

Public Space Recycling Project Assessment

City of Toronto

Project delivered with assistance from the Waste Diversion Ontario's Continuous Improvement Fund.

CIF- 548.7 Public Space Recycling Phase I

CIF- 396: Public Space Recycling: Phase II

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Executive Summary

With the City of Toronto working aggressively to achieve their goal of 70% waste diversion, they began looking internally into their own operations. In 2009, the City Manager directed Solid Waste Management Services to negotiate a Service Partnership Agreement with Parks, Forestry and Recreation that transferred the responsibility for providing waste and recycling pickup services in parks to Solid Waste Management Services. This service transfer began in 2010 in Scarborough and North York in 2011. Etobicoke –York and Toronto and East York districts followed, beginning in 2012, and Waterfront parks, beginning in 2013. The arrangement to replace the Park's wire mesh receptacles with a semi automated cart system helps the City achieve four key goals:

1. Operating efficiently
2. Increasing diversion from landfill
3. Maintaining clean and safe parks
4. Improving worker health and safety

The new semi-automated cart system consists of 360L wheeled carts which can be attached to and tipped by the collection vehicles. These vehicles were retrofitted with mechanical arms that lift the waste into the vehicle's hopper. Installation of this new system occurred in two phases, which was supported with financial assistance from Waste Diversion Ontario's Continuous Improvement Fund (CIF). Phase I received \$96,672 from the CIF. Phase II received \$383,129 from the CIF.

As part of the CIF's funding requirements, the City of Toronto developed and implemented a monitoring and reporting plan for this project. As a part of this plan, the City of Toronto contracted AET Consultants to conduct a waste audit on 340 litter and recycling carts at 30 parks around the city. The audit took place over the course of a two week period. AET sorted into 33 material categories classified as recyclable items, non-recyclable items, pet waste, green bin materials, other organics, illegally deposited waste, hazardous waste and other waste.

The scale house records and the Public Space Recycling audit were used to compare the effectiveness of the new Public Space Recycling program before and after implementation of the project. Additionally, interviews were conducted with collection crews and parks staff to assess how the new semi-automated cart system is performing in comparison to the old wire mesh receptacles.

The diversion rate in park receptacles increased from 14% in 2008 to 22% in 2013. Also, the capture rate has improved from 51%, in 2008, to 68%, in 2013, and contamination has decreased from 41% to 34%. The amount of "other organics" in the litter and recycling streams has also been reduced since project implementation.

The 2013 audit revealed that largest component of the litter stream were; Green bin material (38%), illegally dumped material (21%), pet waste (20%), recyclable items (13%), and non-recyclable items (4%). The only significant change in waste composition from the 2008 audit was an 11% decrease in non-recyclable material and 17% increase in green bin material.

The 2013 audit also revealed that the largest components of the recycling stream were recyclable items (52%), green bin material (24%), illegally dumped material (11%), pet waste (5%), and non-recyclable items (5%). In the litter stream, between the 2008 and 2013, the only material categories that experienced a significant change were non-recyclable items (14% increase) and green bin material (11% decrease).

The audit data and feedback from staff indicates that the new semi-automated cart system has improved the waste management systems by improving diversion, the capture of recycling, the efficiency of collection and reducing workplace injuries.

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1 Background

1.1 City of Toronto

The City of Toronto is the largest urban centre in Canada, with a population of 2.7 million people. With such a large population, the collection and management of waste has become an important issue. As such, the City seeks:

"To be a leader in providing innovative waste management services to residents, businesses and visitors within the City of Toronto in an efficient, effective and courteous manner, creating environmental sustainability, promoting diversion and maintaining a clean city"

Mission Statement- Solid Waste Management Services

The City of Toronto has set an aggressive 70% waste diversion target and implements many different waste management policies and programs to achieve this goal, including:

- Source Reduction Initiatives
- Green Bin Organics in Apartments/Condos
- Enforcement Mandatory Diversion By-law
- Volume Based Rate Structure/Billing System
- New Materials for Recycling
- Improved Recycling Capacity
- Reuse/Disassembly of Durable Goods for Recycling
- Townhouse Collection
- Biogas Composting Facility

So far, the City has achieved 66% waste diversion from single family residences and 24% waste diversion from multi-family residences. It seeks to set an example for the community and educate them by improving their own internal public-facing operations.

1.2 Toronto Parks System

The Toronto Parks Systems consists of 1500 parks located across four districts; Etobicoke York (West), North York(North), Toronto and East York(South), and Scarborough (East). The park locations in the City of Toronto are illustrated in Figure 1-1. The parks included in the audit range in size between 0.1 acres and 485 acres and are classified by park type and usage into four categories:

Destination Parks: attracts citizens from across Toronto and/or is a tourist destination spot. Often have numerous facilities including pools, playgrounds, sports fields, picnic areas, etc.;

Regional Parks: attracts visitors from across the City for special events and sports. Often have numerous facilities including pools, playgrounds, sports fields, picnic areas, etc.;

Neighbourhood Parks: primary users are people from the local neighbourhood. They typically have playgrounds, wading pools/splash pads;

Parkettes: defined by limited size and limited or no amenities.

Collection of this waste is undertaken by the Solid Waste Management Services division, who took over collection services in 2009 from the Parks and Forestry Division of the City of Toronto.

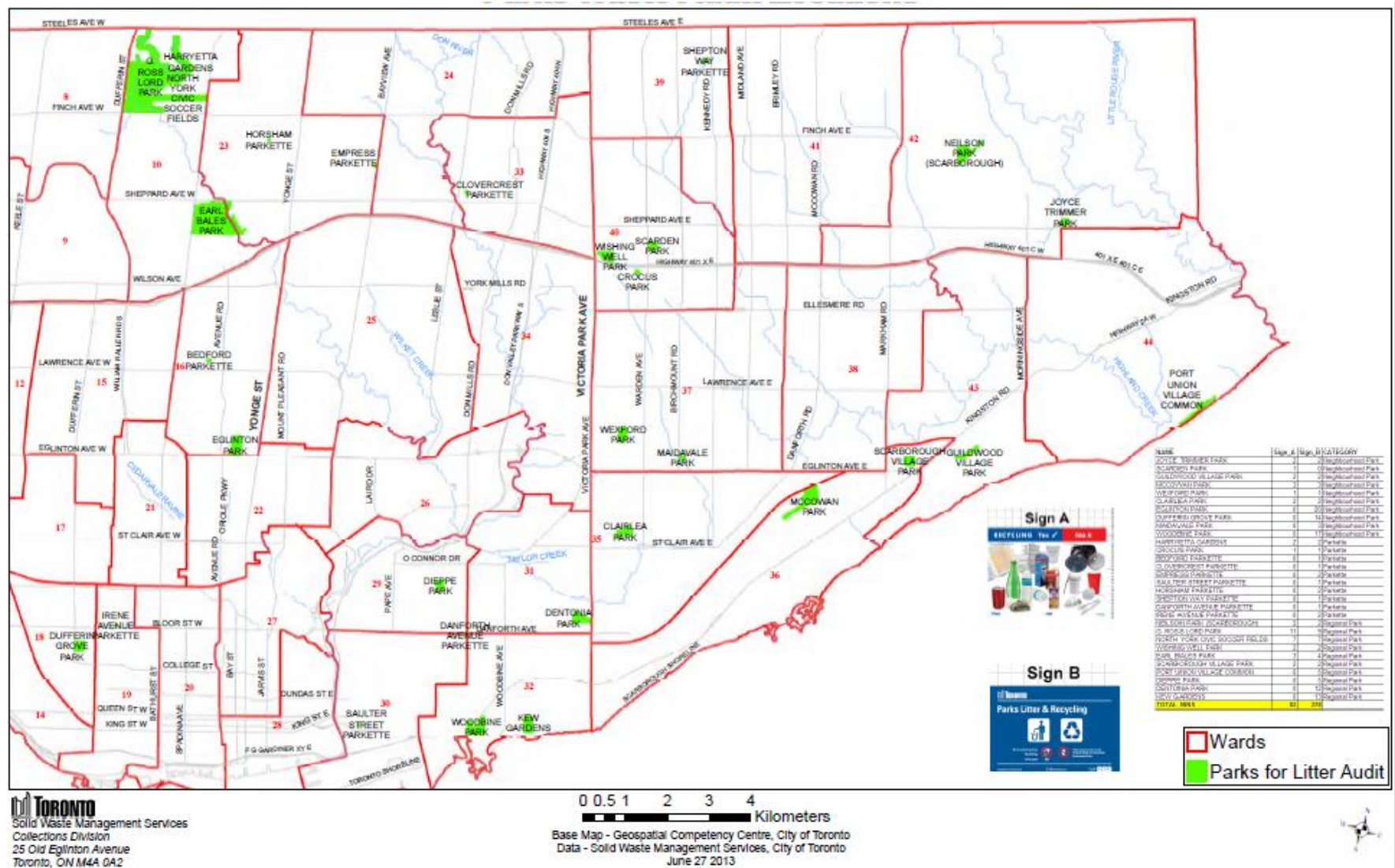


Figure 1-1. Map of the City of Toronto illustrating audited park locations

1.3 Pre-implementation Waste Management System

Waste is collected in two source separated streams; litter and recycling. The recycling stream includes all material included in the City of Toronto's residential recycling program. The litter stream includes all other wastes generated within the parks, except for leaf and yard waste collected by parks maintenance staff.

City of Toronto parks receptacles are not meant as a substitute for residential or commercial waste collection. It is illegal (under municipal by-law 548) to place residential or commercial waste in parks collection receptacles. If caught and convicted, offenders may receive a fine of up to \$10,000 for individuals and \$50,000 for commercial organizations.

Litter and recycling were most commonly collected in blue (for recycling), or black or dark green (for garbage) steel mesh receptacles (illustrated in Figure 1-2). These receptacles were sometimes covered by a clasped lid with a 6" diameter hole. This hole permits the passage of most beverage containers and paper. Often, a large clear (for recycling) or black (for garbage) bag was placed in these bins. A graphic identifier was placed on the side of each recycling receptacle. A sticker label was also located on most recycling receptacle lids to show all acceptable recyclable materials.



Figure 1-2. Photograph of the steel mesh litter (left) and recycling receptacles (right)

In order to collect waste, two parks staff members unlocked and removed the clasped lids. Next, they removed the bag containing the waste material. Heavy or overflowing bags were split into several smaller bags and carried manually to the collection vehicle. New bags were inserted into the receptacles and tied down at the corners. The clasped lids were placed back on the receptacle and re-secured.

The resulting bags were manually loaded onto packer trucks and pick-up trucks which were operated by the Parks, Forestry and Recreation division.

1.4 Potential Areas for Improvement

After the Solid Waste Management Services division overtook responsibility for waste collection in the City of Toronto parks system, they identified the following areas that should be addressed to improve the efficiency of the current system:

- Labour and time associated with two person bag removal.
- Rainwater infiltration into the litter and recycling bags through the wire mesh receptacles.
- Resident recognition and differentiation between the wire mesh receptacles for litter and recycling.
- The physical stress on staff due to manually delivering bags to the collection vehicles.
- The ability of scavenging animals to access and damage litter and recycling bags.

2 Public Space Recycling Project

The City of Toronto decided to replace the existing wire receptacles within parks with 360 litre wheeled carts that are collected with automated lifters; and increase the signage to promote recycling opportunities within each park (Wheeled carts are illustrated in Figure 2-1). This project was completed in two phases:

2.1 Phase I: Semi-Automated Cart Pilot (CIF Project 548.7)

In 2010, the City of Toronto replaced the existing wire mesh receptacles with 360 litre wheeled garbage and recycling carts in the North and East park districts. These carts were designed so that they could be lifted by a semi-automated mechanical arm. Along with these carts, new litter and recycling signs were purchased to raise community awareness and participation in the Public Space Recycling program. In total, 2,200 360 litre garbage and recycling carts and 600 litter/recycling signs were purchased.

2.2 Phase 2: Expanding the Semi-Automated Cart System (CIF Project 396)

By early 2011, the remaining wire mesh receptacles were replaced with 4,500 360 litre wheeled carts. These carts were supplemented with an education and awareness program employing an additional 3,000 litter and recycling signs. Furthermore, in order to support the use of these new garbage and recycling carts, the City of Toronto retrofitted 24 collection vehicles with semi-automated mechanical lift arms.



Figure 2-1. Photograph of the new recycling (left) and litter (right) 360L wheeled carts secured to a pole in the Semi-Automated Cart system.

2.3 Monitoring and Measuring Strategy

As part of Phase I and Phase II of the project, the City of Toronto compiled data before and after project implementation to assess the new system's effectiveness. This data was collected through waste audits, assessing the composition of the litter and recycling stream, and weigh scale tonnage before and after implementation of the project. The City of Toronto also interviewed collection crews and parks staff for their observation about the effectiveness of the new and old programs.

2.4 Changes to the Collection System

The new procedure for the collection of new garbage and recycling carts is a single person operation. Carts are unclipped from pole and lids on domed totes are unlocked. Bins are then wheeled to a side loading truck and attached to lifting device, where they are hoisted mechanically and deposited into the vehicle's hopper. Once dumped, the bins are wheeled back to pole and re-secured.

As part of this program, the City of Toronto also began creating new collection areas and schedules. This allowed them to collect data and design more efficient pickup routes using their new advanced routing program, Route Smart.

2.5 Continuous Improvement Fund Financial Assistance

This project has been delivered with the assistance of Waste Diversion Ontario's Continuous Improvement Fund, a fund financed by Ontario municipalities and steward of blue box waste in

Ontario. The Continuous Improvement Fund (CIF) contributed \$96,672 dollars to Phase I of the project and \$383,129 to Phase II of the Public Space Recycling Project.

CIF's contribution to each phase of the project is presented in Table 2-1 and Table 2-2.

Table 2-1. Financial assistance provided by Continuous Improvement Fund for Phase I of the Public Space Recycling Project (CIF- 548.7)

Deliverables	Tasks / Description	WDO Grant Contribution* (including taxes)
Development of Monitoring & Reporting Strategy	Development of a monitoring and measuring strategy for both Public Space Recycling – Phase 1 & 2 projects (CIF #548.7 & #396) to the satisfaction of the CIF. Refer to CIF Project Monitoring & Reporting guidance document.	\$9,667 (10% of funding)
Proof of Purchase	The City of Toronto will provide documentation confirming receipt of and full payment for 2,220 recycling bins (360 l). Provide documentation confirming receipt and installation of 600 litter/recycling signs.	\$62,837 (65% of funding)
Monitoring, data analysis, final report and project evaluation	Submission of a combined final report summarizing both Public Space Recycling – Phase 1 & 2 projects (CIF #548.7 & #396), including performance, impact and learning's, i.e. analysis on the practicality/limitations of using auto carts in parks.	\$24,168 (25% of funding)
Total		\$96,672

Table 2-2. Financial assistance provided by Continuous Improvement Fund for Phase II of the Public Space Recycling Project (CIF- 396)

Deliverables	Tasks / Description	WDO Grant Contribution* (including taxes)
Proof of Purchase	<p>The City of Toronto will provide documentation confirming receipt of and full payment for 4,500 recycling bins (360 l).</p> <p>Provide documentation confirming receipt and installation of 3,000 litter/recycling signs.</p>	<p>\$229,877</p> <p>(60% of funding)</p>
Proof of Installation	The City of Toronto will provide documentation confirming installation of 24 semi-automated lifters	<p>\$57,470</p> <p>(15% of funding)</p>
Monitoring, data analysis, final report and project evaluation	Submission of a combined final report summarizing both Public Space Recycling – Phase 1 & 2 projects (CIF #548.7 & #396), including performance, impact and learning, i.e. analysis on the practicality/limitations of using auto carts in parks.	<p>\$95,782</p> <p>(25% of funding)</p>
Total		\$383,129

3 Methodology

3.1 Audit Scope

The main purpose of the 2013 public space waste audit was to generate detailed information about waste composition in City of Toronto parks and to determine the effectiveness of the new collection system and containers. The goals of this study were to:

- Determine the composition of waste generated by the City of Toronto Parks System
- Determine the effectiveness of current waste management strategies, by:
 - Using standard waste management metrics such as diversion rate, capture rate and contamination rate
 - Interviewing collection crew and parks staff to obtain their observations on effectiveness of the new system versus the old system
- Identify the effect of replacing manual collection with semi-automated collection by comparing these results to those of the 2008 Public Space Recycling waste audit
- Assess the effectiveness of the different types of signs. Signs designated Sign A (Figure 3-1) display materials that are accepted or are not accepted are displayed as pictures. Whereas, Sign B (Figure 3-2) has a much simpler text and graphics oriented design



Figure 3-1. Sample of sign type A used to identify in waste receptacles City of Toronto Parks



Figure 3-2. Sample of sign type B used to identify waste receptacles in City of Toronto parks

3.2 Audit Methodology

The audit took place over the course of a two week period between August 13 and August 22, 2013. A total of 340 carts were scheduled to be audited (170 paired litter and recycling carts), however, 17 carts (8 litter and 9 recycling carts) were either not present for auditing or the auditors were unable to open the lid to access the contained material (seized locks).

Auditors conducted a visual assessment prior to auditing each cart, which included recording the fullness of each container, the amount of litter surrounding the container, illegal dumping in and around the container, condition of the signs and cleanliness of the bins. The materials for each bin were spread out over a tarp and sorted into 33 categories (illustrated in Figure 3-3). These categories include:

Recyclable Items

- Glass Alcohol
- Glass Non-Alcohol
- Glass All Other
- Paper Newspapers
- Paper Hot Drink
- Paper Cold Drink
- Paper Other Beverage
- Paper Take Out Food Containers
- Paper All Other
- Plastic Alcohol
- Plastic Water
- Plastic Other Beverage
- Plastic Take Out Food Container
- Plastic All Other Misc.
- Retail & Grocery PE Film Bags
- Metal Alcohol
- Metal Beverage Cans
- Metal All Other Misc

Non-Recyclable Items

- Paper Take Out Food Packaging
- Paper All Other Misc. (kg)
- Plastic Take Out Food Container
- Plastic All Other Misc
- Metal
- Textiles

Green Bin Materials

- All Food Material
- Leaf/Yard Waste
- Diapers/Sanitary Products
- Paper Towels or Soiled Paper

Pet Waste**Other Organics****Illegally Dumped****Hazardous Waste****Other Waste**

Each material category was weighed (in kilograms) and it was recorded in the appropriate audit forms. (A sample of the audit reporting forms can be found in Appendix A).

When assessing the composition of the litter and recycling stream, the "other organics" category was omitted to remain consistent with the 2008 Public Space Recycling Study. Furthermore, diversion, capture and contamination rates were calculated by also omitting "illegally dumped" material from the total material weight. However, when assessing the proportion of "organic matter" and "illegally dumped material" in the waste samples the total weight of all material, including "other organic" material and "illegally dumped" material, was used.

Furthermore, the generation rates for the litter and recycling streams were obtained from the scale house records obtained from the weigh scales of the landfill transfer stations and the material recovery facilities. Subsequently the diversion rate was calculated based on the weigh scale data, referred to as the diversion rate of delivered material, and the waste audit composition data, referred to as the diversion rate in park receptacles.

Interviews were also conducted by City of Toronto Solid Waste Project leads who interviewed 4 driver loader operation staff members. These interviews were conducted to obtain their overall views of the new system versus the old, and to determine the impact on park litter (See Appendix F for a summary of the interview correspondence).



Figure 3-3. Sample photograph of waste sorted into different material categories on a plastic tarp

3.3 Limitations

Different years were used when comparing the diversion rates before (2006 and 2008 respectively) and after (2012 and 2013 respectively) project implementation. Deviations in recycling practices from year to year may influence this comparison. However, the differences identified in this report are significant enough that year to year variation should not affect the inferences drawn from the data.

Additionally, weather conditions may significantly influence the quantity of "other organics" present in the litter and recycling stream, due to rainwater entering the carts. On its own a comparison between the percentage in 2008 and 2013 of "Other Organics", cannot be used to illustrate that the new carts are reducing rainwater in the litter and recycling streams.

3.4 Definitions

- Capture Rate:** The capture rate is the percentage of a recyclable material collected, out of the total amount of that material generated. It is an excellent indicator of how well a recycling program is working for a particular material.
- Contamination Rate:** The percentage of material in a diversion bin that should not be there as it is material that is not accepted in the program. A high contamination rate may lead to the hauler not accepting the material for the diversion program and redirecting the material for disposal.
- Diversion Rate:** The diversion rate is the percentage of the total waste generated that is diverted from disposal into the various reuse and recycling programs available at the facility.

Garbage Stream:	Material that is collected for disposal rather than diversion. It will include divertible material where the diversion programs are not operating at 100% efficiency. This material is sometimes referred to as residual waste.
Organics:	Refers to material that can be composted. The material accepted in an organics program is dependent on the type of composting facility accepting the material, how it is processed and what quality of processed material is desired.
Cart:	A wheeled bin, often plastic, with a hinged lid ranging from 225 to 340 litres in size (60 to 90 US gallons).
Recycling Stream:	Material that is diverted from the garbage stream in a recycling program, it includes materials from blue box recycling, source-separated organics or scrap metal recycling program. A reuse program (e.g. wood skids) may be included in this stream.

4 2013 Public Space Recycling Audit Results

4.1 Litter Stream Composition

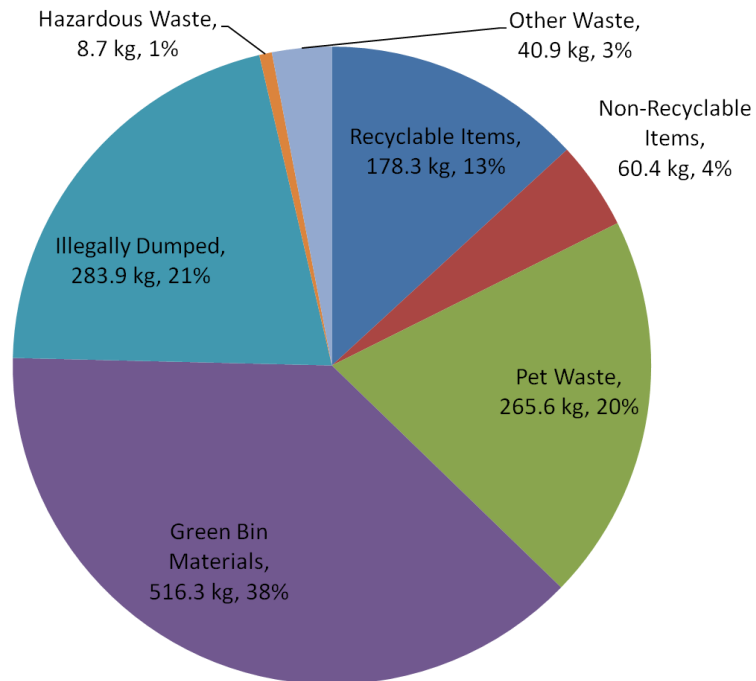
1,377 kg of litter was generated in 30 parks (170 cart locations) of the Toronto Parks System. The most common material type in the litter stream is organic materials (58%). This organic material is broken down into residential green bin materials (38%) and pet waste (20%). A full breakdown of raw data for the litter stream can be found in Appendix B.

In 2008, these organic materials also contributed a significant, though smaller proportion to the waste stream at 21% and 24% respectively. A full breakdown of the 2008 waste audit data can be found in Appendix E.

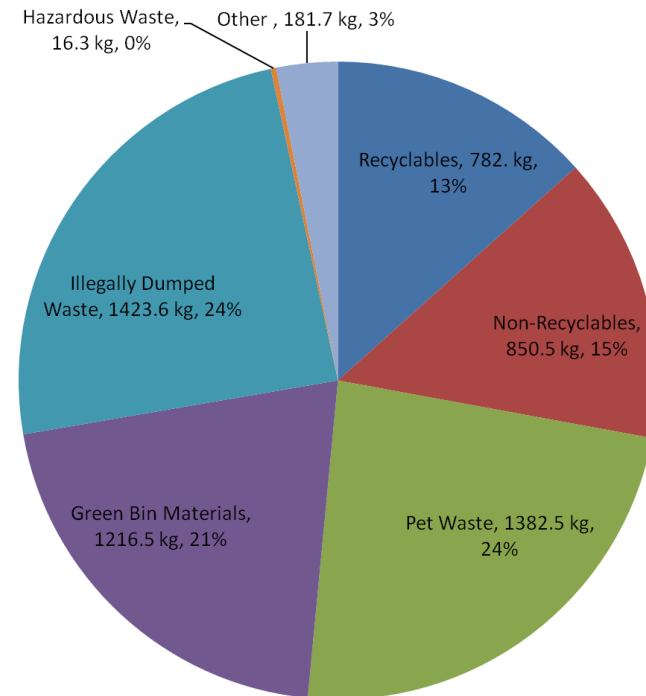
Illegally dumped materials comprise over one fifth, 21% in 2013 and 24% in 2008, of the materials in the litter stream. While non-recyclable materials (waxed papers, textiles, non-packaging plastics, etc) comprise a smaller proportion of the litter stream, at 4% in 2013 and 13% in 2008. Finally, the proportion of recyclable items (PET bottles, HDPE bottles, mixed fine paper, aluminum cans, etc...) remained consistent between 2008 and 2013 at 13%.

4.2 Recycling Stream Composition

There was 759 kg of recycling materials in 170 bins in the Toronto Parks System. Figure 5-2 demonstrates that 52%, by weight, of materials in the recycling stream were recyclable items, a slight increase from 47% in 2008. The second most prevalent material in the recycling stream was green bin materials, which increased from 13% in 2008 to 24% in 2013. Non-recyclable materials decreased significantly from 19% in 2008 to 5% in 2013. The proportion of illegally dumped material remained relatively consistent between 2008 and 2013, with 12% and 11% respectively. The data for the recycling stream of the 2013 waste audit can be found in Appendix C, along with the data from the 2008 audit in Appendix E.



(a) 2013 Litter Composition



(b) 2008 Litter Composition

Figure 4-1. Composition of the litter stream (in kilograms and percentage of material) for the City of Toronto Parks System after (a) Public Space Recycling project implementation in 2013 and (b) before project implementation in 2008. The City of Toronto began recycling in public parks with the release of its Public Spaces Recycling program in 2008.

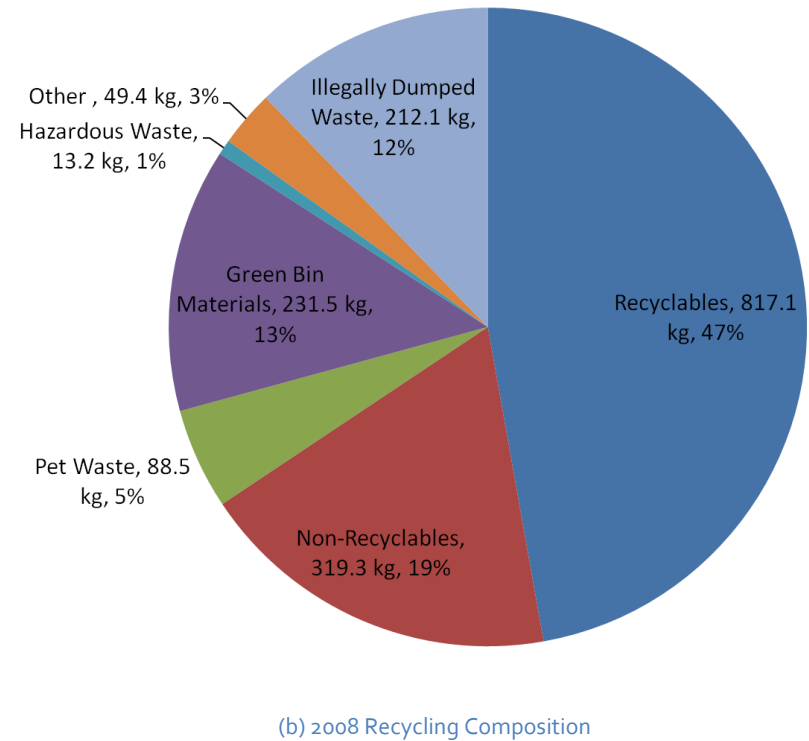
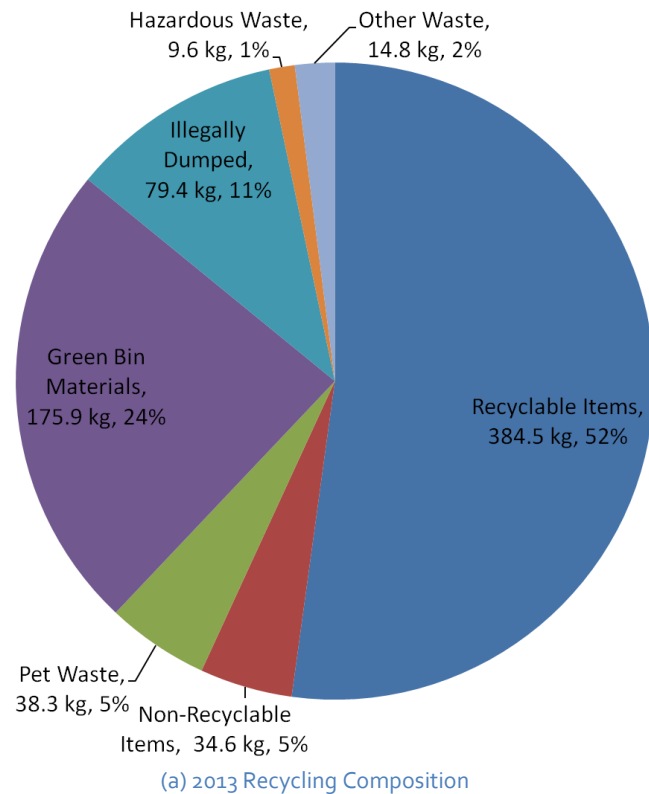


Figure 4-2. Composition of the recycling stream (in kilograms and percentage of material) for the City of Toronto Parks System (a) after Public Space Recycling project implementation in 2013 and (b) before project implementation in 2008. The City of Toronto began recycling in public parks with the release of its Public Spaces Recycling program in 2008

5 Waste Management System Assessment

5.1 Waste Diversion, Capture and Contamination

According to the 2012 scale house records, there was 3,800 tons of waste generated by the City of Toronto Parks system after project implementation. With, 21% of this material diverted to material recovery facilities (MRF). This is consistent with the 2013 Public Space Recycling audit diversion rate of 22% in City of Toronto park receptacles.

According to the results of the 2008 and 2013 public space recycling audits, the capture rate also improved from 51% in 2008 to 68% in 2013 as illustrated in Table 5-1. The recycling stream itself saw a decrease in contamination, with 39% in 2013 compared to a 46% contamination 2008.

Table 5-1. Comparison of the key waste management metrics for the Public Space Recycling project before and after implementation

	2008	2013
Diversion Rate	14%	22%
Capture Rate	51%	68%
Contamination Rate	46%	39%

5.2 Impacts of Other Variables

5.2.1 Park Classification

The diversion rate, displayed in Table 5-2, is higher (23%) for regional parks and parkettes than that of neighbourhood parks. Additionally, the capture rate (78%) at parkettes are higher than those of neighbourhood parks (66%) and regional parks (68%). The recycling stream at the parkettes also have a lower contamination rate (32%) than neighbourhood parks (39%) and regional parks (40%).

Table 5-2. Comparison of waste management metrics for parks of different classifications

	Diversion Rate	Capture Rate	Contamination Rate	# of Bins Audited
Neighbourhood Park	17%	66%	39%	74
Parkette	23%	78%	32%	14
Regional Park	23%	68%	40%	82

5.2.2 Type of Sign

A comparison between the different sign types is tabulated in Table 4-3. The diversion rate (22% for sign A and 22% for sign B) and capture rate (65% for sign A and 70% for sign B) is similar for carts with each type of sign. Whereas, carts without signs had lower diversion rates (16%) and capture rates (61%) than carts that have signs.

Table 5-3. Comparison of the impact of different sign types on waste management practices

	Diversion Rate	Capture Rate	Contamination Rate	Number of Samples
Sign A	22%	65%	43%	69
Sign B	22%	70%	38%	242
No Sign	16%	61%	28%	12

5.2.3 Illegal Dumping

As illustrated in Table 5-1 and Table 5-2, there was no significant change in the percentage of illegal dumping in the litter and recycling stream between the 2008 audit and the 2013 audit. In the 2013 audit, illegal waste comprised 21% of the litter and 11% in the recycling stream. Whereas in 2008, illegal waste comprised 24% and 12% of the litter and recycling stream respectively.

Table 5-4 displays the level of illegal dumping that occurs at City of Toronto Parks at the different park classifications and carts with the different types of signs. Illegal dumping was found at 11% of litter bins and 9% of recycling bins. This material was most frequently found in parkettes, 46% and 24% of carts for litter and recycling respectively. Whereas, for neighbourhood parks and regional parks it was found less frequently. At neighbourhood parks illegally dumped material was found in 13% and 9% of bins for litter and recycling. At regional parks it was found in 11% and 8% of bins for litter and recycling respectively.

When analyzing for sign type, illegal dumping was observed most frequently in bins with no signs (33% and 17% for litter and recycling). Bins with sign type A had illegal dumping present at 16% and 8% of carts for the litter and recycling streams. Bins with sign type B had illegal dumping present at 10% and 8% of carts for the litter and recycling streams respectively.

Table 5-4. Illegal dumping in City of Toronto Parks analyzed by weight and frequency

	Litter Stream (weight %)	Recycling Stream (weight %)	Bin Frequency Litter Stream	Bin Frequency Recycling Stream
Total	21%	11%	or 11%	or 9%
By Park Type				
Neighbourhood Park	17%	10%	or 13%	or 9%
Parkette	49%	24%	or 46%	or 24%
Regional Park	18%	10%	or 11%	or 8%
By Sign Type				
Sign A	23%	5%	or 16%	or 8%
Sign B	20%	12%	or 10%	or 8%
No Sign	13%	13%	or 33%	or 17%

5.2.4 Other Organics Category

In addition, the other organics stream was omitted from the 2008 composition data, as it consisted mostly of rainwater that drained into the bags. It comprised a significant proportion of all the material in the litter (17%) and recycling streams (30%) in 2008. However in 2013, "other organics" constituted a very small proportion of the total material that was present in the litter (1%) and recycling receptacles (0.5%).

5.3 Qualitative Assessment

Interviews were conducted with City of Toronto collection crews and parks maintenance staff on June 6, 2013 (See Appendix E for the interview transcripts). The interviewees identified that the new system has reduced collection times because:

- Increased bin capacity
- Less manual lifting
- Secured carts means fewer errant bins
- Bag less system means that bags don't need to be replaced or split
- Overweight carts can be transferred by one person
- Less recurring injuries and physical strain on employees

The employees interviewed also indicated that the new carts have led to less contamination. The closed lids on the new carts have prevented illegal dumping and collected less rainwater. Also, the addition of recycling carts has reduced cross contamination and increased the quantity of recycling because of easier access and the pairing of litter and recycling carts. However, recycling carts are still significantly contaminated by pet waste.

6 Conclusions

Overall, the new semi-automated cart systems has improved waste management in the City of Toronto Parks System by achieving:

- An increase in the diversion rate of delivered material, (from 1% in 2006 to 21% in 2012, based on scale records) and diversion rate in park receptacles (from 14% in 2008 to 22% in 2013, based on audit results).
- An increase in the recycling capture rate (from 51% in 2008 to 68% in 2013)
- An decrease in the recycling contamination rate (46% in 2008 to 39% in 2013)
- Less rain water in the litter and recycling streams as evidenced by:
 - Less "other organics material" in the litter and recycling stream
 - Solid Waste Management Services staff indicate that there is less water in the new litter and recycling carts
- A larger proportion of diverted material is being received in the material recovery facility after project implementation (95%) than before project implementation (10%).

As for the impact of the different waste management practices on diversion, the capture of recyclable material and the contamination of the recycling stream, the following conclusions may be drawn:

- Nothing significant can be inferred on the impact of park classification on waste diversion, recyclable materials capture rate and recyclable materials contamination rate.
- The type of sign does not seem to significantly influence waste diversion in the parks audited. However, in a limited sample, parks with no signs do seem to experience lower diversion and capture rates.
- Illegal dumping occurred more frequently in the smaller and more isolated parkettes. Illegal dumping was observed at almost half the litter receptacles and one quarter of recycling receptacles.

6.1 Lessons Learned

The Public Space Recycling project provided the City of Toronto with the following information that may be used to optimize waste management on city parks in the future:

- The semi-automated cart system has improved collection efficiency.
- Ease of access to recycling significantly influences diversion rate.
- Ensuring signage is present at bins seems to have more impact on recycling rates than the type of sign which is present.
- Lids are important for preventing the contamination of the litter and recycling stream.
- Smaller and more isolated parks are more prone to illegal dumping.
- The semi-automated cart system has resulted in less recurring injuries and physical stress on employees.

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