The male focus group preferred the concept of the handle on the Blue Box Expander, making it possible to carry two items to the curb simultaneously.

In general the feedback on the flexible blue box lid was favourable and respondents saw merit in the Town piloting the lid to determine its impact on windblown litter and blue box capacity. As a result of these comments, the Town implemented the pilot to test the expandable Blue Box lid system in an operational setting.

## 5.0 Project Implementation

The pilot was conducted during the fall and early winter months in order to test the lids under a variety of weather conditions (wind, rain and snow). The project was rolled out as follows:

- |                   |  |
|-------------------|--|
| • July, 2007      | - conduct baseline composition/set-out audit |
| • August, 2007    | - conduct a one week baseline litter audit   |
| • September, 2007 | - develop educational material               |
| • September, 2007 | - distribute promotional material and lid    |
| • Oct. 1, 2007    | - commence pilot project                     |
| • Oct-Dec, 2007   | - conduct weekly litter survey               |
| • Dec, 2007       | - conduct pilot composition/set-out audit    |
| • January, 2008   | - time trials on collection route            |
| • January, 2008   | - complete pilot project                     |
| • March, 2008     | - conduct door-to-door satisfaction survey   |

The Town established two pilot areas specific to the expandable lid project:

- Ward 8, Milliken Mills district: 531 households
- Ward 7, also of Milliken Mills: 1,409 households.



Appendix 1 depicts location maps for the two pilot areas (Ward 7 & 8).

Two additional areas also received lids during another pilot project that was testing the use of clear garbage bags on waste diversion rates (Johnsview Village - 541 hh, and Swan Lake - 122 hh.) — refer to E&E Project 285 for further details. For the purpose of this project, litter data was collected for Wards 7 & 8 and, as a cost saving mechanism, audit/set-out data prepared by AET Consultants, was shared with E&E Project 285 (Johnsview Village area).

In the first pilot area (Ward 8, Milliken Mills), one lid for every blue box plus any recycling collection container that the householder used for curbside collection (with the exclusion of milk crates or non-rigid plastic containers due to size configuration and integrity of the container) was issued. Based on this method, some households received two or more lids to test for the pilot.

In the second pilot area (Ward 7, Milliken Mills) only one lid per household – regardless of the number of additional recycling containers used at the curbside – was issued.

Town staff installed all the flexible lids to ensure they were properly affixed to the blue boxes and to encourage resident participation. The lids were installed while promotion information outlining the Project was distributed door-to-door two weeks prior to the program launch. The Town did not choose to conduct mail-outs of the promotional literature to ensure that only the targeted pilot areas received information.

Appendix 2 includes a sample of the literature that was handed out with the lids prior to program launch.

Prior to program launch, the Town met with their collection contractor, Miller Waste, to outline the project goals and implementation timeframe. In order to provide collection productivity feedback, Miller conducted an informal time trial study over a two day period near the end of the pilot to determine if there was a noticeable impact to the collection route scheduling. The Town experienced a communication breakdown with the collection contractor which limited the time trail period to only 1 day during the pilot and not for all pilot areas. Originally, the Town intended the contractor to conduct time trials at least once per week over the 3-month period and in the varying pilot areas. As a result, the time trial data is limited and does not include any data on the pilot area where more than one lid per household was issued.

## 6.0 Project Monitoring

### 6.1 Door-to-Door Satisfaction Survey

Town staff designed a door-to-door survey that was conducted as a follow-up to the installation of the flexible Blue Box lids. The survey was intended to measure the satisfaction level of the participating residents and to obtain comments on the following:

- Ease of use;
- Reduction of litter;
- Increase in capacity; and,
- Price of lid.

Markham's co-op students canvassed the pilot areas during the evenings over a one-week period to gather feedback from residents on the blue box lids. A total of 275 responses (households) were gathered from the pilot areas representing approximately 15% of the total households (1,904) in the pilot area.

### 6.2 Litter Sampling

Litter generation was monitored in the pilot area in August 2007, prior to program implementation and again during the pilot. Co-op students were instructed by Town staff to record the number of litter pieces found along streets, sidewalks and curbside lawn areas before and after the scheduled Blue Box collection days.

Baseline litter sampling data indicated that there was approximately 30% more litter on the streets after the blue boxes were collected. In some areas (Spangler Road and Lavron Court), litter generation actually doubled after Blue Box collection, indicating that Blue Boxes were directly contributing to the amount of litter found at the curbside.

Table 6.2 depicts baseline data compiled prior the launch of the lid pilot. Litter weights and categories were not recorded during the sampling period.

**Table 6.2 Baseline Litter Survey Results (Pre-Pilot)**

Street Name	Number of Houses	Pieces of Litter Before Collection Day	Pieces of Litter After Collection Day	Percentage Change in Litter Pieces
Charles Alfred Cres.	76	183	200	9%
Chloe Cres.	102	253	370	46%
Cimmaron St.	126	269	469	74%
Coleraine Ave.	27	177	188	6%
Coppard Ave.	49	376	556	48%
Dellano St.	45	171	257	50%
Douglas Haig Dr.	99	272	245	-10%
Elson St.	55	362	355	-2%
Featherstone Ave.	25	316	313	-1%
Goodwood Dr.	89	298	397	33%
James Edward Dr.	68	184	217	18%
Karen Miles Cres.	45	177	203	15%
<b>Lavron Crt.</b>	<b>66</b>	<b>125</b>	<b>247</b>	<b>98%</b>
Miles Farm Rd.	94	439	624	42%
Norn Cres.	89	183	202	10%
Rosseter Rd.	45	105	108	3%
Rowe Crt.	38	85	61	-28%
<b>Spangler Rd.</b>	<b>21</b>	<b>115</b>	<b>248</b>	<b>116%</b>
Terrosa Rd.	120	471	593	26%
William Honey Cres.	129	367	600	63%
<b>Total/Average</b>	<b>1408</b>	<b>4928</b>	<b>6453</b>	<b>31%</b>

### 6.3 Waste Audit and Set-out Data

The Town retained AET Consultants Inc. (AET) to conduct residential waste audits to monitor the impacts of the lid pilot and the clear garbage bag pilot. The pre-audit was conducted on July 17, 2007 and the pilot audit on December 18, 2007. Garbage, organics and recycling were collected from 20 sample households in Johnsvie Village. The same 20 houses were used for both audits. Town staff collected the sample material for the July audit and AET collected the material for December audit. The collection crews noted how many containers were set out at each house and how full each container was. The sample material was delivered to a Miller Waste maintenance facility at 112 Bales Dr, East Gwillimbury, where AET staff sorted it by stream into 71 material categories and then weighed it to determine composition. Details of the audit methodology are summarized in Appendix 4.

### 6.4 General Observations

Since the pilot was conducted during the winter period, there were some instances of freezing rain causing the lid to freeze to the blue box and forcing the driver to spend additional time attempting to release the lid or not being able to remove the lid and



leaving the full Blue Box at the curb. In some instances, residents would stack flattened cardboard on top of the Blue Box with the lid, which had the potential of slowing down the collection driver but also of increasing windblown litter if the cardboard was lightweight.

Town staff had open communication with Miller during the pilot phase of this Project and discussed issues related to the lid to determine if this type of system could be considered for the entire Town. Miller indicated that the impact on collection efficiency was not as high as originally anticipated and that the areas where residents did not "overstuff" their Blue Boxes proved to have minimal effect on time per stop. The common complaint from the collection drivers was that residents attempted to "trap" too much material in the box by stretching the lid tight across the box. Drivers indicated that the lid would "snap" back and material would spring out of the box and scatter along the streets.

A somewhat troubling event occurred on the day the pilot period officially ended (January 2, 2008). A collection driver purposely removed every lid from the second trial area (Ward 7) where only one lid was issued per household. Town staff hypothesize that the driver for this pilot area was responding to the frustration of residents regularly "overstuffing" their blue boxes as a result of being issued one lid only.

At the end of the pilot, residents were permitted to continue to use the lids. Town staff indicated that after a full year from the time the lids were originally issued, the majority of the residents in Ward 8, Swan Lake and Johnsview Village were still using the lids. Town staff have also indicated that residents in Ward 7, where the lids were removed by the collection driver, have submitted requests for replacement lids after the pilot timeframe.

The lid appears to be quite durable. The two metal screws used to affix the netting to the blue box had no noticeable impact on the integrity of the box. During the first few days of the pilot, approximately five percent of the residents indicated that the netting broke away from the plastic frame. It was determined that the netting's weakest point is where it attaches to the plastic frame. Since the netting prototype was hand-made, NUCOVE indicated that it was probably a result of production staff "getting familiar" with the sewing design of the lid. There were no further reports of lid malfunction for the remainder of the pilot. Additionally, residents who are still using the lid one year after the pilot have not reported any design issues or blue box related problems such as cracking of the plastic.

The reliability of the waste audit data is questionable for the following reasons:

- small size of the sample (only 20 households);
- short auditing timeframe (one day for baseline and one day for pilot);
- seasonality issues (summer for baseline vs. winter for pilot); and



- participation and selection of households (the baseline measurements were made on 20 households with material set out, whereas the pilot audit included quite a few households without set outs).

Town staff have indicated that, in hindsight, combining audit data from two projects (lids and bags) and limiting the duration of the audit, while enabling cost savings, did not serve either of the projects well.

## **7.0 Project Results**

### **7.1 Door-to-Door Survey Results**

A total of 275 respondents participated in the door-to-door survey conducted over a three day period in mid-march 2008. In general, all the respondents were satisfied with the expandable lid. 58% agreed that their property had less litter after having used the blue box lid while only 29% disagreed that using the Blue Box lid resulted in less litter. The balance had no opinion. Respondents also indicated that they found the lid easy to use and that it made carrying the Blue Box to the curb convenient.

The hand-made prototype lid cost \$9 to produce. Residents were asked if the reduced manufactured rate of \$5 per lid was acceptable. Approximately 84% of the respondents were favourable to the \$5/lid price and given a choice, respondents would purchase a minimum of 1 lid per household.

When asked whether they felt they recycled more material because of the lid, results were somewhat less definitive. 46% of respondents felt they recycled more material while 36% disagreed that they recycled more material because of the blue box lid. The balance had no opinion.

Complete survey results are included in Appendix 3.

### **7.2 Litter Sampling Results**

It quickly became apparent that in the area where only one expandable lid was issued per household, residents would "overstuff" their Blue Boxes. The Town indeed discovered that Ward 7 residents tended to overfill their boxes beyond the lip of the box and then stretched the lid tight across the top of the box to keep the contents from spilling out onto the street. When the collection driver quickly "flicked" the lid off the Blue Box, material that was held under pressure by the lid would spring out of the box and onto the street. In some instances, it was observed that residents would attempt to add additional items to the Blue Box after the lid had been secured by squeezing a plastic bottle through the netting holes, slowing the driver as the bottle was removed from the netting.

In Ward 8, where residents were issued lids for all recycling collection containers, windblown litter was reduced and collection times per stop were minimally affected.



Table 7.2 depicts data collected during the expandable lid pilot project. Areas marked in blue represent households with one lid for every container (Ward 8).

**Table 7.2 Litter Pieces (Pilot Phase)**

Street Name	Number of Houses	Pieces of Litter on Blue Box Collection Day	Pieces of Litter After Blue Box Collection Day	Percentage Change in Garbage
Charles Alfred Cres.	76	151	135	-11%
Chloe Cres	102	231	363	57%
Cimmaron St.	126	350	405	16%
Coleraine Ave.	27	256	164	-36%
Coppard Ave.	49	346	253	-27%
Dellano St.	45	150	98	-35%
Douglas Haig Dr.	99	180	209	16%
Elson St.	55	374	292	-22%
Featherstone Ave.	25	230	295	28%
Goodwood Dr.	89	200	150	-25%
James Edward Dr.	68	140	193	38%
Karen Miles Cres.	45	153	163	7%
Lavron Crt.	66	126	100	-21%
Miles Farm Rd.	94	250	295	18%
Norn Cres.	89	125	158	26%
Rosseter Rd.	45	100	102	2%
Rowe Crt.	38	56	35	-38%
Spangler Rd.	21	86	104	21%
Terrosa Rd.	120	321	296	-8%
William Honey Cres.	129	173	170	-2%
Total	1408			6%

Out of the 1408 households sampled, 719 households (51%) experienced a reduction in litter that can be attributable to the use of the lid. It is interesting to note that households experiencing a litter reduction were located in the area where households received one lid for every container (Ward 8). It can also be noted that of the 719 households that experienced litter reduction, just over half (394 households) experienced reductions greater than 20%.

Comparing the baseline litter data from the two streets (Lavron and Spangler) where litter doubled in generation on Blue Box collection day, Lavron Court experienced 21% less litter during the lid pilot (refer to Section 6.2). Spangler Road still experienced litter during the lid pilot but instead of the baseline 116% increase in litter, this area witnessed 21% increase in litter during Blue Box collection.

The pieces of litter that were sampled were not broken down into categories or weighed during this study. Staff have indicated that it may be advantageous to



record this type of data in the future to determine potential impacts on reducing windblown litter and its effect toward increasing material capture rates.

### 7.3 Time Trial Results

Collectively, town staff and Miller determined that there are various factors influencing collection times that are unrelated to the use of the expandable lid. Factors affecting the Town’s collection times include:

- Distance the collection containers are placed from the curb;
- The number of collection containers set out for collection;
- Orientation of the collection containers;
- Weight of the containers (particularly organics and waste);
- Vehicles parked in front of the collection containers;
- Pedestrians;
- Snow banks and snow removal; and
- Health of collection employee.

Miller chose not to alert the collection vehicle drivers of the time trails in an effort not to skew results. Two areas were chosen by Miller to monitor:

- Chloe Crescent (where residents were issued 1 lid per household); and
- Caboto Trail (where no lids were being used).

All times were recorded, from the driver’s exit from the vehicle to the driver’s re-entering the vehicle. The times include the collection of Blue Boxes and green bins (organics). Miller tracked the number of bins set out per collection stop for both trial areas. A total of eight consecutive houses were tested along a street (route) for each trial area.

Table 7.3 depicts time trials for Caboto Trail where there were no Blue Box lids.

**Table 7.3 Time Trial – No Blue Box Lid**

Street and House Number	Number of Bins		Start/Finish Times (min/sec)		Total Time Per Stop
	# Blue	# Green			
539	1	1	0	0:10	0:00
537	2	1	0:18	0:32	14
535	1	0	0:41	1:03	22
533	1	1	1:11	1:28	17
531	1	1	1:37	1:52	15
527	1	1	2:00	2:14	14
525	2	1	2:20	2:31	11
523	1	1	2:38	3:02	14
<b>Totals</b>	<b>10</b>	<b>7</b>			<b>107</b>



The area without Blue Box lids averages 13 seconds per stop. All of the stops with the exception of one (Caboto Trail 535), set out a green bin and only two of the stops set out more than one Blue Box.

Table 7.4 depicts the time trails for Chloe Crescent where one Blue Box lid per household was issued. It should be noted that there were no official time trials conducted in areas where a lid for every recycling container was issued. It should also be noted that during this time trial, there is one stop, (Chloe Crescent 115) that skews the data table for comparison purposes with Table 7.3. The household set out three green bins and two blue boxes representing a total stop time of 55 seconds. When examining the average stop time of the remaining seven households in this time trial, the average is 17 seconds per stop representing approximately 4 seconds per stop more than for the Caboto Trail time trial area.

**Table 7.4 Time Trial – one Blue Box Lid**

Street and House Number	Number of Bins		Start/Finish Times		Total Time Per Stop (sec)
	# Blue	# Green	Start Time (min/sec)	End (min/sec)	
115	2	3	0:00	0:55	55
117	1	1	1:03:00	1:28	25
119	1	1	2:03:00	2:18	16
121	1	1	2:37	2:49	12
123	2	0	3:15	3:27	12
125	1	1	2:57	3:15	18
127	2	1	3:37	3:57	20
129	1	1	4:07	4:24	17
<b>Totals</b>	<b>11</b>	<b>9</b>			<b>175</b>

Town staff indicated that the contractor originally anticipated that collection times for areas using Blue Box lids would show a significant increase in time per stop. For those households using only one lid, the preliminary results reflect an increase of 4 seconds per stop, which translates into approximately 30 additional minutes per route (~500 stops per route for co-collection).

The contractor noted that the time per stop was not as limiting as originally anticipated. However, data was not recorded for longer periods of time or for the pilot area where more than one lid per box was supplied. Although data is not available, it can be projected that areas using more than one lid per box/stop would experience a greater impact on time efficiencies. Based on preliminary data generated from the areas that were time trialed, it can be anticipated that additional lids could increase the time per stop by an additional 8 seconds (one hour per collection route), thereby causing a larger impact on collection efficiency.



## 7.4 Capture Rate and Set-Out Results

The pre-pilot audit conducted in July, 2007 was able to capture full participation (set-out) from all but one household from the 20 household sample. Data generated indicated the overall capture rate of recyclables was approximately 91%. The pilot audit conducted in December 2007 for the same area (Johnsview Village) did not capture the same set out rate, which skewed data to reflect an actual decrease in overall capture rate to 87%. In the December audit, only 11 of the 20 households set out material at the curbside. When reviewing the data from the 11 households, it appears that the capture rate remains fairly constant at 91%. Interestingly, there is actually less paper fibres in the mid-December audit (pilot phase), when the lids are being used, compared to the July audit (pre-program launch). This is atypical of this time of the year, when a higher instance of paper fibres in the form of advertising flyers is usually experienced.

Set out rates for the pre-audit indicate that residents set out an equivalent of 1.4 boxes per week and that the boxes are roughly 90% full. Comparatively, the pilot set out rates for the 11 participating households depict an average of 1.3 boxes per week with all the boxes but one being 100% full. Although the data is generalized, preliminary results show that residents using the lid filled the blue box to optimum capacity and used fewer blue boxes. Details are depicted in Appendix 4 in the AET waste audit report.

Based on the generalized audit results, recycling tonnage collected from the pilot area did not show any change (increase or decrease) from the pre-audit to the pilot audit. Originally, Town staff had anticipated that the lid would be a mechanism for additional capture of recyclable material but the pilot did not show any results to support this. The pilot findings show that the lid served well as a convenience factor (carrying to the curb) and a source of litter reduction (where more than one lid was issued per box).

## 7.5 Cost Benefit Analysis of the Blue Box Lid

Currently, the Town charges \$6/box to residents for a standard size blue box. The oversize boxes are sold at a cost of \$10/box. Based on blue box set out data collected from the pre-pilot audit in July 2007, residents were averaging 1.4 blue boxes per household with many of the boxes partially full. The December 2007 pilot audit revealed that residents were averaging 1.3 blue boxes per set out, (based on the participating households) with all but one of the boxes rated as full. The audit data did not capture the size variations of the blue boxes used by the sampled households, therefore the following assumptions have been made:

- Residents are issued one free blue box per household to launch the blue box program; and
- The majority of residents would purchase a lower priced additional blue box at \$6/box rather than the \$10/box.



Although the data generated is representative of a small sampling (20 households), pilot results indicate that residents are reducing the number of blue boxes set at the curb when using the blue box lid. A preliminary cost analysis of the lid compared to the purchase of an additional standard size blue box indicates that if the lids are mass produced at \$5/lid, residents have the opportunity to save roughly \$1 per household, by using a lid instead of purchasing an additional box.

## 8.0 Conclusions and Recommendations

When considering the intended goals of this Project, the following conclusions can be made:

- Preliminary results indicate that recycling capture rates are not noticeably affected by the use of the lid;
- Preliminary time trails indicate that lids increase collection times but perhaps not as much as anticipated;
- Windblown litter is reduced with the lid, particularly in areas where there is a lid for every box; and
- The public likes the lid for its convenience when carrying blue boxes to the curb and for litter reduction.

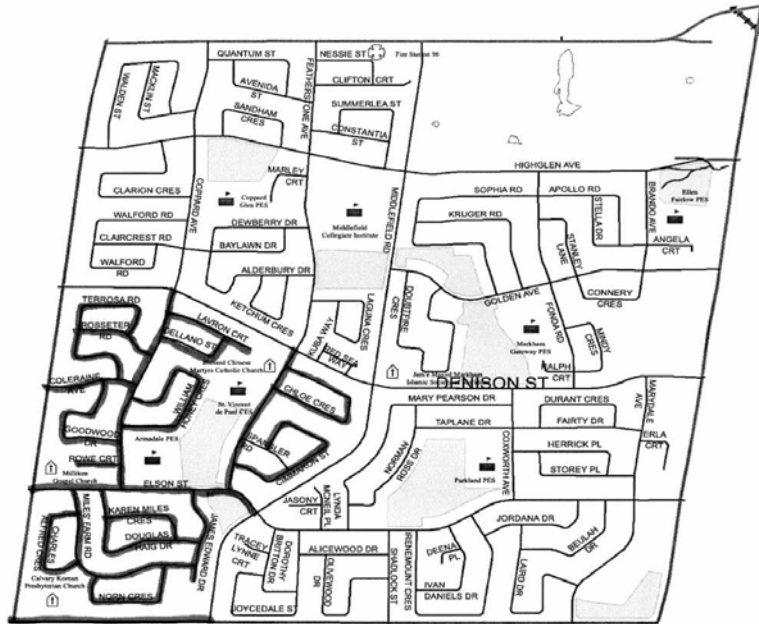
As of October 2008, 84% of the pilot homes were still using the lid. As outlined in section 6 of this report, residents in the second pilot area (Ward 7) have also submitted requests for replacements lids after they were removed by the contractor.

When considering whether to implement the lids Town-wide, staff will need to conduct a larger-scale time motion study to determine the full impact of the lid on collection times (i.e. minutes per stop per household). Additionally, if the Town is considering further study to determine the lid's effectiveness at increasing blue box capacity and capture, it is recommended that the Town conduct larger scale waste composition audits (i.e. 100 sample homes instead of 20) with a control area and a test area that differs only in that the residents are issued lids. It is also recommended that the Town record and compare before and after truck tonnages in the lid and the control area.

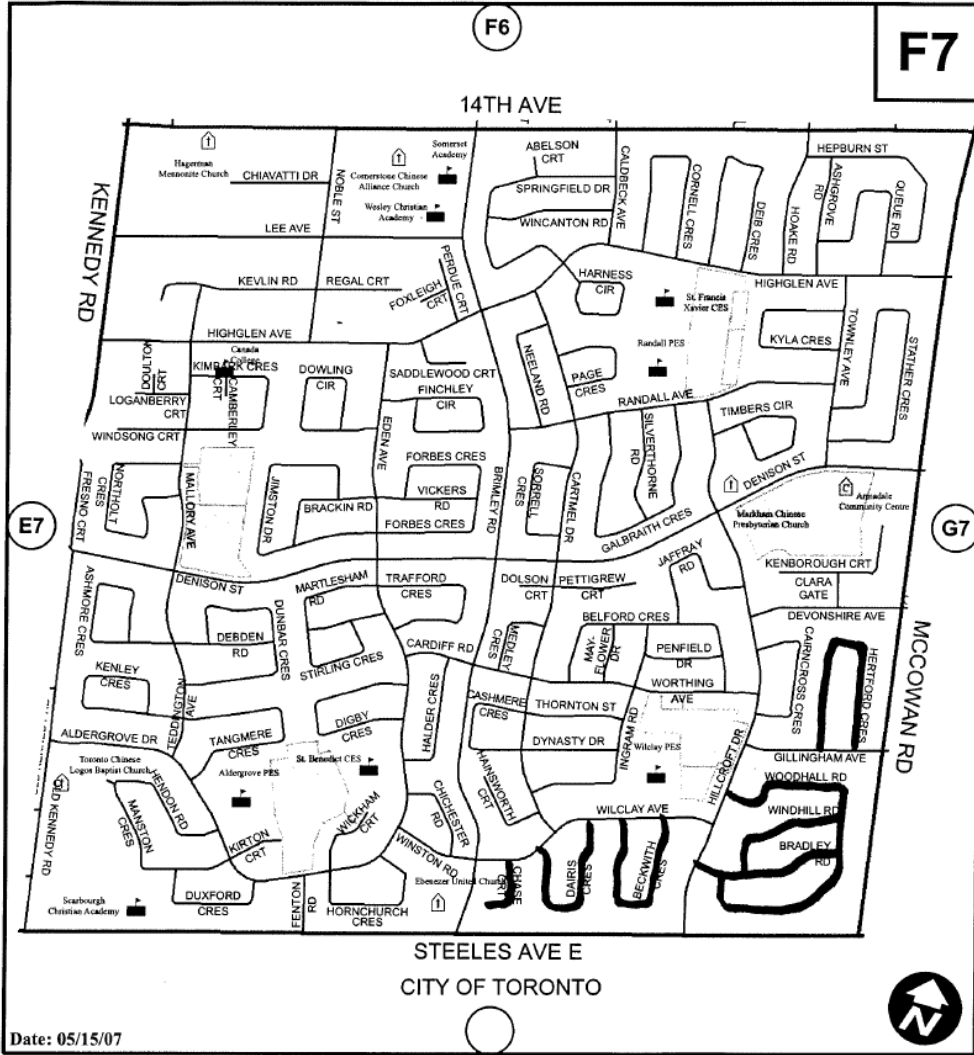
The Town indicated that if NUCOVE decides to implement a retrofit of their machinery to manufacture the blue box lids, staff will recommend to Council that they are willing to assist in marketing and distributing the lids and amend the by-law to allow the use of lids. Currently, there are no municipal funds available to issue the lids free of charge to the residents therefore the lids would be made available to residents on a cost recovery basis similar to the blue box sales.

# Appendix 1 Site Maps

## Ward 7 Blue Box Lid Pilot Area



# Ward 8 Blue Box Lid Pilot Area



Date: 05/15/07

**MARKHAM**  
CENTRE FOR GIS  
LINK TO SPATIAL EXCELLENCE™

0 0.25 0.5 0.75 1  
Kilometers

**MARKHAM**

<ul style="list-style-type: none"> <li> GO Transit Station</li> <li> Ambulance Station</li> <li> Fire Station</li> <li> Police Station</li> <li> Hospital</li> <li> Airport</li> </ul>	<ul style="list-style-type: none"> <li> Place Of Worship</li> <li> Community Centre</li> <li> School</li> <li> Library</li> <li> Park / Open Space</li> </ul>	<ul style="list-style-type: none"> <li> Local Roads</li> <li> Laneway</li> <li> Major Roads</li> <li> Highways</li> <li> Railways</li> <li> Watercourse</li> </ul>	<div style="text-align: center; margin-bottom: 5px;"><b>KEY MAP</b></div> <p style="text-align: center;">1 2 3 4 5 6 7</p> <p style="text-align: center;">A B C D E F G H J K L</p>
--	---	--	---

## Appendix 2 Examples of Education Material

### **IMPORTANT INFORMATION REGARDING YOUR RECYCLING AND GARBAGE SERVICE**

Dear Resident,

Thanks to the high participation in Markham's Mission Green recycling program, Markham now diverts 70% of our waste – the highest recycling rate in Canada.

As an environmental leader, Markham is always looking for new and innovative ways to improve our services. The residents on your street have been chosen to participate in a pilot program to test one of these new solutions.

Blue Boxes can be a significant source of litter. In the next few weeks, you will notice Markham staff installing a flexible netting onto one of your blue boxes. This netting is a new type of blue box lid that is designed to let you fit more recycling in your Blue Box and to stop recyclables from falling out.

The Blue Box Lid Pilot program will begin in mid - October and end on the last week of December. During the pilot program all we ask is that you pull the netting over your full blue box and clip the handle over the edge when you put your full blue box out on your collection day. The Town will take care of the rest.

The Town will monitor the program to see if the use of the netting increases recycling and reduces the amount of litter on our streets. As a thank you for participating, you are welcome to keep and to continue using your Blue Box lid after the pilot.

Thank you in advance for helping the Town of Markham to try new solutions to recycle more and to keep Markham litter free.

Please feel free to call our Contact Centre at (905) 415-7535 if you need a blue box or if have any questions regarding this pilot or any other waste management issues.

Sincerely,

Logan Kanapathi  
Councillor, Ward 7

## Appendix 2 Examples of Education Material (continued)

### BLUE BOX LID PILOT WARD 7 FREQUENTLY ASKED QUESTIONS

**Q: Why is the Town conducting this pilot program?**

A: The Town of Markham is conducting this pilot program for 2 reasons. The first is to increase waste diversion. The second is to reduce litter on Markham streets by stopping recyclables from falling or being blown out of blue boxes.

**Q: Will my collection schedule change with this pilot?**

A: No. There will be no change to your collection schedule.

**Q: Will this pilot affect the 3-bag/can limit for garbage?**

A: No. There will be no change to the 3-bag/can limit for garbage.

**Q: How do I use my Blue Box Lid?**

A: A Blue Box Lid has been installed on one of your blue boxes. All you have to do is pull the lid over your blue box, so that the netting covers your recyclables, and clip the hook over the lip of the box when you put your recycling at the curb for collection.

**Q: What if I don't want to participate?**

A: Your participation in using the Blue Box Lid will better help the Town determine if the lids will help increase recycling and keep our streets clean. However, if you wish, you may call the Contact Centre at (905) 415-7535 and arrange for someone from the Town to pick up your lid.

Your recycling will be collected as long as you adhere to the Town's waste set out rules, regardless if you choose to participate.

**Q: I do not have a blue box or I need another blue box. Where can I get a blue box?**

A: Blue boxes can be purchased at any of Markham's Community [Recycling Depots](#) and at the [Angus Glen](#), [Thornhill](#), [Centennial](#) and [Milliken Mills](#) Community Centres during regular business hours.

**Q: My existing blue box is broken. How can I get a replacement blue box?**

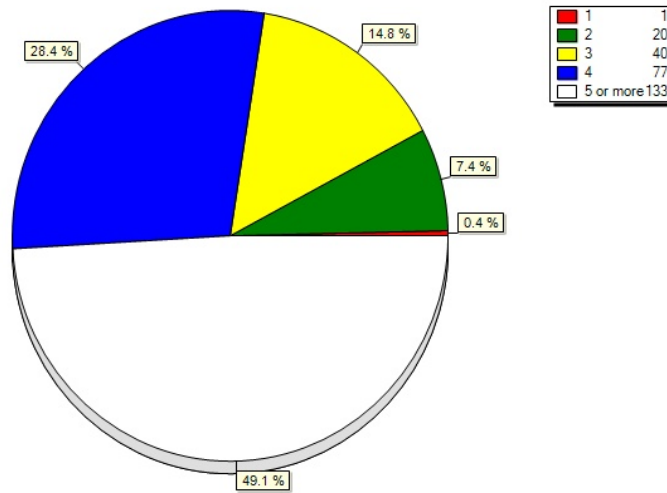
A: You can bring your existing broken blue box to any of Markham's Community [Recycling Depots](#) and at the [Angus Glen](#), [Thornhill](#), [Centennial](#) and [Milliken Mills](#) Community Centres during regular business hours and we will be glad to exchange it for a new one, free of charge.

**Feel free to call the Town's Contact Centre at (905) 415-7535 for locations and hours of operation of these facilities, or you can visit the Town at [www.markham.ca](http://www.markham.ca)**

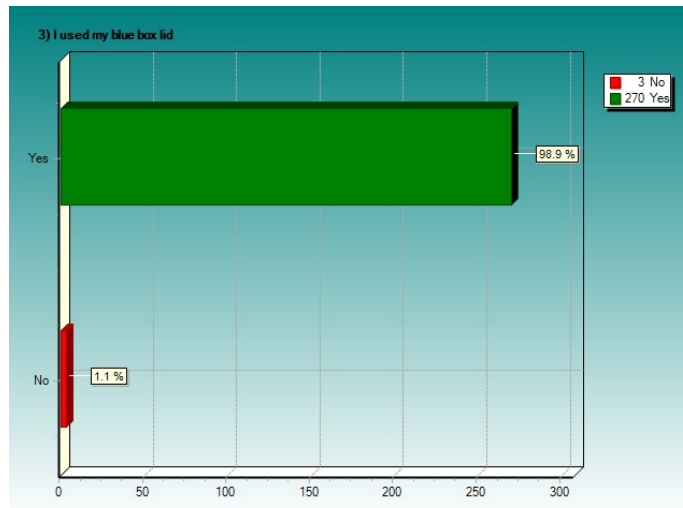
# Appendix 3 Satisfaction Survey

## Slide 1- Number of people per household

2) Number of people in household:

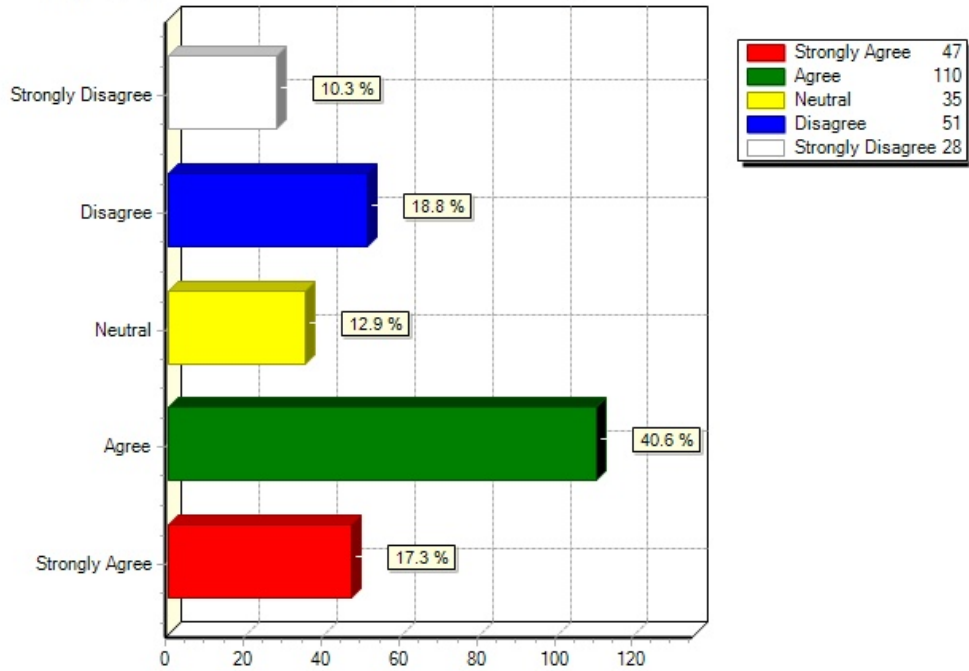


## Slide 2 - "I used my blue box lid"



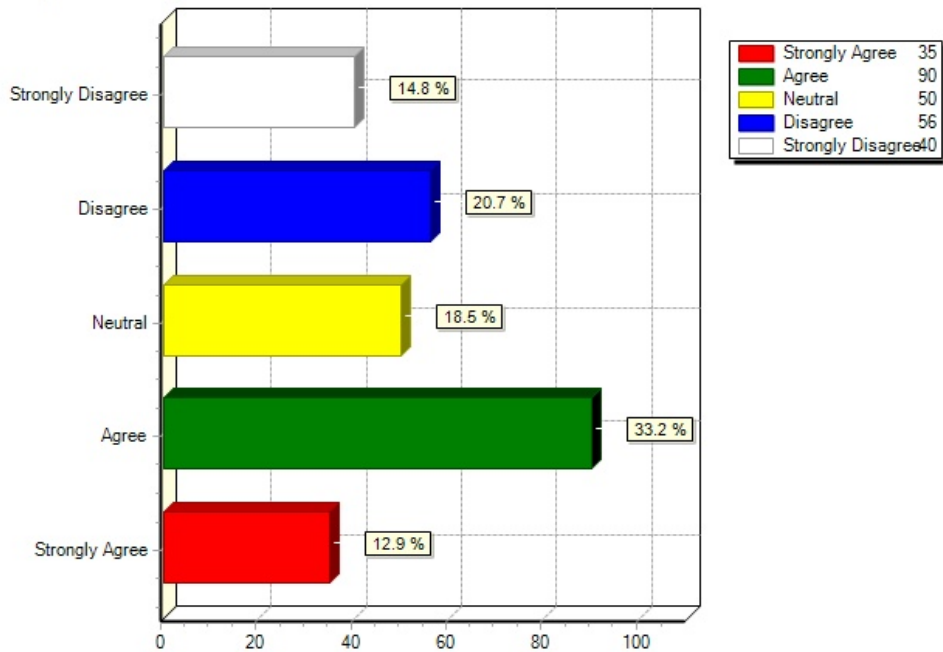
### Slide 3 – "My property has less litter since using the lid"

4) My property has less litter since my neighbourhood started using the blue box lids

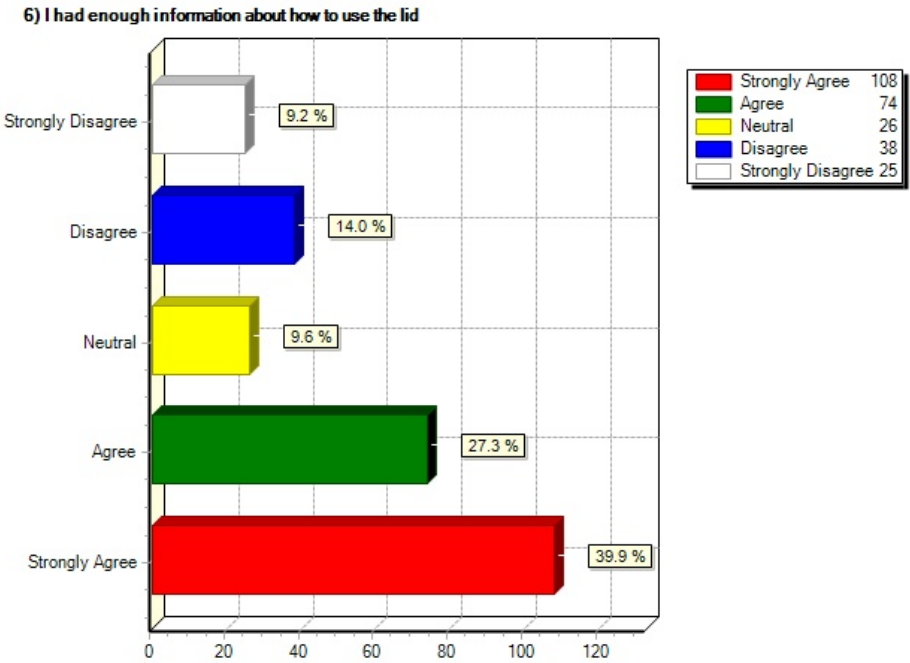


### Slide 4 – "I feel I recycled more because of lid"

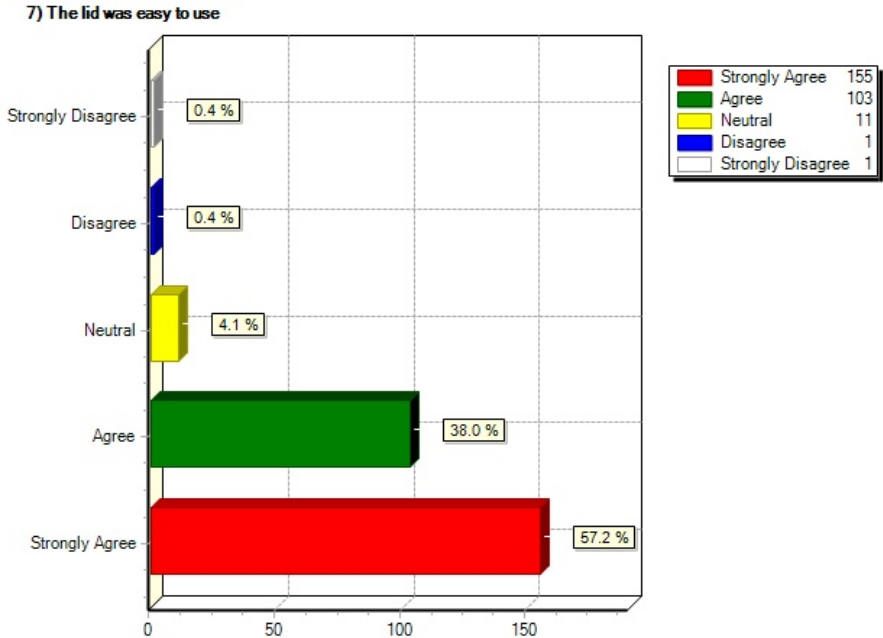
5) I feel that I recycled more because of the lid



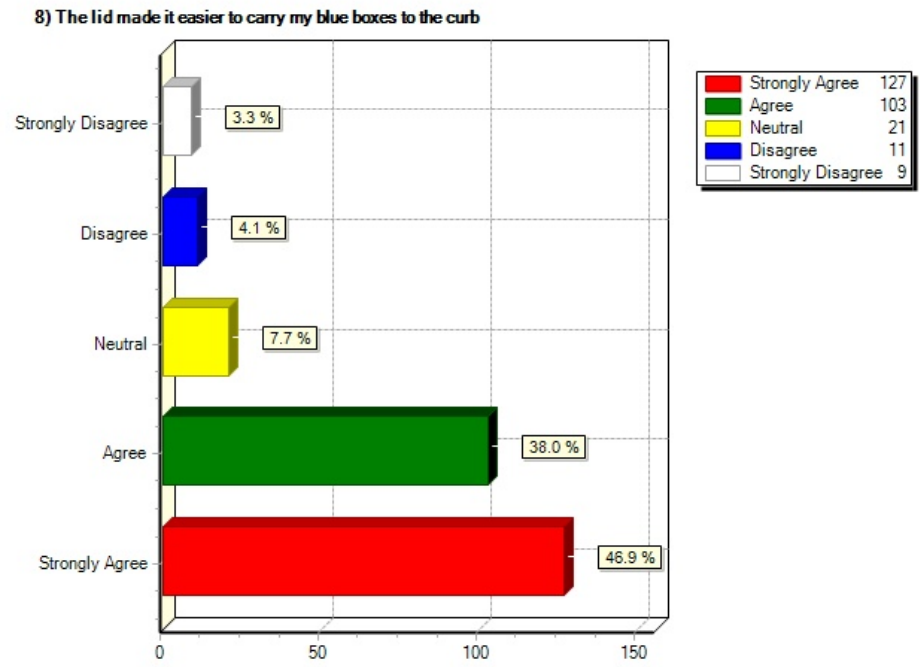
Slide 5 – "I had enough information about how to use the lid"



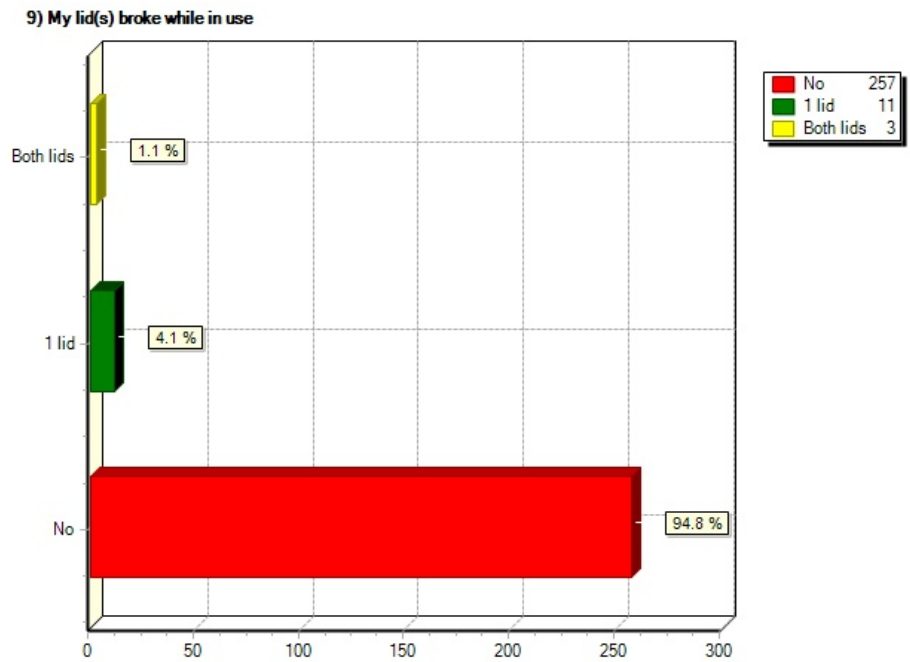
Slide 6 – "The lid was easy to use"



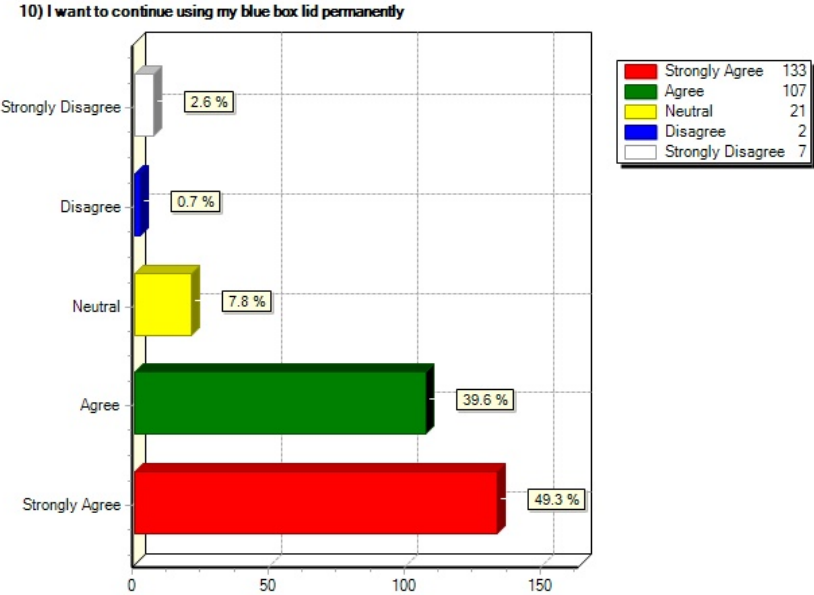
## Slide 7- "The lid made it easier to carry box to curb"



## Slide 8 - "My lid(s) broke while in use"



Slide 9 – "I want to continue using my blue box lid permanently"



**Appendix 4**  
**AET Waste Audit Report**

**Residential Waste Audit Report  
Clear Garbage Bag Pilot Study  
Town of Markham**

*Draft Report*

*Prepared for:*



**Town of Markham**  
101 Town Centre Blvd  
Markham, Ontario L3R 9W3

*Prepared by:*



**AET Consultants Inc.**  
133 Weber Street North, Suite 3-504  
Waterloo, Ontario N2J 3G9  
Phone: 519-576-9723  
Fax: 519-570-9589  
[www.aetconsultants.com](http://www.aetconsultants.com)

January 2008



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- Appendix A: Pre-Pilot Collection Log
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- Appendix C: Description of Material Categories
- Appendix D: Detailed Audit Sort Results

## EXECUTIVE SUMMARY

In the fall of 2007, the Town of Markham began a clear garbage bag pilot study to test the use of clear bags for garbage as a method to eliminate the ease of concealing recyclables in the garbage. The main objective of this study was to monitor the impact of the use of clear bags on waste diversion. AET Consultants Inc. (AET) was retained by the Town of Markham to conduct waste composition audits prior to the pilot program and during the pilot program.

The waste audit approach was adopted from the methodology established by Waste Diversion Ontario (WDO) and Stewardship Ontario (SO) for residential curbside waste audits. For this audit, samples from 20 households were collected on July 17, 2007 (pre-pilot), and the same households were re-sampled on December 18, 2007 (pilot). Garbage, Blue Box and Green Bin materials were audited separately. The results of the two samples were compared in order to determine the effects of clear garbage bags on capture and diversion rates for Green Bin organics and Blue Box recyclables.

A comparison of results from the two audits reveals an overall waste diversion rate decrease from 71.90% (pre-pilot) to 66.88% (pilot). Only four out of ten households that set out waste during the pilot period complied with the clear bag directive; the remainder used standard green or black opaque bags. The clear garbage bags that were placed at the curb often contained opaque bags (kitchen catchers, grocery bags), which made it difficult or impossible to visually identify the types of materials contained inside.

A total of 78.71% of accepted organic materials were being captured in the Green Bin in the pre-pilot audit, while 67.72% of accepted organic materials were being captured in the Green Bin in the pilot audit. A total of 91.17% of accepted recyclable materials were being captured in the Blue Box in the pre-pilot audit, while 87.49% of accepted recyclable materials were being captured in the Blue Box in the pilot audit.

In the pre-pilot audit, divertible materials comprised 51.37% of the residual waste stream (36.87% Green Bin organics, 14.50% Blue Box recyclables); in the pilot audit, divertible materials comprised 70.87% of the residual waste stream (56.13% Green Bin organics, 14.74% Blue Box recyclables).

## 1.0 INTRODUCTION

### 1.1 Background

In the fall of 2007, The Town of Markham, with the support of the Federation of Canadian Municipalities, began a pilot study to test the use of clear bags for garbage as a method to eliminate the ease of concealing recyclables in the garbage. The Town of Markham had previously successfully implemented a three-stream program (blue box, green bin, and residual waste) but wished to investigate ways to increase the diversion rates further. Since opaque garbage bags enable residents to conceal recyclables and green bin organics in the garbage, it was hypothesized that requiring residents to use clear garbage bags may reduce the presence of divertible materials in the garbage stream.

The Town of Markham retained AET Consultants Inc. (AET) in 2007 to perform residential waste audits to monitor the impacts of the new program. A pre-pilot audit was conducted on materials collected on July 17, 2007 and a pilot audit was conducted on materials collected on December 18, 2007.

### 1.2 Objectives

The waste audit study was intended to accomplish the following objectives:

1. Determine how much material is being diverted through the Green Bin and Blue Box programs;
2. Provide information on the amount of recyclables in the waste stream that are accepted for recycling in the blue box program;
3. Provide information on the amount of organics in the waste stream that are accepted for composting in the Green Bin program,
4. Compare the results of the December 2007 audit to baseline data collected in July 2007, so as to determine whether the use of clear bags leads to an improvement in the diversion rate of green bin materials and blue box materials.
5. To test the use of clear bags for garbage collection to optimize blue box and green bin capture rates.

## 2.0 WASTE AUDIT METHODOLOGY

The waste audit approach was based on the adopted methodology established by Waste Diversion Ontario (WDO) and Stewardship Ontario for residential waste audits. For this audit, residual waste, Blue Box recycling and Green Bin organics samples were collected at the curb for 20 households.

### 2.1 Curbside Sample Collections

The sample area was chosen by the Town of Markham staff and consisted of 20 homes in the Johnsview Village neighbourhood. This neighbourhood consists of townhouses, and is populated primarily by lower to middle income families. Residents were not made aware of the audit so as to ensure that they did not change their waste management habits during the study. The same 20 households were sampled for the July (pre-pilot) and December (pilot) audits.

### 2.2 Waste Audit Sampling Process

The Town of Markham was responsible for the curbside collection of residual waste, organics and recycling from the 20 households on July 17, 2007. On the sampling day, the Town of Markham staff completed a waste collection log, documenting the number and fullness of bags, blue boxes and green bins collected at each home. See Appendices A and B for the curbside collection log sheets. Samples were delivered to a Miller Waste maintenance facility at 112 Bales Dr, East Gwillimbury, Ontario, where AET sorted, analyzed and reported on the material composition of the samples. AET was responsible for the curbside collection of residual waste, organics, and recycling from the same 20 households on December 18, 2007; this material was brought to the Miller Waste material recovery facility (MRF) at 8050 Woodbine Ave, Markham, Ontario, for sorting.

### 2.3 Sorting Methodology

All of the materials collected during both sampling periods were sorted and weighed. Residual waste, Blue Box and Green Bin samples were sorted and weighed separately. Samples were sorted into 8 major waste groups consisting of 71 individual categories. See Figure 2.1 for the waste audit set-up and sort. Waste categories were based on Stewardship Ontario's waste audit protocol list. The list of sort categories is provided below in Table 2.1. A description of each material category is provided in Appendix C.



Figure 2.1 Waste Audit Set-up

Table 2.1 Material Sort Categories

<p><b>Paper</b></p> <ul style="list-style-type: none"> <li>- Newspaper – Dailies and Weeklies</li> <li>- Newspaper - Other</li> <li>- Telephone Books / Directories</li> <li>- Magazines &amp; Catalogues</li> <li>- Mixed Fine Paper</li> <li>- Shredded Paper *</li> <li>- Books</li> <li>- Other Paper</li> </ul> <p><b>Paper Packaging</b></p> <ul style="list-style-type: none"> <li>- Corrugated</li> <li>- Kraft Paper</li> <li>- Boxboard / Cores</li> <li>- Molded Pulp</li> <li>- Paper Cups and - Paper Ice-Cream Containers</li> <li>- Laminated Paper Packaging</li> <li>- Composite Cans</li> <li>- Gable Top Cartons</li> <li>- Aseptic Containers</li> <li>- Tissue/Towelings</li> </ul>	<p><b>Plastics</b></p> <ul style="list-style-type: none"> <li>- PET Beverage Bottles</li> <li>- PET Other Bottles &amp; Jars</li> <li>- PET Other Packaging</li> <li>- HDPE Beverage Bottles</li> <li>- HDPE Other Bottles &amp; Jugs</li> <li>- PVC Bottles &amp; Jars</li> <li>- Other Bottles, Jars &amp; Jugs</li> <li>- Polystyrene Packaging – Rigid*</li> <li>- Polystyrene Packaging - Expanded Styrofoam*</li> <li>- Wide Mouth Tubs &amp; Lids</li> <li>- Large HDPE &amp; PP Pails &amp; Lids</li> <li>- Polyethylene PE Plastic Bags &amp; Film - Packaging</li> <li>- Polyethylene Plastic Bags &amp; Film - Non-Packaging</li> <li>- Laminated/Other Plastic Bags &amp; Film</li> <li>- Other Rigid Plastic Packaging</li> </ul>	<p><b>Plastics Cont.</b></p> <ul style="list-style-type: none"> <li>- Blister Packaging*</li> <li>- <i>Durable Plastic Products</i></li> </ul> <p><b>Metals</b></p> <ul style="list-style-type: none"> <li>- Aluminum Food &amp; Beverage Cans</li> <li>- Aluminum Foil &amp; Foil Trays</li> <li>- Other Aluminum Containers</li> <li>- Steel Food &amp; Beverage Cans</li> <li>- Steel Aerosol Cans</li> <li>- Steel Paint Cans</li> <li>- Other Metal</li> </ul> <p><b>Glass</b></p> <ul style="list-style-type: none"> <li>- LCBO Clear</li> <li>- LCBO Coloured</li> <li>- Clear</li> <li>- Coloured</li> <li>- Other Glass</li> </ul> <p><b>HSW</b></p> <ul style="list-style-type: none"> <li>- Batteries</li> <li>- Paint &amp; Stain</li> <li>- Motor Oil</li> <li>- Other HSW liquids</li> <li>- Other HSW</li> </ul>	<p><b>Organics</b></p> <ul style="list-style-type: none"> <li>- Food Waste</li> <li>- Yard Waste</li> <li>- Pet waste</li> </ul> <p><b>Other Materials</b></p> <ul style="list-style-type: none"> <li>- Diapers and Sanitary Products</li> <li>- Textiles</li> <li>- Carpeting</li> <li>- Construction &amp; Renovation</li> <li>- Computer / IT Equipment</li> <li>- Telecom Equipment</li> <li>- TV &amp; Audio Equipment</li> <li>- Small Kitchen Appliances</li> <li>- Other Electrical</li> <li>- Tires and Other Rubber</li> <li>- Ceramics</li> <li>- Furniture</li> <li>- Mattresses</li> <li>- Wood</li> <li>- Other Large Bulky Items</li> <li>- Other Waste</li> </ul>
--	--	---	---

\* Categories added to Stewardship Ontario's waste audit categories for this Study

The material weights were measured using a digital scale to the nearest 1/100<sup>th</sup> kilogram and recorded onto sort log sheets. After being weighed, the residual waste, Blue Box recyclables and Green Bin organics were kept separate for disposal by Miller staff.

## 2.4 Calculations

### Residual Waste Generation

The following formula was used to estimate the average residual waste generation weight in kilograms per household per year (kg/hh/yr):

$$\text{kg/hh/yr} = \frac{\text{sample material weight (kg)}}{\# \text{ of households sampled}} \times 26 \text{ weeks/year (bi-weekly collection)}$$

### Recyclables and Organics Generation

The following formula was used to estimate the average recyclables and organics generation weight (kg/hh/yr).

$$\text{kg/hh/yr} = \frac{\text{sample material weight (kg)}}{\# \text{ of households sampled}} \times 52 \text{ weeks/year (weekly collection)}$$

### Capture Rate

The following formulae were used to calculate the percentage of the accepted recycling and organics materials that were captured in the blue box and green bin.

$$\text{Blue Box Capture Rate} = \frac{\text{Blue Box recyclable weight}}{(\text{weight of recyclables in the Blue Box} + \text{weight of recyclables in the residual waste}/2 + \text{weight of recyclables in organic stream})} \times 100$$

$$\text{Green Bin Capture Rate} = \frac{\text{Green Bin organics weight}}{(\text{weight of organics in the Green Bin} + \text{weight of organics in the residual waste}/2 + \text{weight of organics in the recycling stream})} \times 100$$

### Diversion Rate

The following formula was used to calculate the percentage of total waste materials diverted from landfill through the recycling and organics collection programs. Note that contamination in the blue box or green bin was not counted towards the diversion rate.

$$\text{Diversion Rate} = \frac{(\text{Total weight of Blue Box recyclables} + \text{Green Bin organics})}{\text{Total weight of all waste streams}} \times 100$$

### 3.0 RESULTS & DISCUSSION

#### 3.1 Curbside Set-out Results

A summary of set-out rates for the sampled households is provided in Table 3.1. The pre-pilot collection logs reveal that each household set out an average of 0.66 full garbage bag equivalents per week (1.33 items per bi-weekly collection period). The average number of full garbage bag equivalent set-outs per week was decreased to 0.34 (0.69 per bi-weekly collection period) during the clear bag pilot. Average Blue Box set-outs per household pre-pilot was 0.93 full box equivalents per week, while during the pilot period set-outs decreased to 0.68 full box equivalents per week. The average number of Green Bin set-outs was 0.43 full bin equivalents per week pre-pilot, which decreased to 0.33 full bin equivalents per week during the pilot.

**Table 3.1 Residual Waste, Blue Box and Green Bin Set-out Results**

	Pre-Pilot July 2007	Pilot December 2007	Pre-Pilot vs Pilot (+/-)
Number of households sampled	20	20	20
Average residual waste set-outs for all households (full bag equivalents)	0.66 (=1.33 /2wks)	0.34 (=0.69 /2wsk) (10 no set-outs)	-0.32
Average Blue Box set-outs for all households (full box equivalents)	0.93 (1 no set-out)	0.68 (9 no set-outs)	-0.25
Average Green Bin set-outs for all households (full bin equivalents)	0.43 (1 no set-out)	0.33 (10 no set-outs)	-0.10

Of the 10 households with residual waste set out during the pilot study, only four had used clear bags as directed; the remainder used opaque (black/green) bags. Under the pilot program, residents who set out garbage in opaque bags still had their waste collected but were given a reminder notice by the Town of Markham monitoring staff. The clear garbage bags that were placed at the curb often contained opaque bags (kitchen catchers, grocery bags), which made it difficult or impossible to visually identify the types of materials contained inside (see Fig. 3.1).



Figure 3.1 Clear Garbage Bag Curbside Set-out on Right

### 3.2 Curbside Waste Generation, Recovery and Composition

A detailed breakdown of the waste audit results can be found in Appendix D. The weights for every category of material sorted, annual generation rates (kilograms/household/year), and capture rates for recyclables and organics are presented for the pre-pilot and pilot audits.

### 3.3 Blue Box Recyclables

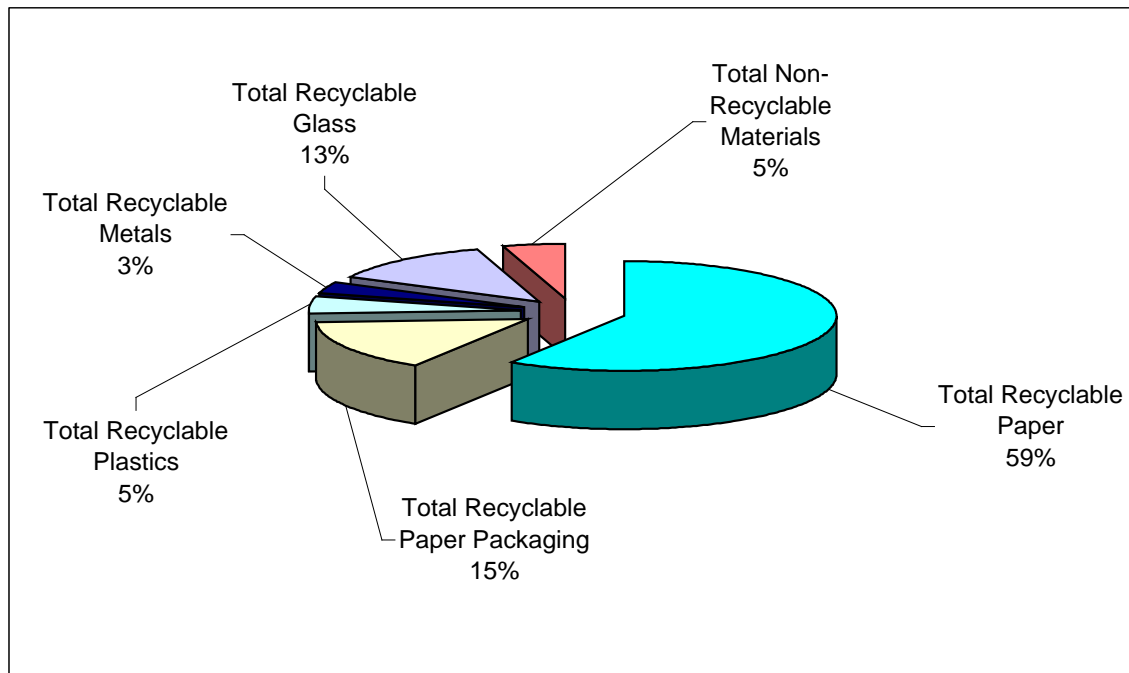
Table 3.2 summarizes the audit results and capture rates for the pre-pilot and pilot recycling stream (Blue Boxes). The overall capture rate for recyclable Blue Box materials was approximately 91.17% in the pre-pilot audit, but dropped to 87.49% in the pilot audit. Recyclable metals had the lowest capture rate in the pre-pilot sample, at 72.62%, while recyclable plastics had the lowest capture rate in the pilot sample, at 79.57%. Recyclable paper accounted for the largest proportion of the Blue Box stream by weight in both samples (see Figs. 3.2 and 3.3). Non-recyclable waste (contamination) accounted for 4.67% of the total weight of material placed in the Blue Box in the pre-pilot sample, which increased to 7.28% in the pilot sample.

**Table 3.2 Blue Box Generation and Capture Rates**

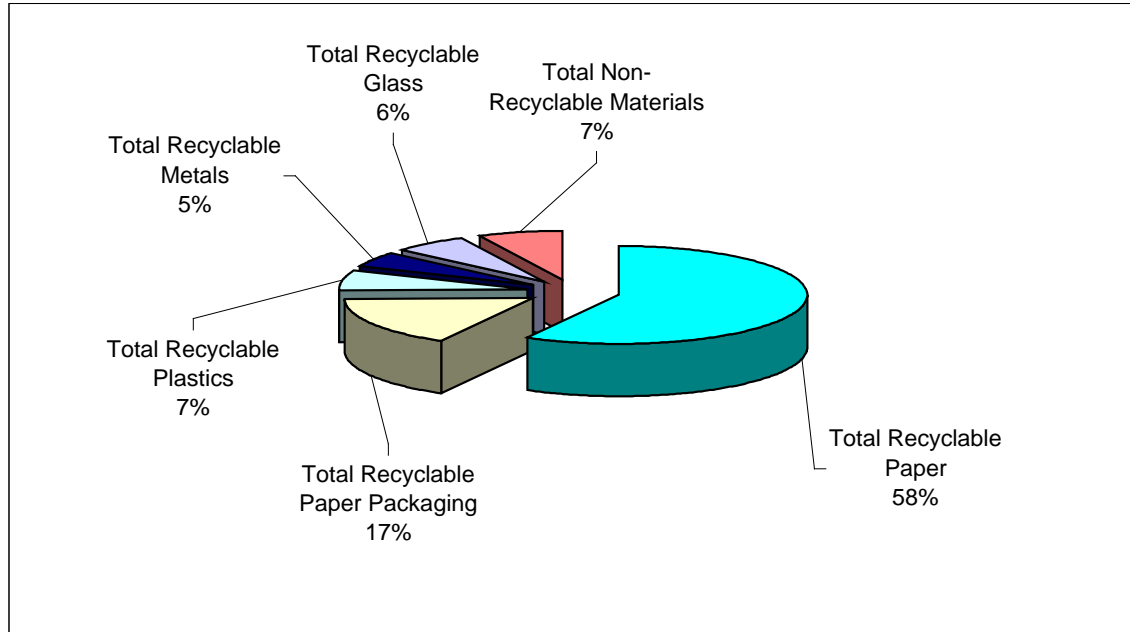
Blue Box Material Category	Pre-Pilot				Pilot			
	Diverted kg	Disposed kg*	Total kg	Capture Rate	Diverted kg	Disposed kg*	Total kg	Capture Rate
Recyclable Papers	58.25	3.17	61.42	94.85%	32.91	4.01	36.92	89.14%
Recyclable Paper Packaging	15.23	3.06	18.29	83.29%	9.42	1.88	11.30	83.40%
Recyclable Plastics	5.07	1.06	6.13	82.78%	3.70	0.95	4.65	79.57%
Recyclable Metals	3.09	1.17	4.26	72.62%	2.88	0.53	3.41	84.46%
Recyclable Glass	12.81	0.71	13.52	94.75%	3.53	0.13	3.66	96.45%
<b>Total</b>	<b>94.45</b>	<b>9.15</b>	<b>103.60</b>	<b>91.17%</b>	<b>52.44</b>	<b>7.50</b>	<b>59.94</b>	<b>87.49%</b>

Sample = 20 Households

\* Disposed includes blue box materials in the residual waste stream and the Green Bin organics stream



**Figure 3.2 Composition of Blue Box Materials By Weight (Pre-Pilot)**



**Figure 3.3 Composition of Blue Box Materials By Weight (Pilot)**

### 3.4 Green Bin Organics

Table 3.3 summarizes the audit results and capture rates for the organics stream (Green Bin). The overall capture rate for Green Bin organic materials was approximately 78.71% in the pre-pilot audit, dropping to 67.72% for the pilot audit. Excluding materials that can be accepted in both the blue box and green bin (molded pulp, newsprint, corrugated), shredded paper had the highest capture rate at 100% in the pre-pilot audit and the pilot audit. Food waste had the second highest capture rate at 87.51% pre-pilot, and 77.84% for the pilot. The lowest capture rate was for tissue/toweling (31.66% pre-pilot, 41.10% pilot).

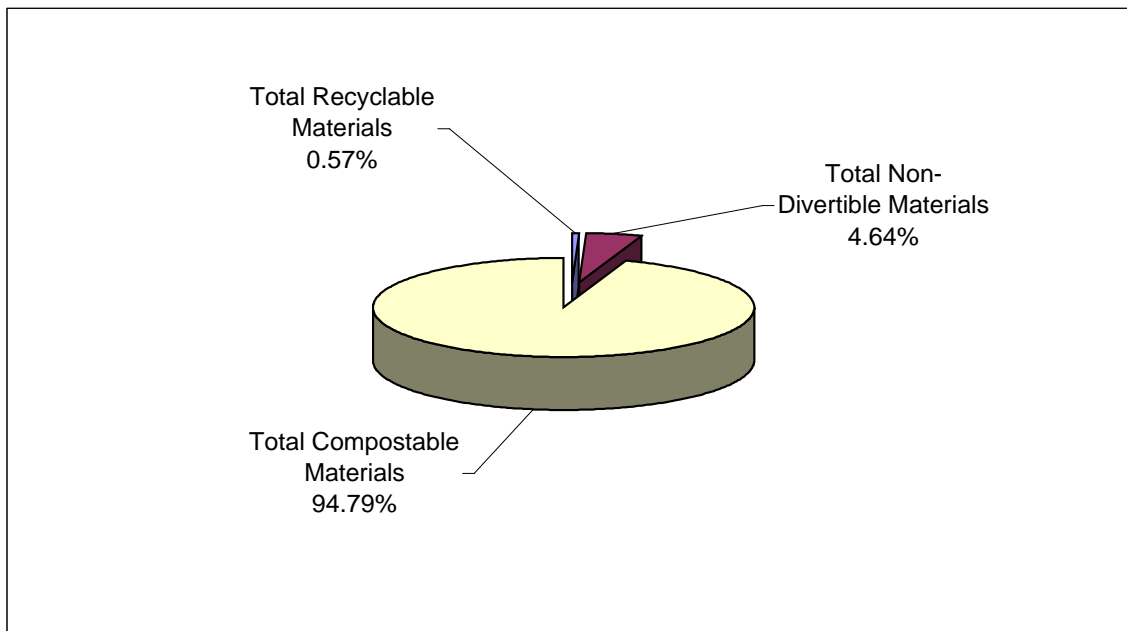
Residual waste and/or recyclables (contamination) accounted for 5.21% of the total weight of the pre-pilot Green Bin sample and 5.33% of the pilot sample (see Figs. 3.4, 3.5); note, however, that residents are permitted to use polyethylene film to contain materials in their Green Bins, and this material is included among the non-divertible component in the bins. This material comprised 3.70% of the pre-pilot sample and 2.41% of the pilot sample, omitting the plastic bags, contamination rates are 1.51% for the pre-pilot sample and 2.92% for the pilot sample.

**Table 3.3 Green Bin Generation and Capture Rates**

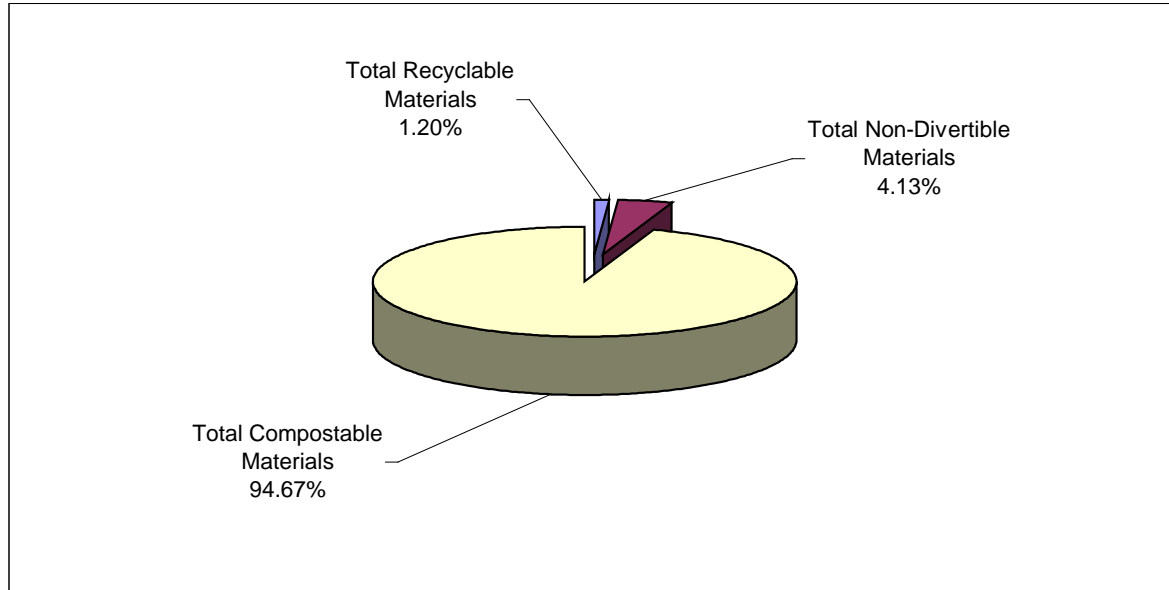
Green Bin Material Category	Pre-Pilot				Pilot			
	Diverted kg	Disposed kg*	Total kg	Capture Rate	Diverted kg	Disposed kg*	Total kg	Capture Rate
**Newsprint	0.09	**	0.09	**	0.17	**	0.17	**
Shredded Paper	0.24	0.00	0.24	100.00%	0.17	0.00	0.17	100.00%
**Corrugated	0.00	**	0.00	**	0.26	**	0.26	**
**Molded Pulp	0.01	**	0.01	**	0.00	**	0.00	**
Tissue/Toweling	1.95	4.21	6.16	31.66%	1.34	1.92	3.26	41.10%
Food Waste	64.52	9.21	73.73	87.51%	44.35	12.63	56.98	77.84%
Pet Waste	7.49	1.67	9.16	81.77%	4.16	5.36	9.52	43.70%
Diapers/Sanitary	7.34	7.00	14.34	51.20%	4.79	6.425	11.22	42.71%
<b>Total</b>	<b>81.64</b>	<b>22.09</b>	<b>103.73</b>	<b>78.71%</b>	<b>55.24</b>	<b>26.33</b>	<b>81.57</b>	<b>67.72%</b>

Sample - 20 Households

\* Disposed includes materials in the residual waste stream (adjusted for weekly generation) and the Blue Box stream, but \*\*does *not* include dual-use materials (these are considered lost from the blue box program rather than the green bin program and thus are not counted again here).



**Figure 3.4 Composition of Green Bin by Weight (pre-pilot)**



**Figure 3.5 Composition of Green Bin by Weight (pilot)**

### 3.5 Residual Waste

Figures 3.6 and 3.7 summarize the composition of the residual waste stream for the pre-pilot and pilot samples, respectively. Approximately 48.63% of the pre-pilot residual waste (by weight) consisted of materials not accepted in either the Blue Box or Green Bin programs; this decreased to 29.13% for the pilot. The largest components of the non-accepted materials in the pre-pilot sample were durable plastic products, accounting for 8.63% of the residual waste stream, and polyethylene plastic bags and film (non-packaging), accounting for 4.83% of the residual waste stream. In the pilot sample, the largest components of the non-accepted materials were polyethylene plastic bags and film (packaging), accounting for 4.84% of the residual waste stream, and small kitchen appliances, accounting for 4.44% of the residual waste stream.

In both samples, substantial amounts of divertible materials ended up in the residual waste stream. In the pre-pilot sample, acceptable green bin materials represented 36.87% of the residual waste stream; this increased to 56.13% in the pilot sample. The largest component of this was food waste in both samples, representing 15.42% of the residual waste stream in the pre-pilot sample and 26.44% of the residual waste stream in the pilot sample. Similarly, recyclable materials accounted for 14.50% of the residual waste stream in the pre-pilot sample and 14.74% of the residual waste stream in the pilot sample. In the pre-pilot sample, the most prevalent recyclable material was mixed fine paper, at 3.03% of the residual waste stream, while in the pilot sample the most prevalent recyclable material was other newsprint (flyers etc), which represented 3.43% of the residual waste stream.

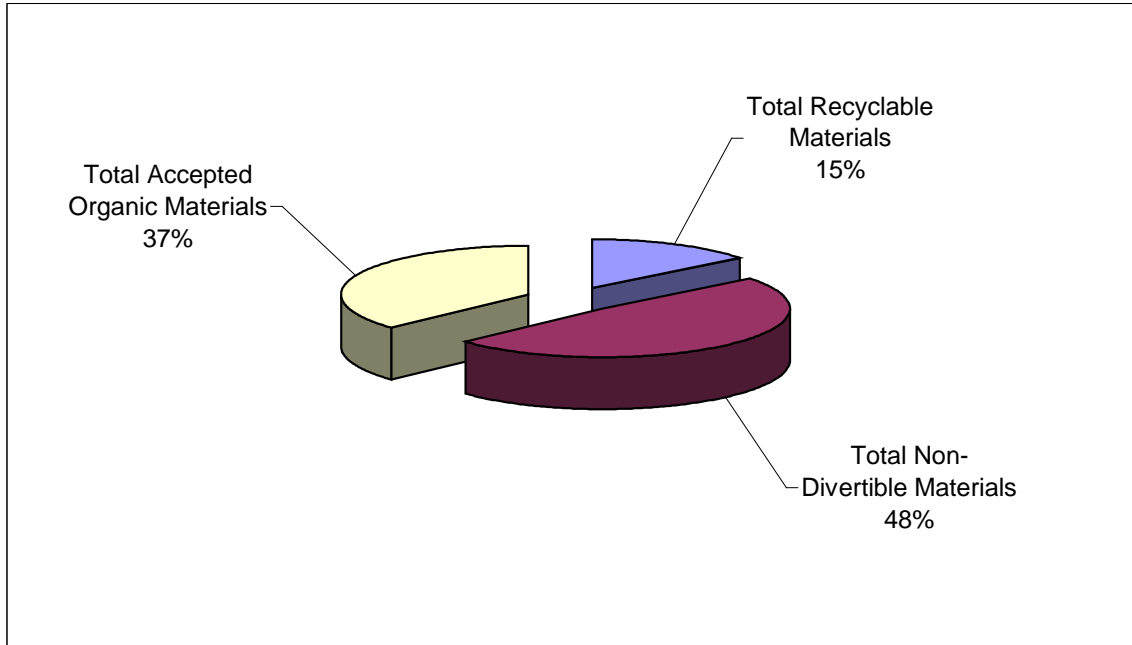


Figure 3.6 Composition of Residual Waste by Weight (pre-pilot)

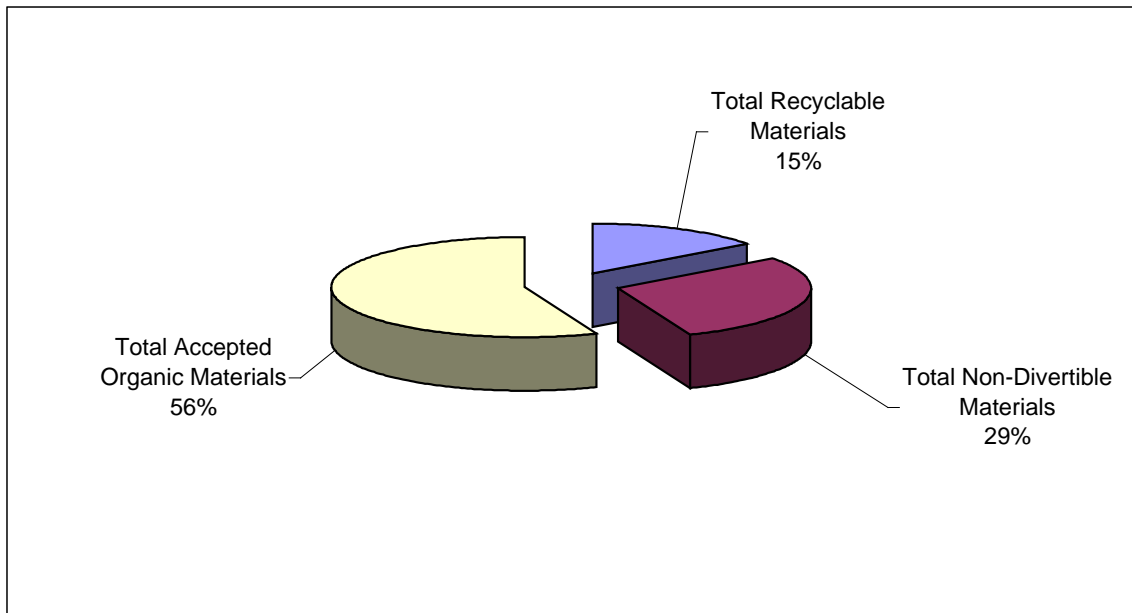


Figure 3.7 Composition of Residual Waste by Weight (pilot)

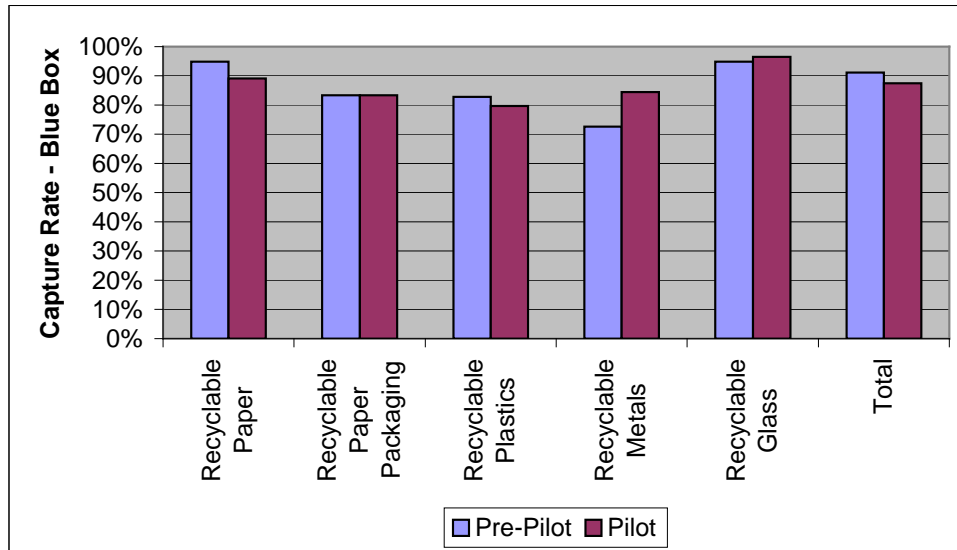
### 3.6 Pre-Pilot Versus Pilot Audit Results

Table 3.4 summarizes the audit results for the pre-pilot and pilot audits.

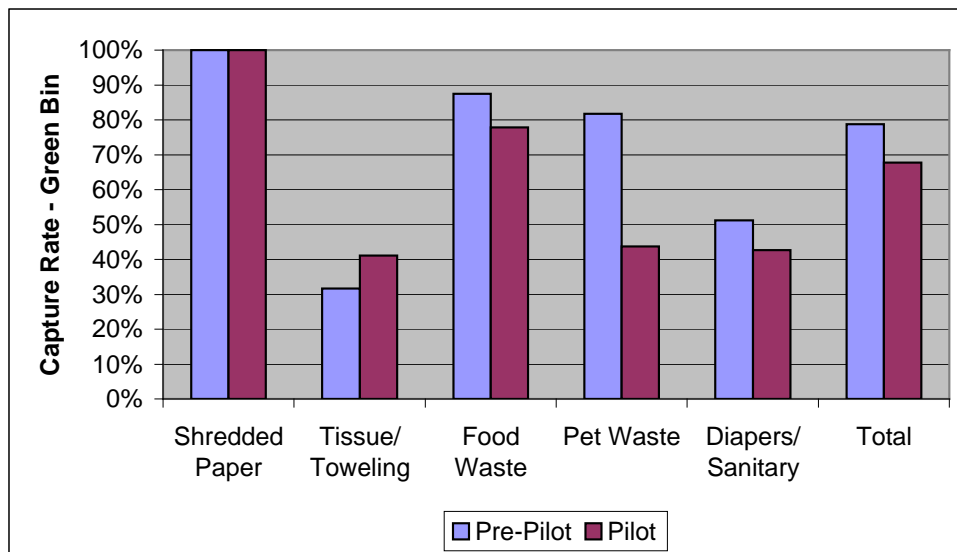
**Table 3.4 Pre-Pilot Versus Pilot Summary**

	Pre-Pilot	Pilot
Green Bin Generation (kg) *	86.13	58.35
Blue Box Generation (kg)*	99.08	56.56
Residual Waste Stream Generation (kg) **	59.71	46.09
Total Waste Generation (kg)	244.92	161.00
Capture Rate - Green Bin (%)	78.71%	67.72%
Capture Rate - Blue Box (%)	91.17%	87.49%
<b>Total Waste Diversion (%)</b>	<b>71.90%</b>	<b>66.88%</b>
* Total weights for 20 household sample		
** Bi-weekly Residual Waste Stream result divided by 2 to obtain weekly generation weight for accurate calculations with weekly Green Bin and Blue Box collection.		

Pre-pilot versus pilot data analysis has revealed that the introduction of the clear bag collection program has not increased the overall curbside waste diversion rate; in fact the diversion rate has dropped from 71.90% to 66.88%. Detailed breakdowns of Blue Box and Green Bin materials, with the capture rates of each material category, are shown in Figures 3.8 and 3.9. As shown in Tables 3.2 and 3.3, above, capture rates have decreased for most materials, although they have increased modestly for recyclable paper packaging, metals, glass, and tissue/toweling. Further studies would be required to determine whether the observed changes in diversion rates represent an anomaly, seasonal fluctuation or a sustained pattern. In particular, it would be desirable to conduct another study once the proper enforcement regime is in place, in order to establish whether increased compliance with the clear bag policy would alter the results of the study.



**Figure 3.8 Blue Box Capture Rates Pre-Pilot Versus Pilot**



**Figure 3.9 Green Bin Capture Rates Pre-Pilot Versus Pilot**

The estimated average weight of garbage set out for landfill disposal fell from approximately 155.25 kg/hh/yr for the pre-pilot sample to approximately 119.83 kg/hh/yr for the pilot sample. The estimated average weight of Blue Box materials set out dropped from approximately 257.61 kg/hh/yr pre-pilot to approximately 147.06 kg/hh/yr for the pilot sample. The estimated average weight of Green Bin materials set out dropped from approximately 223.94 kg/hh/yr pre-pilot to approximately 151.71 kg/hh/yr for the pilot sample. Note that annual generation rates (kg/hh/yr) are calculated on the total number of households in the sample group (20), and only 12 of the 20 households in the sample group had set out materials on the day of the pilot audit.

## 4.0 CONCLUSIONS

The data collected and analyzed by AET Consultants from the July 17, 2007 pre-pilot waste composition audit and the December 18, 2007 clear garbage bag pilot waste composition audit have yielded the following conclusions:

- 10 of the 20 households in the sample group had garbage set out on the pilot audit date. Only four out of the ten households that set out waste complied with the clear garbage bag directive; the remainder used black/green opaque bags.
- The clear garbage bags that were set out at the curb were often filled with opaque bags (i.e. kitchen catchers, grocery bags), which made it difficult or impossible to visually identify material contents.
- 91.17% of accepted recyclable materials were being captured in the Blue Box in the pre-pilot audit, while 87.49% of accepted recyclable materials were being captured in the Blue Box in the pilot audit.
- The overall waste diversion rate decreased from 71.90% in the pre-pilot audit to 66.88% in the pilot audit.
- The average number of residual waste items set out fell from 0.66 full bag equivalents per household per week (1.33 items biweekly) in the pre-pilot audit to 0.34 full bag equivalents per household per week (0.69 items bi-weekly) in the pilot audit.
- The average number of Blue Boxes set out decreased from 0.93 full box equivalents per household per week to 0.68 full box equivalents per household per week over the same period.
- The average number of Green Bins set out decreased from 0.45 full bin equivalents per household per week to 0.33 full bin equivalents per household per week over the same period.
- 78.71% of accepted organic materials were being captured in the Green Bin in the pre-pilot audit, while 67.72% of accepted organic materials were being captured in the Green Bin in the pilot audit.
- In the pre-pilot audit, divertible materials comprised 51.37% of the residual waste stream (36.87% Green Bin organics, 14.50% Blue Box recyclables); in the pilot audit, divertible materials comprised 70.87% of the residual waste stream (56.13% Green Bin organics, 14.74% Blue Box recyclables).

- Non-recyclable waste in the Blue Box accounted for 4.67% of the total weight of the pre-pilot sample but 7.28% of the total weight of the pilot sample.
- Non-compostable waste in the Green Bin accounted for 5.21% of the total weight of the pre-pilot sample and 5.33% of the pilot sample.

#### 4.1 Limitations

Seasonal variability, holidays and weather, among other factors, can affect the amount and composition of waste, organics and recyclables generated by households. Collecting multiple samples over several weeks and seasons would help smooth out uncharacteristic occurrences in single sample audits. Further studies are recommended to determine if Green Bin and Blue Box set outs and generation rates remain constant over the bi-weekly residual waste collection schedule. It was assumed that Green Bin and Blue Box set out and generation rates were the same on weeks when residual waste is not collected. Annual generation rates (kg/hh/yr) and set-out rates were calculated based on the original pre-pilot sample group of 20 houses, whether or not they had set-outs during the pilot audit. Larger sample sizes (50-100 households) are also recommended for any future studies to obtain more representative results. The pre-pilot sample selection methodology of choosing only households with set-outs may not be representative of average neighbourhood set-out and generation habits. It is recommended that future sample selection methodology select a pre-determined sample group, considering all households within the group as part of the sample, regardless of whether or not they have set-outs.

#### 4.2 Disclaimer

AET Consultants makes no warranty and assumes no liability for the information contained in this report outlining the waste audit results. These results reflect measurements made from a one day sample (1 week Green Bin & Blue Box, 2 weeks Residual Waste) as described in the methodology. As such, waste generation measurements should be considered snapshots and may not reflect accurately conditions across all Markham households at all times of the year. These reported generation and diversion rates more accurately reflect the quantity of each material generated over one (Green Bin & Blue Box) and two week(s) (Residual Waste) for the sample area and have been extrapolated to calculate annual rates based on the annual collection schedule.

Respectfully submitted,

**AET CONSULTANTS INC.**

Mike Keenan, BSc, BA  
Environmental Technician

Ben Dunbar, BES, CEPIT, LEED AP  
Project Coordinator

## Appendix A - Town of Markham - Clear Garbage Bag Pre-Pilot Waste Collection Log

Sample Area: JOHNSVIEW VILLAGE

NOTE: DO NOT COLLECT FROM HOMES WITHOUT A SETOUT

Collector's Name: Summer Students

Date: 17-Jul-07

Weather: sunny and clear

Time: 8:30 AM

Entry	Street Name	House	Garbage			Blue Box				Green Bin			Notes/Observations
		#	Bags	Full Bag Equivalents (in 1/4s)	No Set Out	Boxes	"Fullness" (in 1/4s)	Overflowing	No Set Out	Bins	"Fullness" (in 1/4s)	No Set Out	
1	Porterfield Cres	69	1	1.00		2	2.00			1	0.50		
2	Porterfield Cres	73	1	1.00		1	0.75			1	0.25		
3	Porterfield Cres	3	1	0.75		1	0.75			1	1.00		
4	Niles Way	79	3	3.00		1	1.00			1	0.25		Lots of organics and recycling in garbage
5	Niles Way	41	2	2.00		1	1.50	1		1	1.00		
6	Niles Way	11	3	3.00		1	0.75			1	0.25		
7	Harper Way	27	1	0.75		1	0.75			1	0.25		
8	Norris Way	19	1	1.00		1	1.00			1	0.25		
9	Norris Way	20	1	1.00		0	0.00		X	1	0.50		
10	Norris Way	3	1	1.00		1	1.50	1		1	0.75		
11	Norris Way	5	1	1.00		1	0.50			1	0.25		
12	Corkory Way	2	2	2.00		2	0.75			1	0.50		
13	Bowman Way	25	2	2.00		2	0.75			1	0.25		
14	Norris Way	43	1	1.00		2	2.00			1	0.50		
15	Norris Way	41	1	1.00		1	1.00			1	0.25		
16	Norris Way	37	1	1.00		2	0.75			1	0.50		
17	Norris Way	33	1	1.00		2	0.63			1	0.25		Microwave oven and oversized cardboard
18	Norris Way	31	1	1.00		2	0.75			1	0.50		
19	Norris Way	29	1	1.00		1	0.50			0	0.00	X	
20	Norris Way	27	1	1.00		2	1.00			1	0.50		
<b>Avg per participating household</b>			1.35	1.33		1.42	0.98			1.00	0.45		

### Appendix B - Town of Markham - Clear Garbage Bag Pilot Waste Collection Log

**Sample Area:** JOHNSVIEW VILLAGE **NOTE: COLLECT ONLY FROM HOMES ON THE LIST**  
**Collector's Name:** B. Marissen **Date:** 18-Dec-07  
**Weather:** Dark, cold **Time:** 7:05 AM - 8:15 AM

Entry	Street Name	House	Garbage			Blue Box				Green Bin			Notes/Observations
		#	Bags	Full Bag Equivalents (in 1/4s)	No Set Out	Boxes	"Fullness" (in 1/4s)	Overflowing	No Set Out	Bins	"Fullness" (in 1/4s)	No Set Out	
1	Porterfield Cres	69	0	0.00	X	0	0.00		X	0	0.00	X	
2	Porterfield Cres	73	1	0.50		0	0.00		X	1	0.25		Clear bag
3	Porterfield Cres	3	0	0.00	X	1	1.00			1	1.00		
4	Niles Way	79	2	1.50		1	1.00			0	0.00	X	Clear bag
5	Niles Way	41	2	2.00		1	1.00			1	1.00		Clear bag
6	Niles Way	11	4	3.50		1	1.00			0	0.00	X	Opaque bag
7	Harper Way	27	0	0.00	X	2	2.00	1 clear bag 1 OCC box		1	1.00		Hauler collected garbage on this street.
8	Norris Way	19	0	0.00	X	0	0.00		X	0	0.00	X	
9	Norris Way	20	0	0.00	X	0	0.00		X	0	0.00	X	
10	Norris Way	3	0	0.00	X	0	0.00		X	0	0.00	X	
11	Norris Way	5	1	1.00		1	1.00			1	0.25		Opaque bag
12	Corkory Way	2	0	0.00	X	0	0.00		X	0	0.00	X	
13	Bowman Way	25	0	0.00	X	0	0.00		X	0	0.00	X	
14	Norris Way	43	1	1.00		1	1.00			1	0.50		Opaque bag
15	Norris Way	41	1	1.00		1	1.50	X		1	0.25		Opaque bag
16	Norris Way	37	2	1.50		1	1.00			1	0.50		Clear bag
17	Norris Way	33	1	0.75		2	1.00			1	0.75		Opaque bag
18	Norris Way	31	0	0.00	X	0	0.00		X	0	0.00	X	
19	Norris Way	29	0	0.00	X	0	0.00		X	0	0.00	X	
20	Norris Way	27	1	1.00		2	2.00			1	1.00		Opaque bag
<b>Avg per participating household</b> 1.60    1.38    1.27    1.23    1.00    0.65													