# Brock University
# 2017 Solid Non-Hazardous Waste Audit

Prepared for:

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## Executive Summary

Brock University retained the services of Waste Reduction Group Inc to conduct a solid non-hazardous waste audit at its campus located in St. Catharines, Ontario. A waste audit was conducted during the fall of 2017 to determine waste composition. Twenty-four hour samples of trash and recyclables were collected for the waste audit from 30 buildings, consisting of 1766 kg of trash and 516 kg of recyclables. The collected samples were audited over eight (8) days in October 2017. Waste materials collected for the audit were tagged to indicate the functional area of the building that generated the waste, including office, public, food service kitchens, food service dining areas, food service tenant areas, washrooms, labs, self-contained residences and outdoor bins. The following list summarizes the overall trash composition determined from the audit:

- Organic Waste 35.9%
- Other/Non-recyclable 20.3%
- Paper Towels: 17.8%
- Mixed Containers: 9.6%
- Mixed Papers: 7.2%
- Coffee Cups: 4.9%
- LDPE (#4 Plastic) films: 2.5%
- Cardboard & Scrap Metals: Each 0.4%
- Scrap woods, Styrofoam: Each 0.3%
- Other Plastics, Ewastes, Batteries, Toners: Each <= 0.1%

In addition, recycle stream samples were collected at the University. Approximately 71% of the recycle stream samples consisted of mixed papers and mixed containers. The recycle stream sample had a contamination rate of approximately 14.2%, comprised mainly of non-recyclables and organics.

Waste diversion programs have been implemented on campus for cardboard, mixed containers, mixed papers, confidential papers, scrap metals, organics, coffee cups, oil & grease, bulbs & ballasts, electronic wastes, batteries, yard wastes, wood pallets, printer toners, used furniture/clothing donations, lab bottles, LCBO/Beer Store returns, and waste reduction initiatives. Through discussions with Brock U and waste management and recycling service providers, estimates of the annual amounts of solid non-hazardous waste materials disposed and diverted were determined. The following table summarizes the annual quantities of wastes reduced, reused, recycled, composted and disposed in 2017.

**Annual Quantities Disposed & Diverted in 2017**

| Material | Total Annual Amount | |
|---|---|---|
| | Metric Tonnes | Percent |
| Disposed to Landfill | 538.5 | 28.2% |
| Materials Reduced | 8.1 | 0.4% |
| Materials Reused | 86.9 | 4.5% |
| Materials Recycled | 942.3 | 49.3% |
| Materials Composted | 334.8 | 17.5% |
| **Total Waste Generated** | **1910.7** | **100.0%** |

Based on the total annual amount of waste generated and materials diverted, the 2017 waste diversion rate at Brock U was determined to be approximately 71.8%. The Ministry of the Environment and Climate Change's (MOECC) provincial objective is 60% waste diversion rate. Brock U's management team are committed to maintaining this excellent result and minimizing the amount of materials disposed to landfill.

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# 1 Introduction

Brock University (Brock U) retained the services of Waste Reduction Group Inc to conduct a solid non-hazardous waste audit in 2017 at its campus located in St. Catharines, Ontario. The waste audit examined representative samples of waste (trash and recyclables) from the entire campus over an eight (8) day period in October to gain an understanding of the quantities and composition of solid wastes generated on campus.

Brock U is a multi-building community that has approximately 18,704 students (Fall 2016) and staff that generate waste and recyclable materials. According to Brock U's website, 17,216 Full-Time Equivalent (FTE) students attended the university in 2016-17 (Refer to Appendix A).

Brock U took the initiative to conduct a solid non-hazardous waste audit with the intent of remaining in compliance with O.Reg. 102/94 and to further improve upon their present waste reduction, reuse and recycling initiatives.

## 1.1 Purpose

The purpose of the solid non-hazardous waste audit was to:

- Comply with Part X of O.Reg. 102/94 'Waste Audits and Waste Reduction Work Plans', which requires the operator of an educational institution with more than 350 students enrolled per year, to conduct an annual waste audit and prepare and implement a waste reduction work plan (Refer to Appendix A for a partial excerpt of O.Reg.102/94);

- Ensure compliance with Section 14 of O.Reg.103/94 'Industrial, Commercial and Institutional Source Separation Programs' and Part X 'Educational Institutions' of the Schedule attached to the Regulation (Refer to Appendix A for a partial excerpt of O.Reg.103/94).

- Determine the annual waste diversion rate for Brock U resulting from existing waste reduction, reuse, and recycling programs;

- Identify point of generation and quantify composition of wastes at Brock U;

- Identify any additional opportunities for waste reduction and diversion that may exist at Brock U;

- Identify potential cost savings associated with the disposal of solid waste materials; and

- Address any specific concerns or opportunities identified during the study.

## 1.2 Scope of Work

To satisfy the purpose of the waste audit, the following scope of work was completed:

- Collected data pertaining to waste composition and collection practices between October 17th and 27th, 2017.
- Determined the total quantity of waste materials diverted from landfill by Brock U through current reduction, reuse, and recycling initiatives;

- Completed a Waste Audit Report (per MOE protocol) that addressed the amount, nature and composition of the waste, the manner by which the waste was generated, including management decisions and policies that relate to the production of waste, and the way in which the waste is managed on campus; and

- Completed a Waste Reduction Work Plan (per MOE protocol) regarding plans to reduce, reuse and recycle waste on campus. The report set out who will implement each part of the plan, when each part will be implemented and what the expected results shall be.

## 2 Methodology

Discussions were held with Brock U personnel to review existing waste management and recycling programs implemented on campus. Based on previous audit experience and information gathered by Domenic Maniccia of Brock U, a detailed waste audit schedule was developed. The waste audit was performed over eight (8) days in October 2017, as summarized in Table 1:

**Table 1: 2017 Waste Audit - Sample Summary**

| Date | Building/Location |
|---|---|
| Oct. 17, 2017 | Walker Complex, South Block, Kenmore Centre, Harrison Hall, Welch Hall, CUB and BRIC |
| Oct. 18, 2017 | Cairns, Plaza & Book Store, Taro and Student Centre |
| Oct. 19, 2017 | Outdoor Bins, Alphie Trough and Marilyn I. Walker School |
| Oct. 20, 2017 | Tower, Thistle, Scotia Bank Hall |
| Oct. 24, 2017 | International Centre, 573A Glenridge, East Academic, Daycare, Quarryview N, Quarryview S |
| Oct. 25, 2017 | Earp Residence, DeCew Residence N and DeCew Café |
| Oct. 26, 2017 | Lowenberger and Village |
| Oct. 27, 2017 | MacKenzie Chown and Hamilton Campus |

In coordination with the Brock U staff, one (1) twenty-four hour sample of waste was collected from each of the identified buildings on the audit schedule. Bags of trash and recyclables were collected and tagged with coloured tape describing the functional area within the building that generated the waste material, as summarized in Table 2:

**Table 2: 2017 Waste Audit - Functional Area Summary**

| Colour Tag | Functional Areas |
|---|---|
| Blue | Office / Administrative Areas |
| Red | Public Areas (Class rooms, lobbies, lounges, libraries, corridors, etc.) |
| Orange | Washrooms |
| Green | Food Services – Kitchens |
| Silver | Food Services – Dining Areas |
| Purple | Laboratories |
| Untagged | Self contained residences |
| Untagged | Outdoor bins |

The tagged bags of wastes were brought to designated collection areas by Brock U staff and placed into temporary plastic pushcarts supplied by Waste Reduction Group. The total bagged weight of all trash and recyclable materials from each functional area per building were recorded. Refer to Appendix A for a copy of the Scale Calibration Certificate.

Waste materials were then unloaded, sorted into individual material categories, weighted, re-bagged and disposed of in the appropriate garbage or recycling bins. Trash and recyclable samples were sorted by a qualified two (2) person team from Waste Reduction Group. Some of the materials source separated by Brock U for recycling (i.e. cardboard, organics, ewastes, printer toners, etc) were not collected and categorized during the audit, due to infrequency of generation, however the annual quantity of each material was reviewed and included in the audit results.

Waste material categories were established prior to the audit based on O.Reg.103/94 requirements for source separation at educational institutions, including:

- Aluminum food or beverage cans (including cans made primarily of aluminum);
- Cardboard (corrugated);
- Fine paper;
- Glass bottles and jars for food or beverages;
- Newsprint; and
- Steel food or beverage cans (including cans made primarily of steel).

In addition to these standard categories other important waste streams such as other mixed containers (PET, HDPE, polypropylene, aseptic, gable top), organic wastes, paper towels, mixed plastics, Styrofoam, yard waste, electronic waste (ewaste), scrap wood, scrap metal and special wastes (i.e. batteries, bulbs and ballasts) were included depending on what auditors found in the samples.

# 3 Waste Audit Results

## 3.1 Trash Quantities & Distribution

A key aspect of O. Reg. 102/94 is for waste generators to gain a good understanding of the areas of their operation that generate the most waste, how it is generated, as well as the waste composition. One can use this information to focus their recycling and waste reduction efforts efficiently and effectively.

Figure 1 and Table 3 ranks trash generated per building based on the audit results.

**Figure 1: Brock University 2017 Annualized Garbage Generation Distribution**

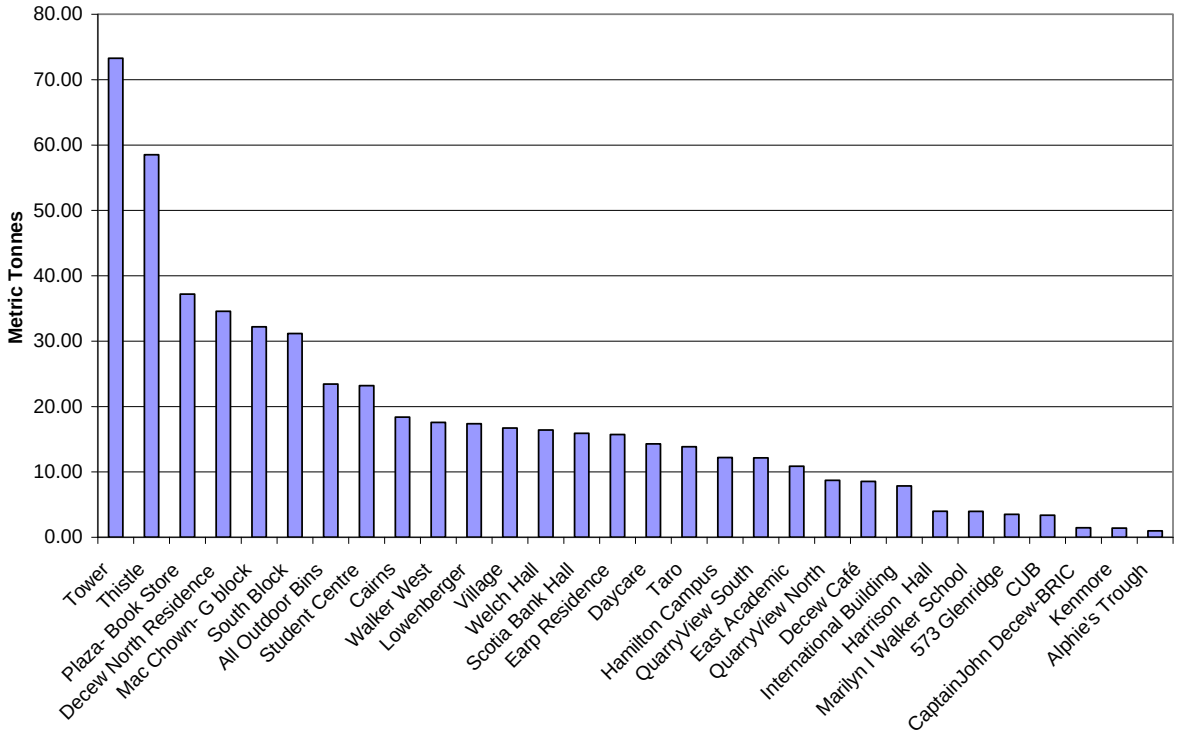



**Table 3: 2017 Waste Audit - Annualized Waste Generated per Building (Based on 24-hr Sample)**

| Building Name | Percentage[(1)] % | Annual Quantity Metric Tonnes |
|---|---|---|
| Schmon Tower | 13.60% | 73.26 |
| Thistle | 10.86% | 58.51 |
| Plaza- Book Store | 6.91% | 37.19 |
| Decew North Residence | 6.42% | 34.55 |
| Mac Chown- G block | 5.98% | 32.18 |
| South Block | 5.79% | 31.16 |
| All Outdoor Bins | 4.35% | 23.43 |
| Student Centre | 4.31% | 23.20 |
| Cairns | 3.41% | 18.37 |

| | | |
|---|---|---|
| Walker West | 3.26% | 17.56 |
| Lowenberger | 3.22% | 17.37 |
| Village | 3.10% | 16.70 |
| Welch Hall | 3.05% | 16.40 |
| Scotia Bank Hall | 2.95% | 15.90 |
| Earp Residence | 2.92% | 15.71 |
| Daycare | 2.65% | 14.28 |
| Taro | 2.57% | 13.85 |
| Hamilton Campus | 2.26% | 12.19 |
| QuarryView South | 2.25% | 12.14 |
| East Academic | 2.02% | 10.87 |
| QuarryView North | 1.62% | 8.70 |
| Decew Café | 1.59% | 8.54 |
| International Building | 1.46% | 7.85 |
| Harrison Hall | 0.74% | 3.98 |
| Marilyn I Walker School | 0.74% | 3.96 |
| 573 Glenridge | 0.65% | 3.50 |
| CUB | 0.62% | 3.36 |
| Captain John Decew-BRIC | 0.27% | 1.44 |
| Kenmore | 0.26% | 1.40 |
| Alphie's Trough | 0.18% | 0.97 |
| **Total** | **100.0%** | **538.54** |

*Note 1: Percentage based on 24-hr garbage sample results from the waste audit.*

Therefore, Schmon Tower, Thistle, Plaza/Bookstore, North Decew Residence, MacKenzie Chown, and South Block were the most significant generators of waste on campus, accounting for approximately 50% of the garbage stream. This result is fairly consistent with previous years, except North Decew Residence was not included and Villages Residence and Hamilton Campus were included in 2016.

As noted above, a review of Brock U's activities identified the following functional areas within campus buildings:

- Office / Administrative Areas
- Public Areas
- Washrooms
- Food Service – Kitchens
- Food Service – Dining Areas
- Food Service – Tenant Areas
- Laboratories
- Self-Contained Residences
- Outdoor Bins

Table 4 ranks trash generated per building functional area based on the audit results.

**Table 4: 2017 Waste Audit – Annualized Waste Generated per Functional Area**

| Functional Area | Percentage[(1)] % | Annual Quantity Metric Tonnes |
|---|---|---|
| Public Areas | 66.7% | 359.41 |
| Residences | 7.4% | 40.05 |
| Washrooms | 6.4% | 34.23 |
| Office & Admin | 6.0% | 32.21 |
| Food Services - Dining | 4.4% | 23.48 |
| Outdoor Bins | 4.4% | 23.43 |
| Labs | 3.1% | 16.51 |
| Food Services - Kitchens | 1.7% | 9.21 |
| Food Services Tenant Space | 0.0% | 0.00 |
| **Total** | **100.0%** | **538.54** |

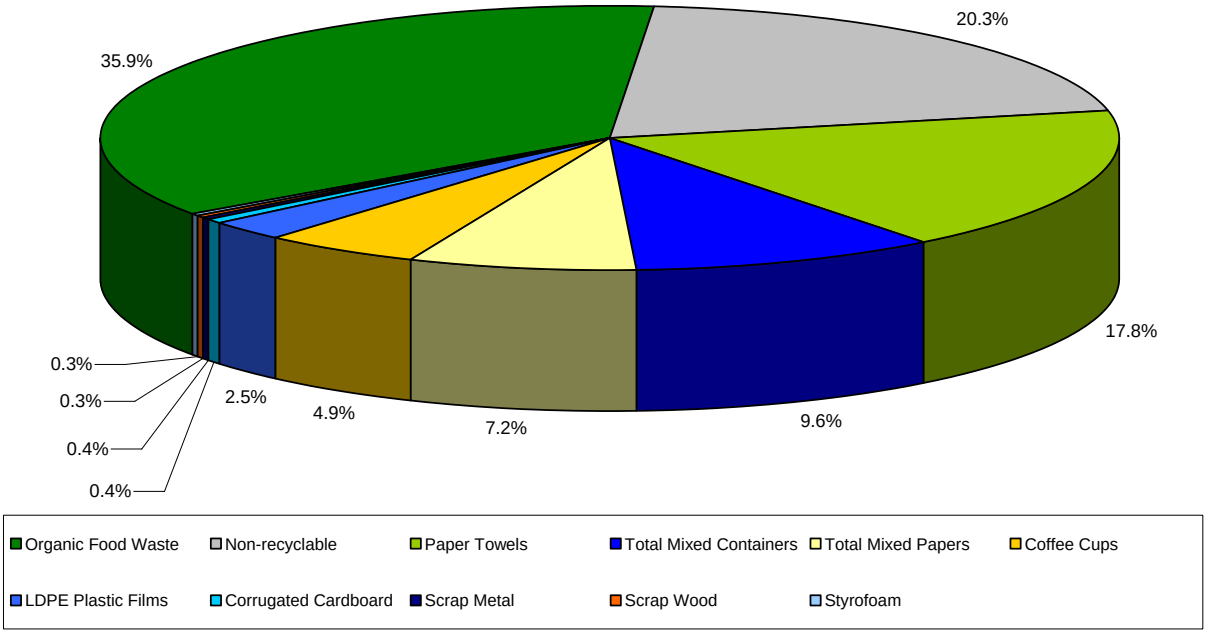
*Note 1: Percentage based on 24-hr garbage sample results from the waste audit.*

Therefore, public areas, self-contained residences, washrooms, office areas and dining areas generated the most trash on campus, accounting for approximately 90% of the garbage stream.

## 3.2 Trash Composition

The total weight of trash collected and sorted for the Fall 2017 waste audit was approximately 1766 kg. In 2015, a summer waste audit was also conducted to estimate trash composition during the summer period in order to account for seasonal variability. Figure 2 summarizes the average overall combined trash composition from the 2017 fall waste audit and 2015 summer waste audit.

**Figure 2: Brock University 2017 Overall Garbage Composition Summary (Combined Fall 2017 & Summer 2015 Trash Compositions)**

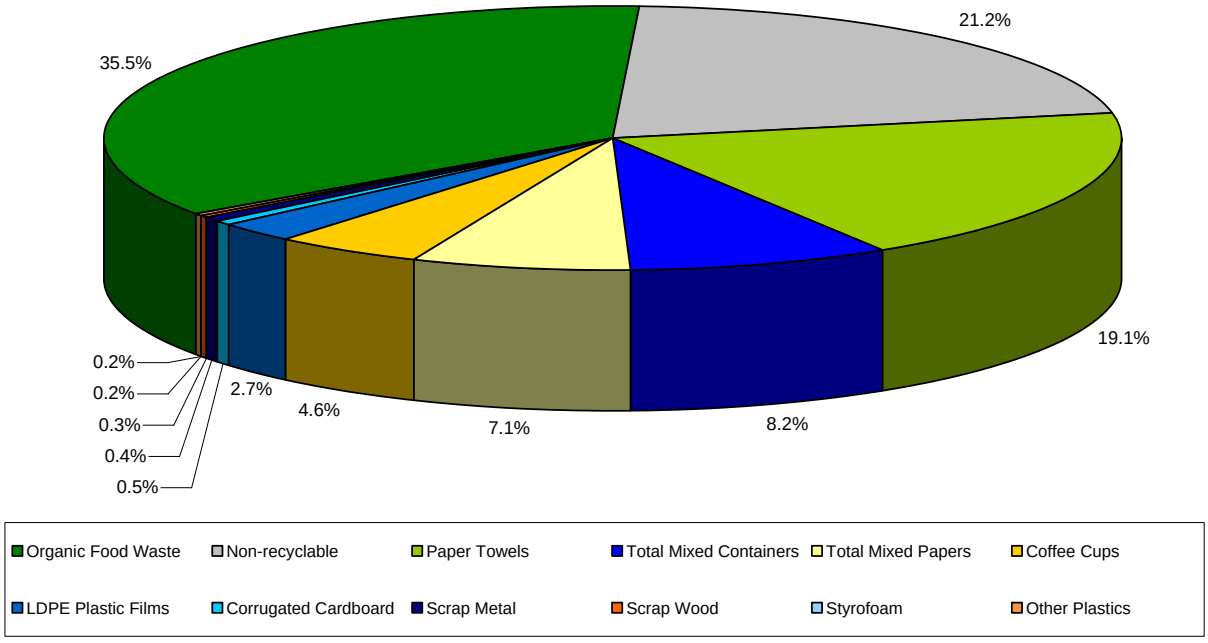



*Note: Other Plastics, Ewastes, Batteries, Printer Toners each <=0.1% thus not included in graph for clarity.*

### 3.2.1 Fall Trash Composition

The total weight of waste collected and sorted for the fall audit was 1765.82 kg. Figure 3 summarizes the average overall fall waste composition of the audited sample:

**Figure 3: Brock University 2017 Fall Garbage Composition Summary**




*Note: Batteries and Printer Toners each <=0.1% thus not included in graph for clarity.*

Summary tables for each building per waste generation functional area, including waste composition, weights and percentages, are included in Appendix B. Table 5 summarizes the largest primary categories (i.e. >5%) of waste materials per generation area (based on the total amount of waste audited):

**Table 5: 2017 Fall Waste Audit - Primary Waste Categories per Generation Area**

| Waste Generation Area | Percent of Sample (By Weight) | Organics | Non-recyclable | Paper Towels | Mixed Containers | Mixed Papers | Coffee Cups |
|---|---|---|---|---|---|---|---|
| Public Areas | 66.7% | 37.7% | 23.1% | 14.7% | 7.8% | 7.3% | |
| Residences | 7.4% | 33.7% | 37.2% | 11.4% | 7.3% | | |
| Washrooms | 6.4% | | | 79.8% | | 5.5% | |
| Office & Admin | 6.0% | 26.9% | 17.4% | 15.8% | 19.1% | 11.3% | |
| Food Services - Dining | 4.4% | 59.4% | 11.1% | 6.8% | 10.8% | | |
| Outdoor Bins | 4.4% | 53.0% | 12.5% | 6.8% | 6.6% | 7.3% | 9.6% |
| Labs | 3.1% | 10.4% | 11.7% | 54.1% | 8.3% | 8.7% | |
| Food Services - Kitchens | 1.7% | 47.0% | 14.0% | 10.5% | 14.2% | 8.1% | |
| **Total** | **100.0%** | **35.5%** | **21.2%** | **19.1%** | **8.2%** | **7.1%** | |

Organic food wastes were found in high quantities in all areas that were audited except washrooms. Organic content was especially high in food service areas and outdoor bins. An organics program is implemented on campus. It is recommended that Brock U focus attention on organics diversion in these areas in order to capture more of the organic materials that are currently ending up in the garbage stream.

Paper towels were found in fairly high quantities in all areas, and especially washrooms and labs. Brock U may want to investigate the feasibility of implementing a diversion program for paper towels in these areas. Often paper towels can be mixed with cardboard or organic programs depending on vendor specifications.

Fairly high amounts of mixed papers and mixed containers were found in the garbage stream from most areas of the university. Brock U has implemented recycling programs for mixed papers and mixed containers. Results suggest that better collection systems, improved labels, program promotion and/or student/employee/cleaner education may be required to capture more of these materials.

### 3.2.2 Summer Trash Composition

Refer to Brock U's 2015 Waste Audit Report (Waste Reduction Group Project P0525, dated February 2016) for details regarding Brock U's summer trash composition.

### 3.2.3 Office/Administrative Areas

Based on the total combined amount of garbage audited from office/administrative areas, the largest primary categories (i.e. >5%) of waste generated were as follows:

- Mixed Containers: 26.3%
- Organics: 23.5%
- Non-Recyclable: 16.9%
- Paper towels: 12.5%
- Mixed Papers: 10.4%

The percentages of mixed containers and mixed papers were high especially since recycling programs have been implemented for these materials. Results suggest that improved collection systems, signs, program promotion and/or staff/cleaner education may be required to capture more of these materials. The organics and paper towel content was quite high and suggests that staff eat meals at their desks. Brock U may wish to focus on placing more organic bins in office areas.

Office / Administrative Areas in the following buildings were found to generate the most trash compared to all office/administrative areas that were audited:

- Mackenzie Chown: 20.4%
- Schmon Tower: 19.9%
- Cairns: 11.7%
- Taro: 9.1%
- Plaza Bookstore: 8.6%

### 3.2.4 Public Areas

Based on the total combined amount of waste audited from public areas, the largest primary categories (i.e. >5%) of waste generated were as follows:

- Organics: 37.0%
- Non-Recyclable: 22.4%
- Paper Towels: 14.1%
- Mixed Containers: 9.4%
- Mixed Papers: 7.5%

The percentage of organic materials and paper towels was quite high. Brock U may wish to investigate the feasibility of adding some organics bins in busy public areas. The percentages of mixed containers and mixed papers were fairly high, especially since recycling programs have been implemented for these materials in public areas. Results suggest that better collection systems, improved signs, program promotion and/or staff/student education may be required to improve the capture rate of these materials.

Public Areas in the following buildings were found to generate the most trash compared to all public areas that were audited:

- Schmon Tower: 15.9%

- Thistle: 11.0%
- Decew Residence: 8.3%
- Plaza & Book Store: 7.0%
- South Block: 7.0%

### 3.2.5 Washrooms

Based on the total combined amount of waste audited from washroom areas, the largest primary categories (i.e. >5%) of waste generated were as follows:

- Paper Towels: 75.8%
- Non-Recyclable: 6.1%
- Organics: 5.9%
- Mixed Papers: 5.6%

The percentage of paper towels was high in washroom waste. Brock U may wish to investigate the feasibility of implementing a paper towel recycle program, or replacing paper towels in washrooms with reusable hand towels or hand dryers. Often, paper towels can be included with organic or cardboard recycle programs.

Washrooms in the following buildings were found to generate the most trash compared to all washrooms that were audited:

- Thistle: 23.5%
- Walker West: 17.5%
- Schmon Tower: 14.1%
- MacKenzie Chown: 7.9%

### 3.2.6 Food Service – Kitchen Areas

Based on the total amount of waste audited from food service kitchen areas, the largest primary categories (i.e. >5%) of waste generated were as follows:

- Organic Material: 47.0%
- Mixed Containers: 14.2%
- Non-Recyclable: 14.0%
- Paper Towels: 10.5%
- Mixed Papers: 8.1%

The percentage of organic material was high. Focus should still be placed on diverting organics from kitchen area garbage streams. Mixed containers and mixed papers were found in fairly high quantities, especially since recycling programs have been implemented to capture these materials. Results suggest that better collection systems, updated labels, program promotion and/or staff education may be required to capture more organics, mixed containers and mixed papers.

Food Service Areas in the following buildings were found to generate the most trash compared to all food service kitchen areas that were audited:

- Thistle: 66.5%
- South Block: 17.2%
- DeCew Café: 8.5%
- Schmon Tower: 6.3%

### 3.2.7 Food Service – Dining Areas

Based on the total amount of waste audited from food service areas, the largest primary categories (i.e. >5%) of waste generated were as follows:

- Organics: 59.4%
- Non-Recyclable: 11.1%
- Mixed Containers: 10.8%
- Paper Towels: 6.8%

The percentage of organic materials was very high (59%). Mixed containers were also found in fairly high quantities, especially since a recycling program has been implemented to capture this material. Results suggest that better collection systems, updated labels, program promotion and/or staff education may be required to capture more organics and mixed containers.

Food Service Dining Areas in the following buildings were found to generate the most trash compared to all food service dining areas that were audited:

- DeCew Café: 32.8%
- Plaza / Bookstore: 27.5%
- Walker West: 25.3%

### 3.2.8 Food Service – Tenant Areas

Based on the total amount of waste audited from food service tenant areas (i.e. Tim Horton's), the largest primary categories (i.e. >5%) of waste generated were as follows:

- Organics: 47.1%
- Non-Recyclable: 33.9%
- Paper Towels: 10.4%
- Coffee Cups: 5.2%

The percentage of organic materials and paper towels were high especially since a diversion program (i.e. organics) has been implemented on campus for these materials. Results suggest that better collection systems, program promotion and/or staff education may be required to capture more of these materials.

The only tenant area audited was located in the Tower.

### 3.2.9 Laboratories

Based on the total amount of waste audited from lab areas, the largest primary categories (i.e. >5%) of waste generated were as follows:

- Paper Towels: 54.1%
- Non-Recyclable: 11.7%
- Organics: 10.4%
- Mixed Papers: 8.7%
- Mixed Containers: 9.3%

The percentage of paper towels was high. Brock U may wish to investigate the feasibility of implementing a paper towel recycle program. Organics was also quite high for a lab setting. The percentages of mixed papers and mixed containers were also quite high. Results suggest that better collection systems, improved labels, program promotion and/or staff/student education may be required to improve the capture rate of these materials.

Lab areas in the following buildings were found to generate the most trash compared to all labs that were audited:

- MacKenzie Chown: 60.3%
- Cairns: 33.5%

### 3.2.10 Residences

Based on the total amount of waste audited from residences, the largest primary categories (i.e. >5%) of waste generated were as follows:

- Non-Recyclable: 37.2%
- Organics: 33.7%
- Paper Towels: 11.4%
- Mixed Containers: 7.3%

The percentages of organic materials, paper towels and mixed containers were quite high. Results suggest that better collection systems, improved labels, program promotion and/or staff/student education may be required to improve the capture rate of these materials.

The following residences were found to generate the most trash:

- Village: 41.7%
- QuarryView S: 30.3%
- QuarryView N: 21.7%

### 3.2.11 Outdoor Bins

Based on the total amount of waste audited from outdoor bins, the largest primary categories (i.e. >5%) of waste generated were as follows:

- Organics: 53.0%

- Non-Recyclable: 12.5%
- Coffee Cups: 9.6%
- Mixed Papers: 7.3%
- Paper Towels: 6.8%
- Mixed Containers: 6.6%

The percentages of organics and coffee cups were very high. Percentages of mixed papers and containers were also quite high. Results suggest that improved labels, program promotion and/or staff/student education may be required to improve the capture rate of these materials.

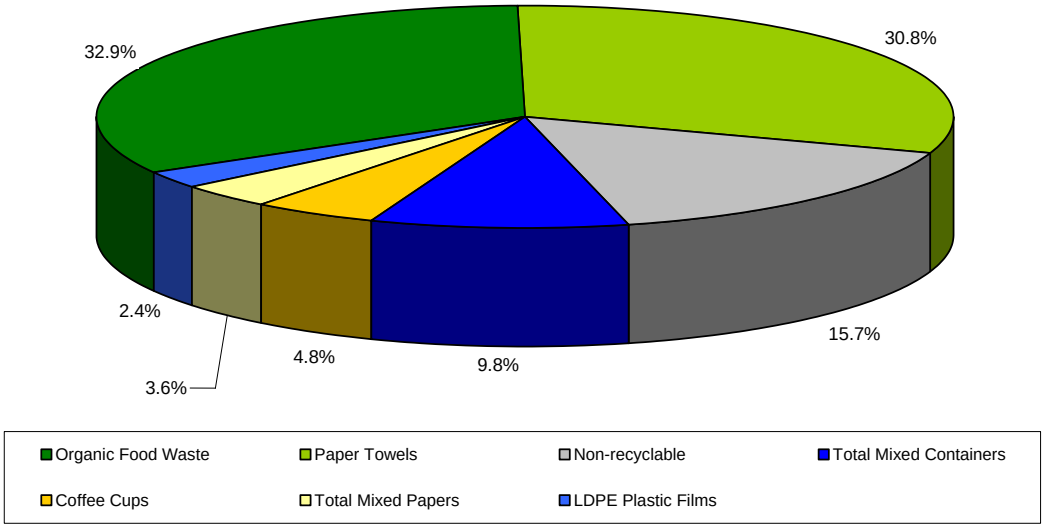
## 3.3 Trash Composition per Building

The overall trash composition determined for each building based on 24-hour sample results is presented below.

### 3.3.1 Schmon Tower

Figure 4 summarizes the trash composition determined at the Tower based on the October 2017 waste audit sample. Organic materials represented 32.9% of the overall sample. Paper towels and non-recyclables represented 30.8% and 15.7% of the sample respectively. Mixed containers, coffee cups and mixed papers represented 9.8%, 4.8% and 3.6% of the sample respectively.

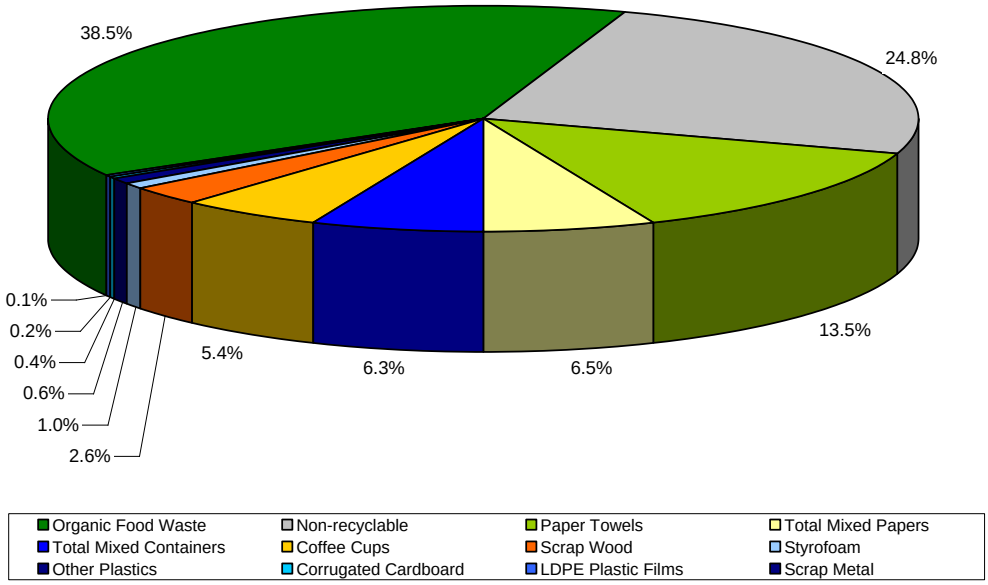
**Figure 4: Schmon Tower 2017 Trash Composition Summary**



### 3.3.2 Thistle

Figure 5 summarizes the trash composition determined at Thistle based on the 2017 fall waste audit. Organic materials represented 38.5% of the entire sample. Non-recyclables represented 24.8% of the sample. Paper towels, mixed papers, mixed containers and coffee cups represented 13.5%, 6.5%, 6.3% and 5.4% of the sample respectively.

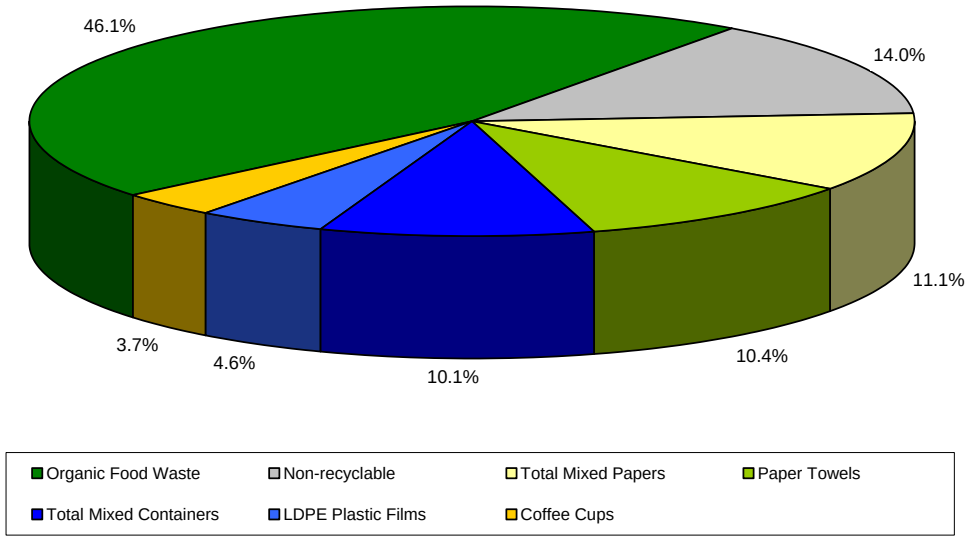
**Figure 5: Thistle 2017 Trash Composition Summary**




### 3.3.3 Plaza/Bookstore

Figure 6 summarizes the trash composition determined at the Plaza/Bookstore in October 2017. Organic materials represented 46.1% of the entire sample. Non-recyclables, mixed papers, paper towels and mixed containers represented 14.0%, 11.1%, 10.4% and 10.1% of the sample respectively.

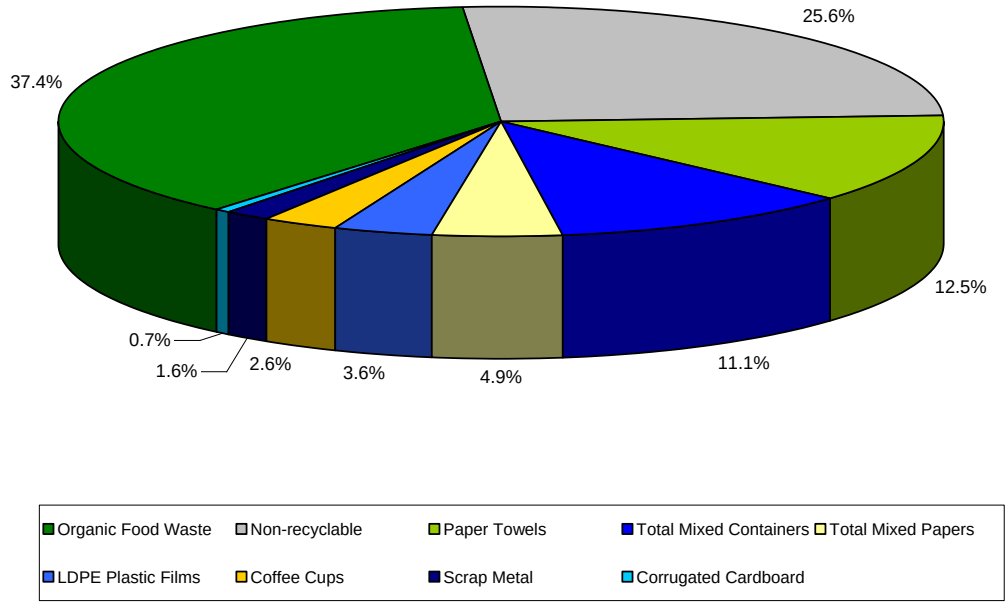
**Figure 6: Plaza/Bookstore 2017 Trash Composition Summary**




### 3.3.4 DeCew Residence

Figure 7 summarizes the trash composition determined at the DeCew Residence in October 2017. Organic materials represented 37.4% of the entire sample. Non-recyclables, paper towels and mixed containers represented 25.6%, 12.5% and 11.1% of the sample respectively.

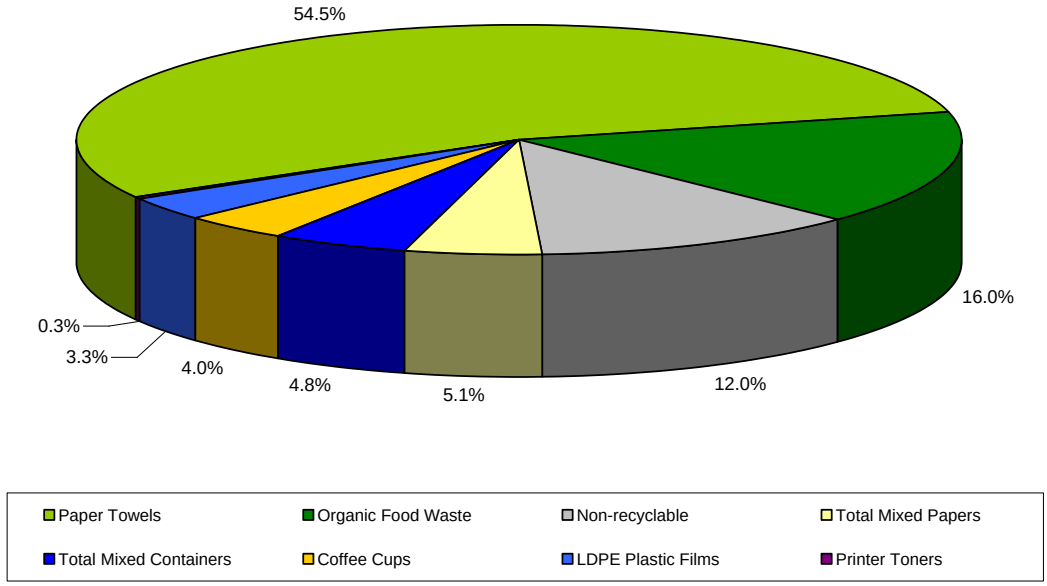
**Figure 7: DeCew Residence 2017 Trash Composition Summary**




### 3.3.5 MacKenzie Chown Complex

Figure 8 summarizes the trash composition determined at the MacKenzie Chown Complex in October 2017. Paper towels and organic materials represented 54.5% and 16.0% of the overall sample respectively. Non-recyclables, mixed papers and mixed containers represented approximately 12.0%, 5.1% and 4.8% of the sample respectively.

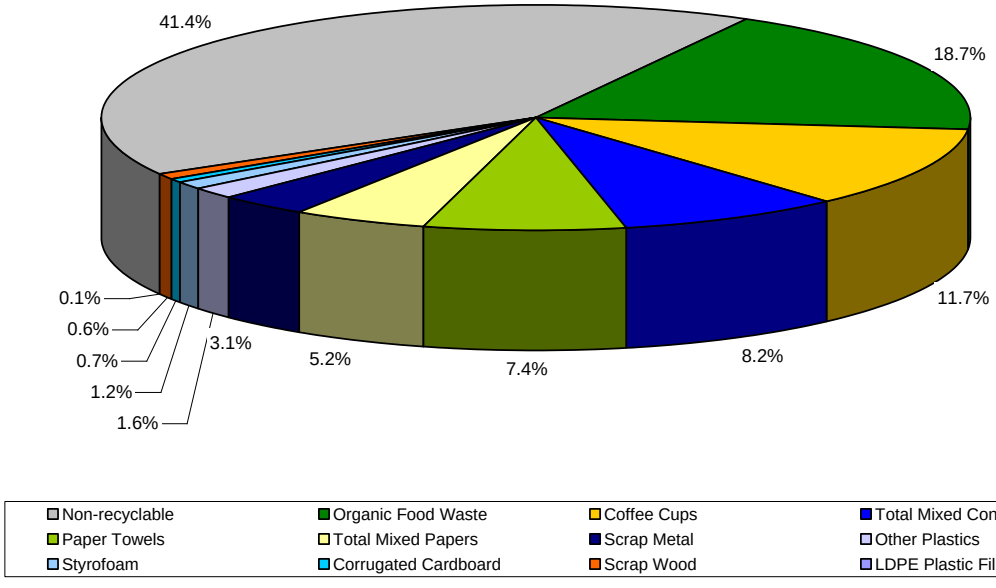
**Figure 8: MacKenzie Chown 2017 Trash Composition Summary**




### 3.3.6 South Block

Figure 9 summarizes the trash composition determined at South Block. Non-recyclables and organics represented 41.4% and 18.7% of the entire sample respectively. Coffee cups, mixed containers and paper towels represented 11.7%, 8.2% and 7.4% of the sample respectively.

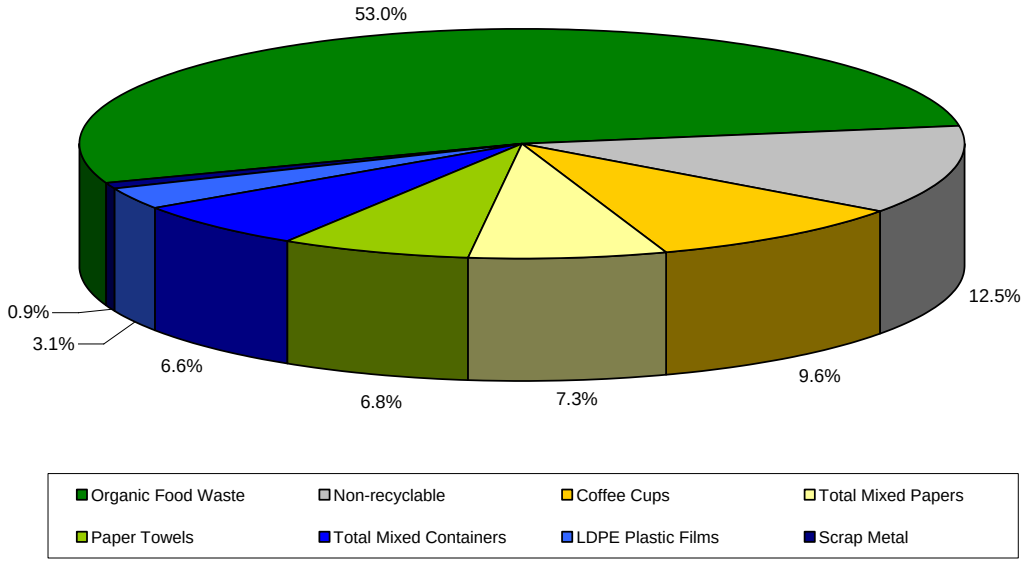
**Figure 9: South Block 2017 Trash Composition Summary**



### 3.3.7 Outdoor Bins

Figure 10 summarizes the trash composition determined in outdoor bins in October 2017. Organic materials, non-recyclables, coffee cups, mixed papers and paper towels represented 53.0%, 12.5%, 9.6%, 7.3% and 6.8% of the sample respectively.

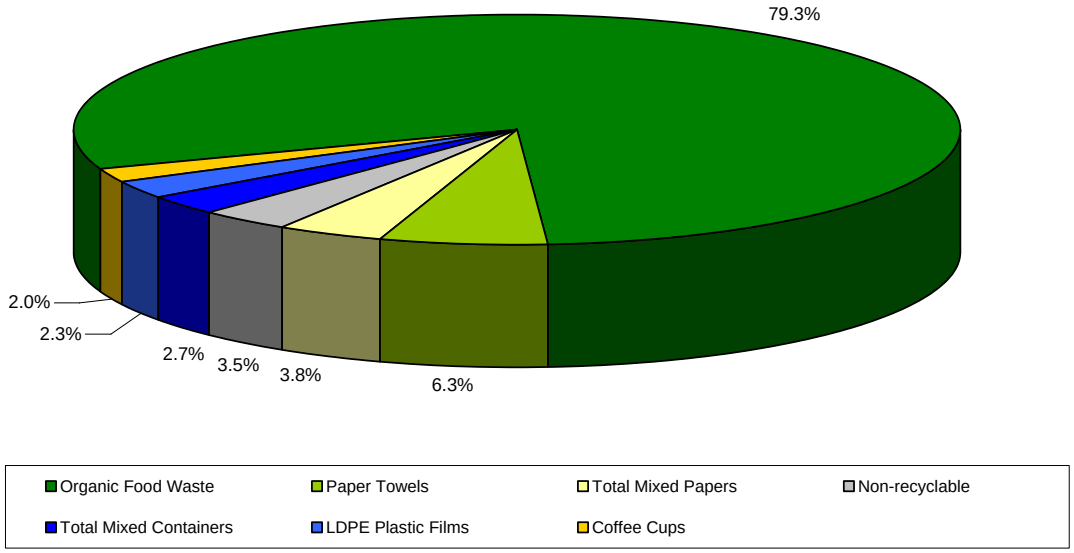
**Figure 10: Outdoor Bins 2017 Trash Composition Summary**




### 3.3.8 Student Centre

Figure 11 summarizes the trash composition determined at the Student Centre in October 2017. Organics represented 79.3% of the entire sample. Paper towels, mixed papers, non-recyclables and mixed containers represented 6.3%, 3.8%, 3.5% and 2.7% of the sample respectively.

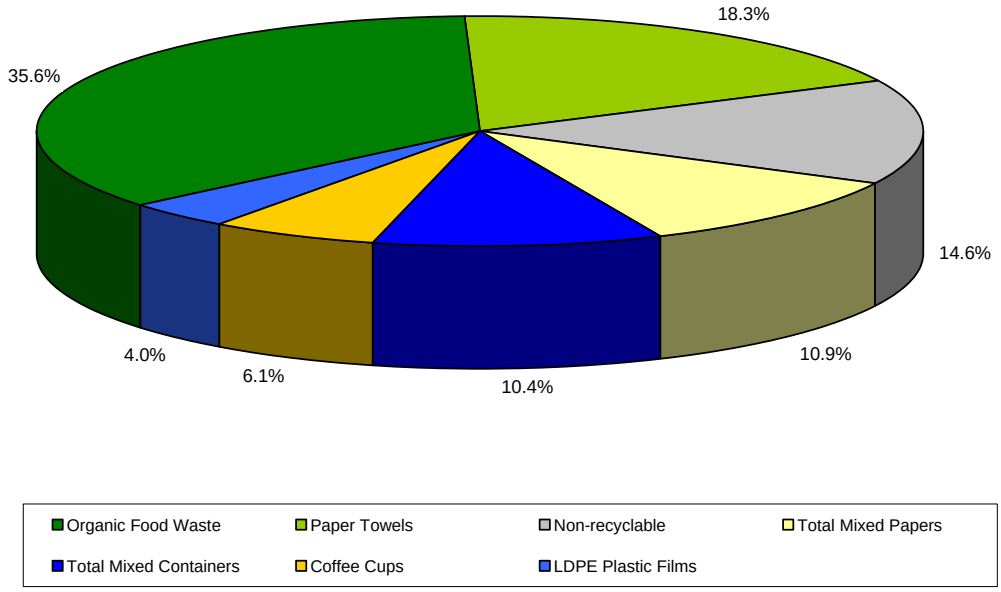
**Figure 11: Student Centre 2017 Trash Composition Summary**



### 3.3.9 Cairns Building

Figure 12 summarizes the trash composition determined at the Cairns Building in October 2017. Organics represented 35.6% of the entire sample. Paper towels, non-recyclables, mixed papers and mixed containers represented 18.3%, 14.6%, 10.9% and 10.4% of the sample respectively.

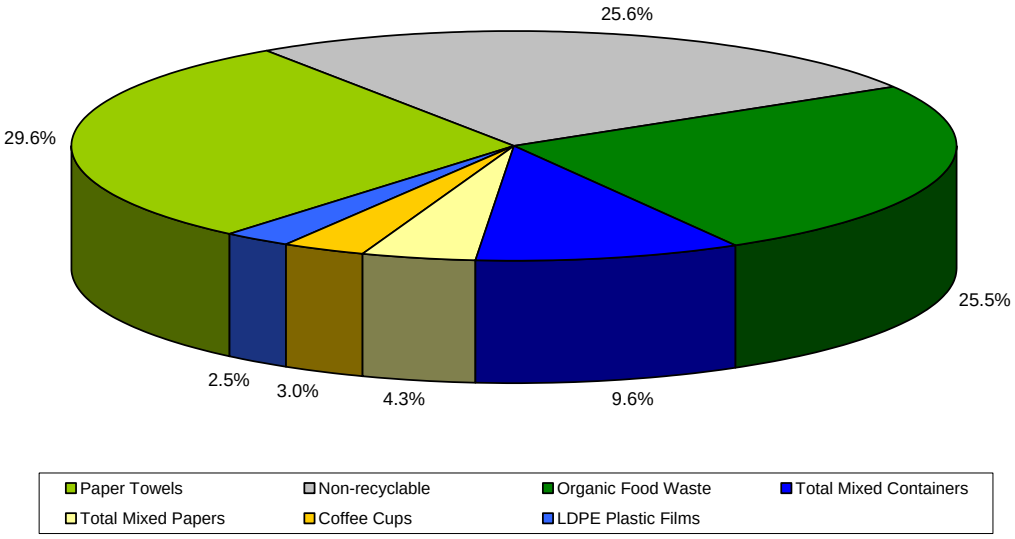
**Figure 12: Cairns Building 2017 Trash Composition Summary**




### 3.3.10 Walker West Complex

Figure 13 summarizes the trash composition determined at the Walker West Complex in October 2017. Paper towels represented 29.6% of the entire sample. Non-recyclables, organic materials and mixed containers represented 25.6%, 25.5% and 9.6% of the sample respectively.

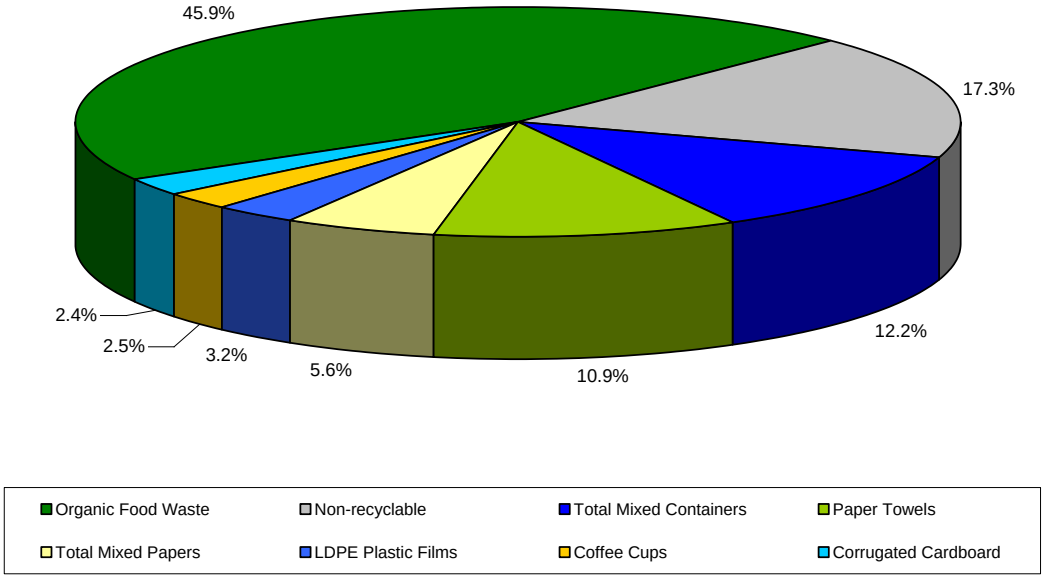
**Figure 13: Walker West Complex 2017 Trash Composition Summary**



### 3.3.11 Lowenberger Residence

Figure 14 summarizes the trash composition determined at the Lowenberger Residence in October 2017. Organic materials represented 45.9% of the entire sample. Non-recyclables, mixed containers and paper towels represented 17.3%, 12.2% and 10.9% of the sample respectively.

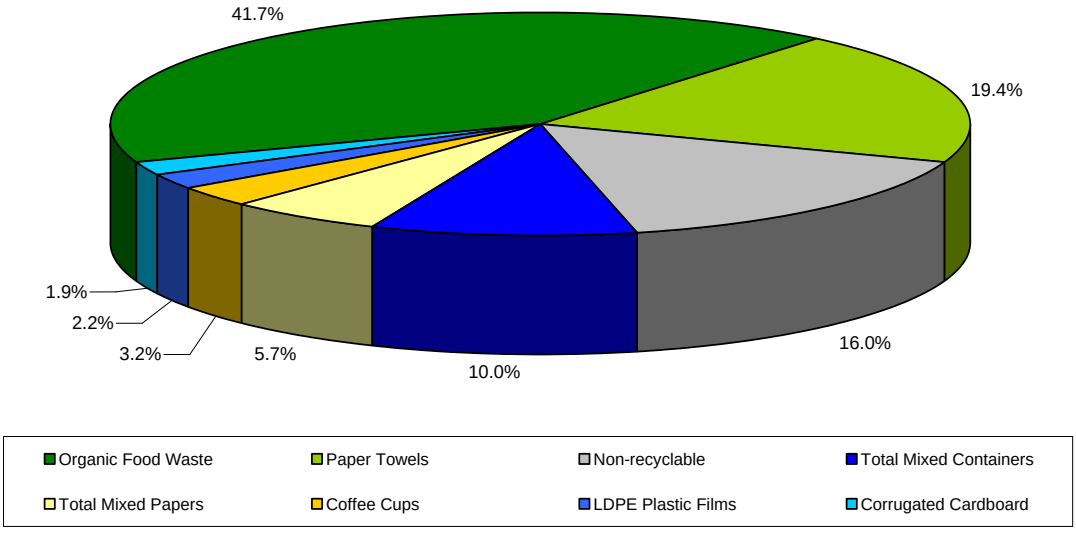
**Figure 14: Lowenberger Residence 2017 Trash Composition Summary**




### 3.3.12 Village Residence

Figure 15 summarizes the trash composition determined at the Village Residence in October 2017. Organics and paper towels represented 41.7% and 19.4% of the entire sample. Non-recyclables, mixed containers and mixed papers represented 16.0%, 10.0% and 5.7% of the sample respectively.

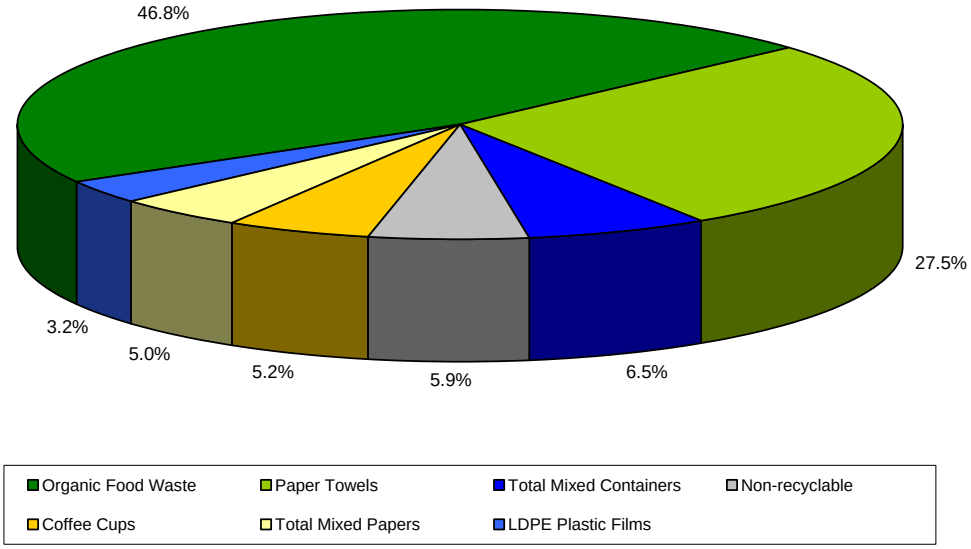
**Figure 15: Village Residence 2017 Trash Composition Summary**



### 3.3.13 Welch Hall

Figure 16 summarizes the trash composition determined at Welch Hall in October 2017. Organics represented approximately 46.8% of the overall sample. Paper towels, mixed containers, non-recyclables and coffee cups represented 27.5%, 6.5%, 5.9% and 5.2% of the sample respectively.

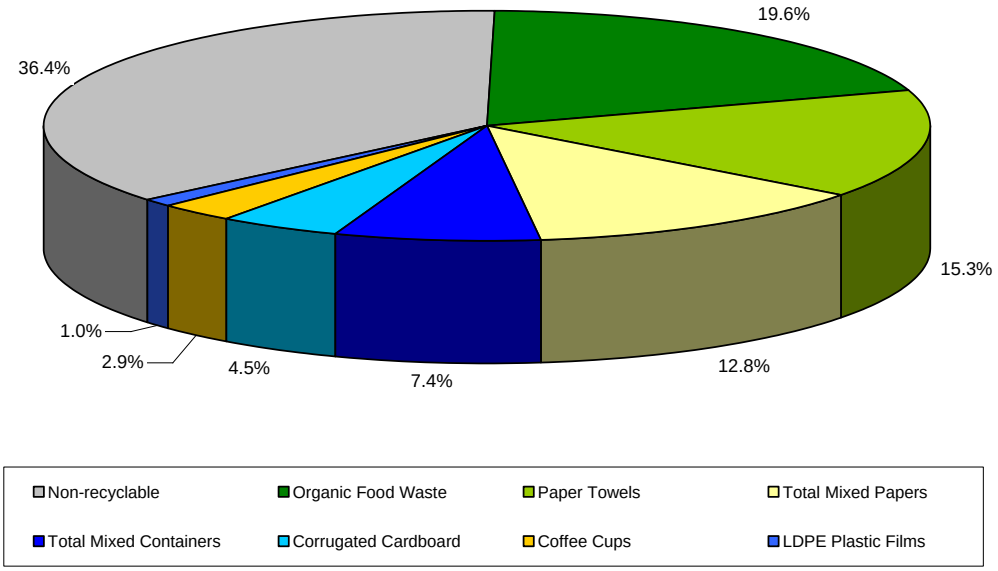
**Figure 16: Welch Hall 2017 Trash Composition Summary**




### 3.3.14 Scotia Bank Hall

Figure 17 summarizes the trash composition determined at Scotia Bank Hall in October 2017. Non-recyclables, organics, paper towels, mixed papers and mixed containers represented 36.4%, 19.6%, 15.3%, 12.8% and 7.4% of the entire sample respectively.

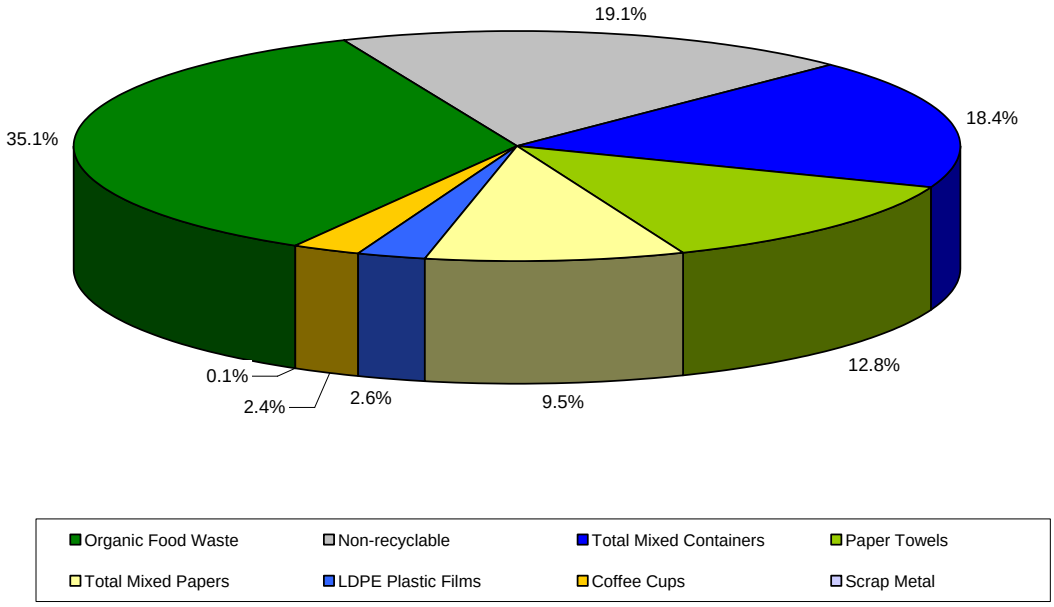
**Figure 17: Scotia Bank Hall 2017 Trash Composition Summary**



### 3.3.15 EARP Residence

Figure 18 summarizes the trash composition determined at EARP Residence in October 2017. Organics represented 35.1% of the entire sample. Non-recyclables, mixed containers, paper towels and mixed papers represented 19.1%, 18.4%, 12.8% and 9.5% of the sample respectively.

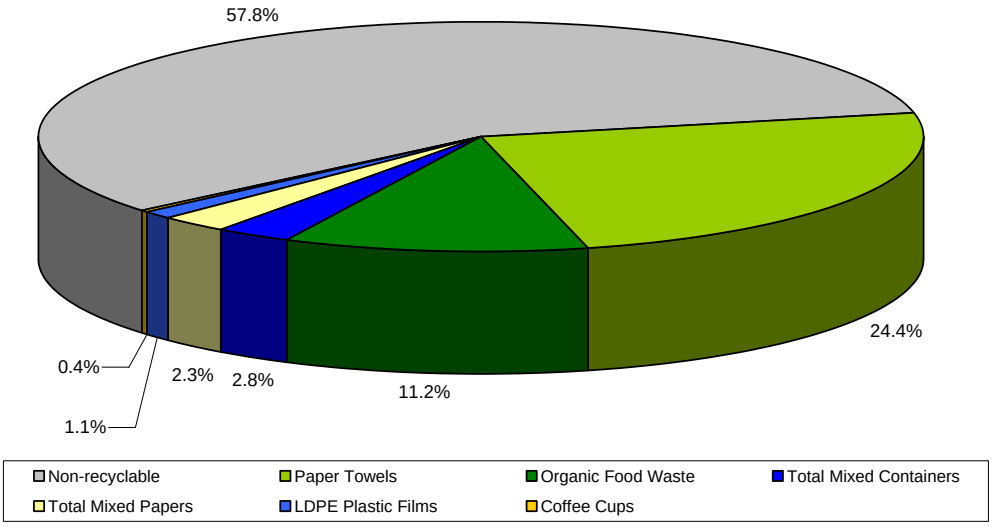
**Figure 18: EARP Residence 2017 Trash Composition Summary**




### 3.3.16 Daycare

Figure 19 summarizes the trash composition determined at the Daycare in October 2017. Non-recyclables, paper towels and organics represented 57.8%, 24.4% and 11.2% of the sample respectively.

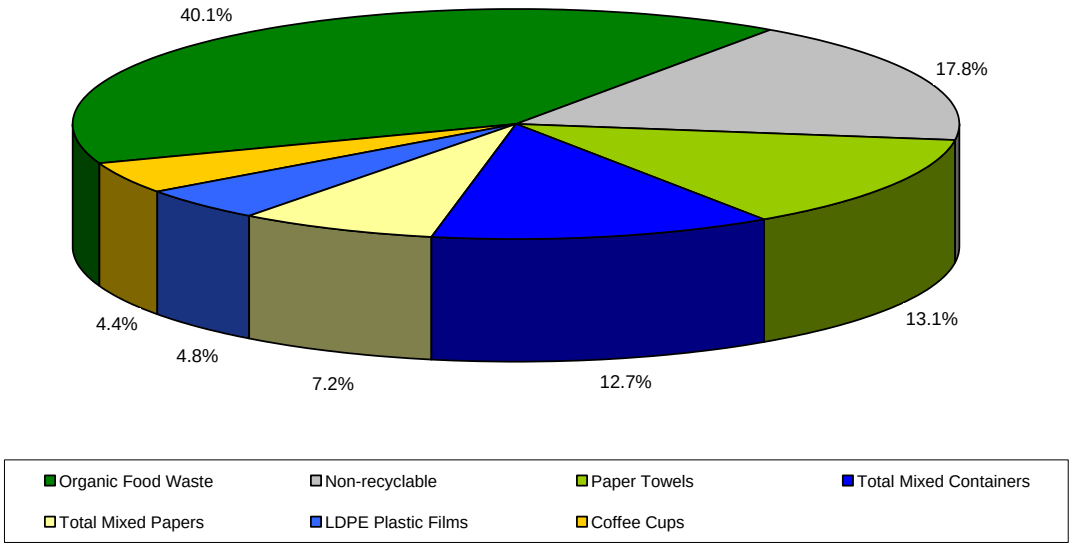
**Figure 19: Daycare 2017 Trash Composition Summary**



### 3.3.17 Taro

Figure 20 summarizes the trash composition determined at Taro in October 2017. Organic materials represented 40.1% of the entire sample. Non-recyclables, paper towels, mixed containers and mixed papers represented 17.8%, 13.1%, 12.7% and 7.2% of the sample respectively.

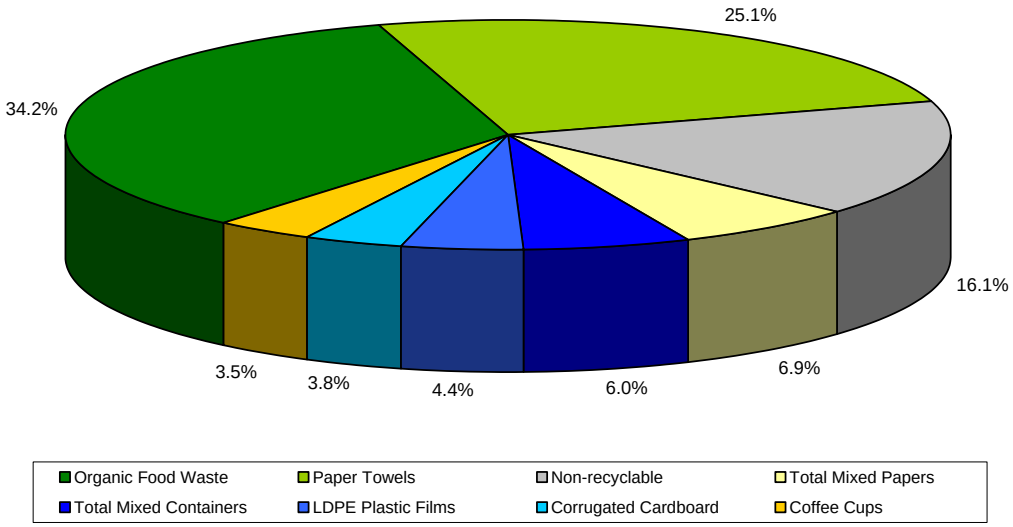
**Figure 20: Taro 2017 Trash Composition Summary**




### 3.3.18 Hamilton Campus

Figure 21 summarizes the trash composition determined at the Hamilton campus in October 2017. Organics and paper towels represented 34.2% and 25.1% of the entire sample. Non-recyclables, mixed papers and mixed containers represented 16.1%, 6.9% and 6.0% of the sample respectively.

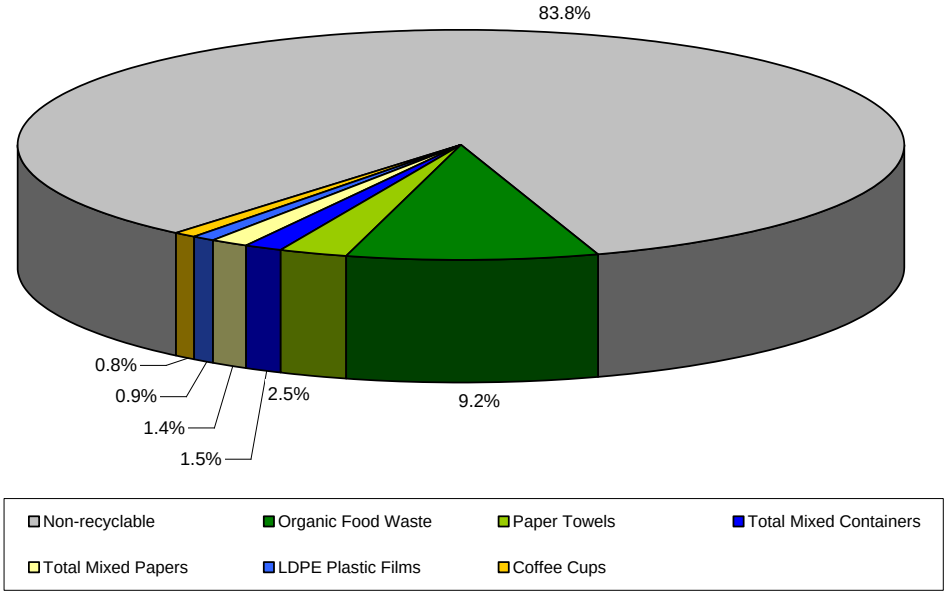
**Figure 21: Hamilton Campus 2017 Trash Composition Summary**



### 3.3.19 Quarryview Residence S

Figure 22 summarizes the trash composition determined at Quarryview Residence S in October 2017. Non-recyclables represented 83,8% of the entire sample. Organics, paper towels and mixed containers represented 9.2%, 2.5% and 1.5% of the sample respectively.

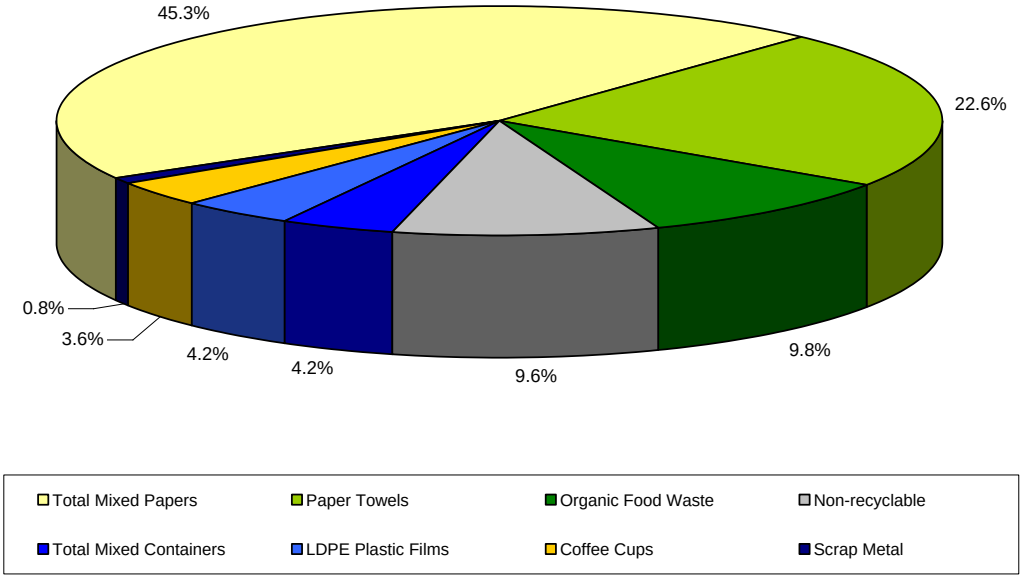
**Figure 22: Quarryview Residence S 2017 Trash Composition Summary**




### 3.3.20 East Academic

Figure 23 summarizes the trash composition determined at the East Academic Building from the October 2017 waste audit sample. Mixed papers represented 45.3% of the entire sample. Paper towels, organics and non-recyclables represented 22.6%, 9.8% and 9.6% of the sample respectively.

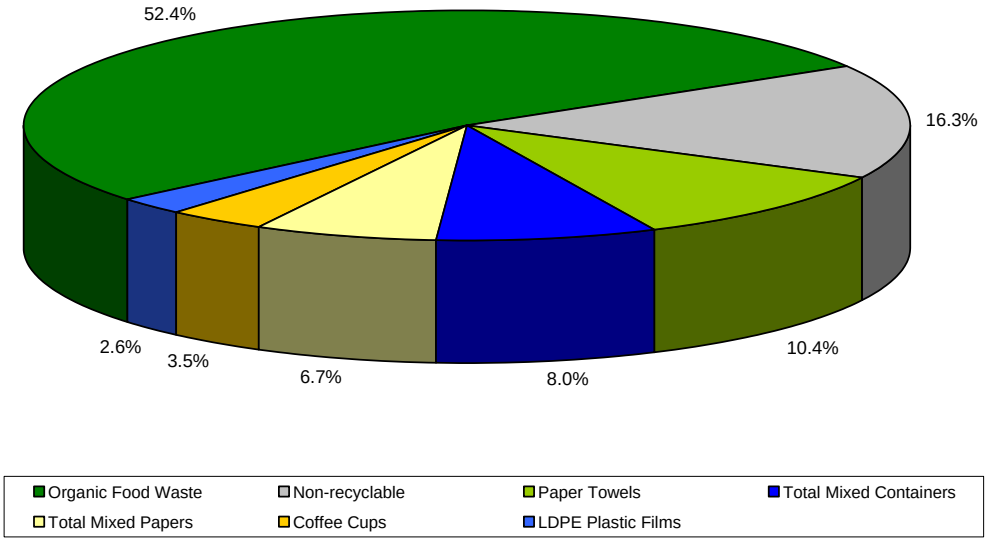
**Figure 23: East Academic 2017 Trash Composition Summary**




### 3.3.21 Quarryview Residence N

Figure 24 summarizes the trash composition determined at Quarryview Residence N in October 2017. Organics represented 52.4% of the entire sample. Non-recyclables, paper towels and mixed containers represented 16.3%, 10.4% and 8.0% of the sample respectively.

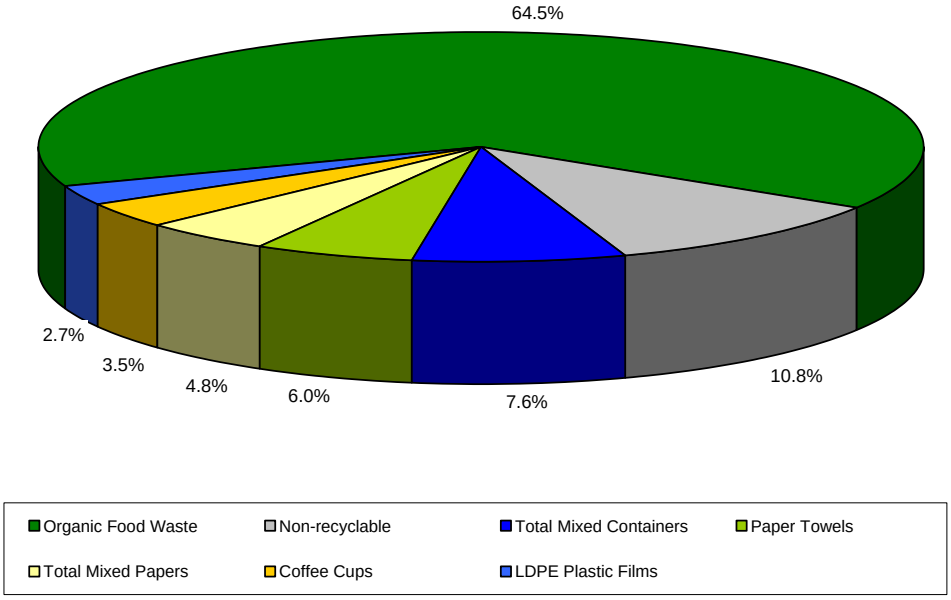
**Figure 24: Quarryview Residence N 2017 Trash Composition Summary**




### 3.3.22 DeCew Café

Figure 25 summarizes the trash composition determined at the DeCew Café in October 2017. Organic materials represented 64.5% of the entire sample. Non-recyclables, mixed containers and paper towels represented 10.8%, 7.6% and 6.0% of the sample respectively.

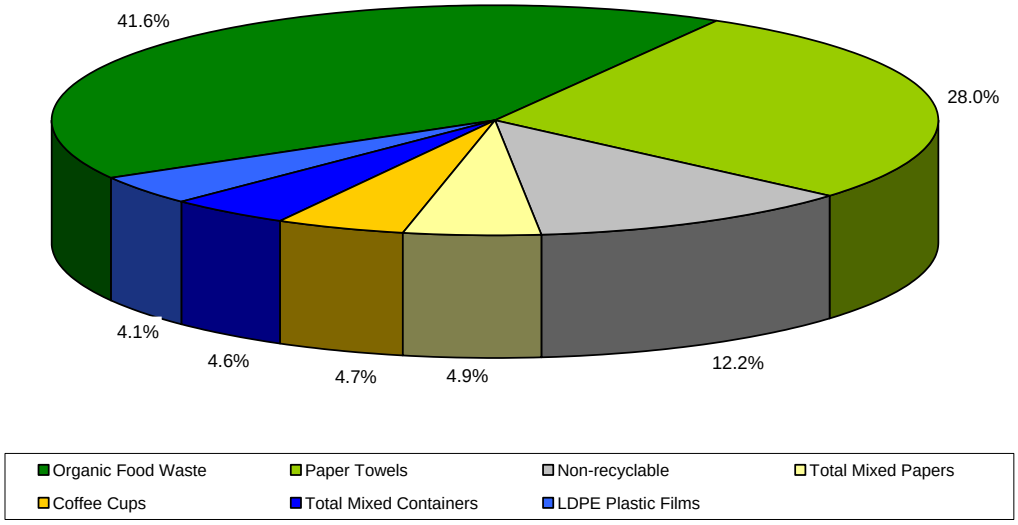
**Figure 25: DeCew Café 2017 Trash Composition Summary**




### 3.3.23 International Centre

Figure 26 summarizes the trash composition determined at the International Centre from the fall 2017 waste audit sample. Organics represented 41.6% of the entire sample. Paper towels, non-recyclables and mixed papers represented 28.0%, 12.2% and 4.9% of the sample respectively.

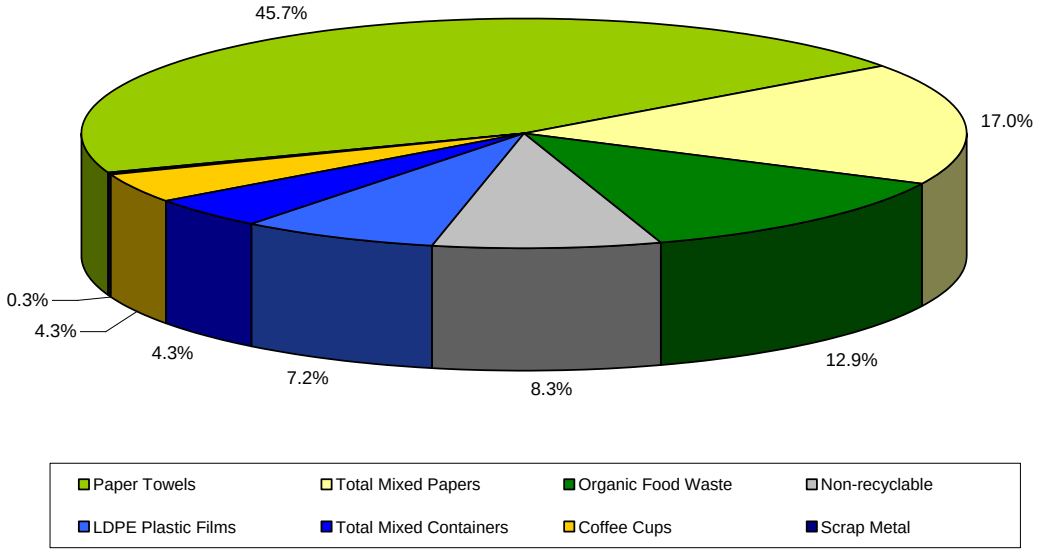
**Figure 26: International Centre 2017 Trash Composition Summary**




### 3.3.24 Harrison Hall

Figure 27 summarizes the trash composition determined at Harrison Hall in October 2017. Paper towels represented 45.7% of the sample. Mixed papers, organics and non-recyclables represented 17.0%, 12.9% and 8.3% of the sample respectively.

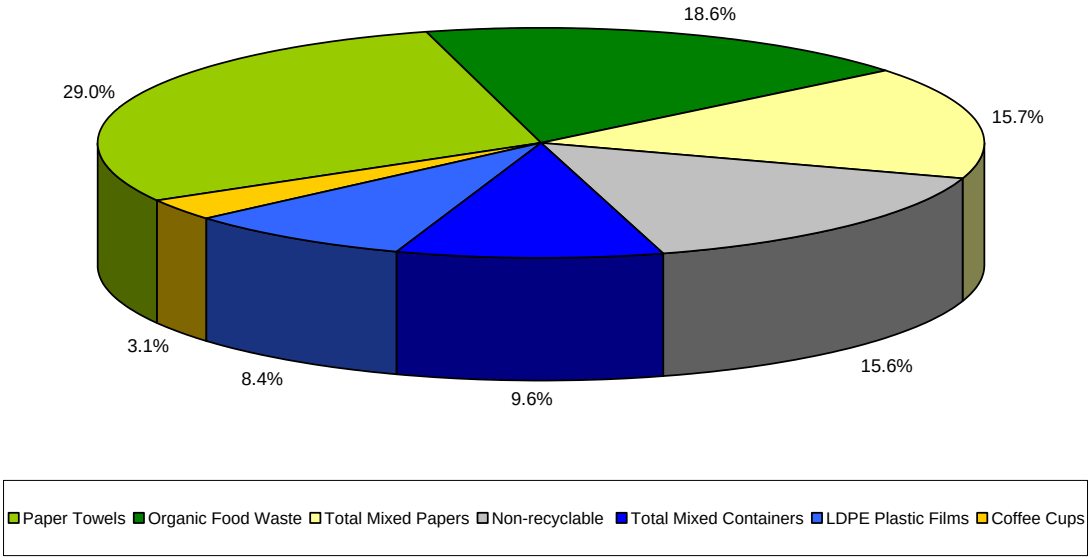
**Figure 27: Harrison Hall 2017 Trash Composition Summary**




### 3.3.25 Marilyn Walker

Figure 28 summarizes the trash composition determined at the Marilyn Walker facility in October 2017. Paper towels and organic materials represented 29.0% and 18.6% of the entire sample respectively. Mixed papers, non-recyclables and mixed containers represented 15.7%, 15.6% and 9.6% of the sample respectively.

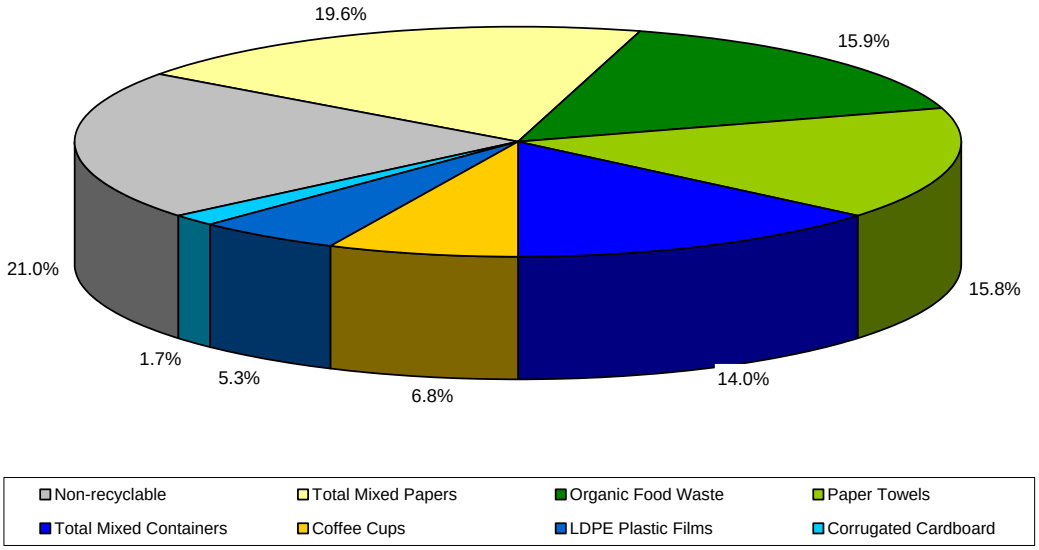
**Figure 28: Marilyn Walker 2017 Trash Composition Summary**




### 3.3.26 573A Glenridge

Figure 29 summarizes the trash composition determined at 573A Glenridge based on the 2017 fall waste audit sample. Non-recyclables, mixed papers, organics, paper towels and mixed containers represented 21.0%, 19.6%, 15.9%, 15.8% and 14.0% of the entire sample respectively.

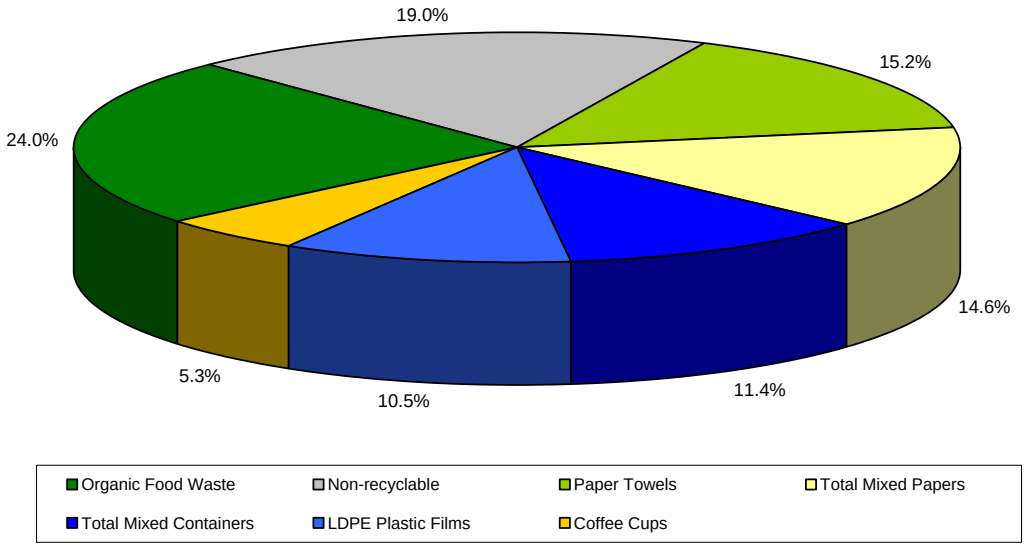
**Figure 29: 573A Glenridge 2017 Trash Composition Summary**




### 3.3.27 Central Utility Building

Figure 30 summarizes the trash composition determined at the CUB in October 2017. Organics and non-recyclables represented 24.0% and 19.0% of the entire sample respectively. Paper towels, mixed papers and mixed containers represented 15.2%, 14.6% and 11.4% of the sample respectively.

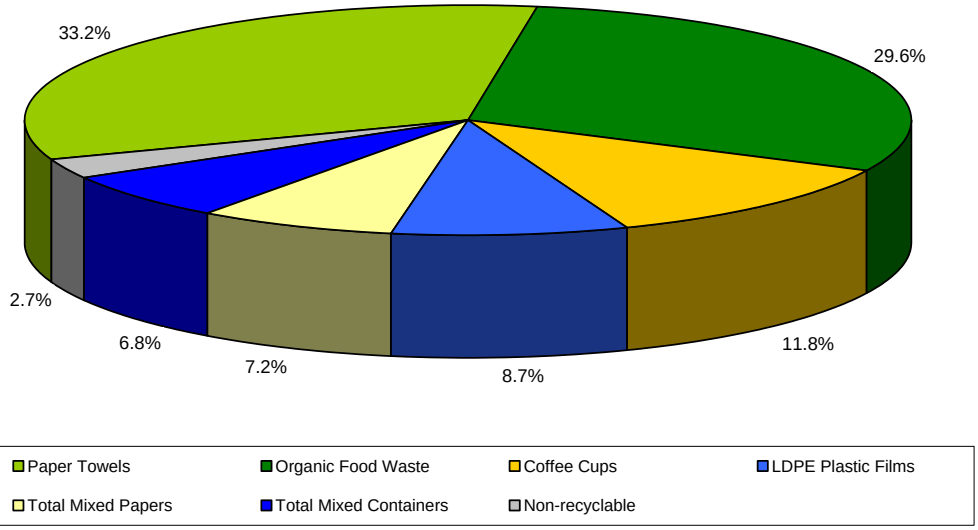
**Figure 30: CUB 2017 Trash Composition Summary**




### 3.3.28 BRIC

Figure 31 summarizes the trash composition determined at the BRIC in October 2017. Paper towels represented 33.2% of the entire sample. Organics, coffee cups and plastic films represented 29.6%, 11.8% and 8.7% of the sample respectively.

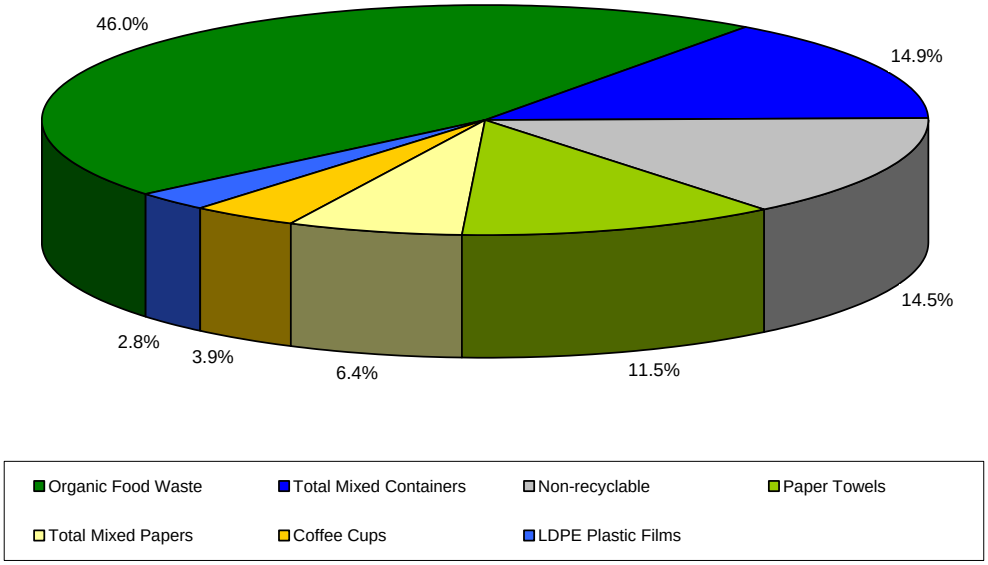
**Figure 31: BRIC 2017 Trash Composition Summary**




### 3.3.29 Kenmore Centre

Figure 32 summarizes the trash composition determined at Kenmore Centre in October 2017. Organic materials represented 46.0% of the entire sample. Mixed containers, non-recyclables, paper towels and mixed papers represented 14.9%, 14.5%, 11.5% and 6.4% of the sample respectively.

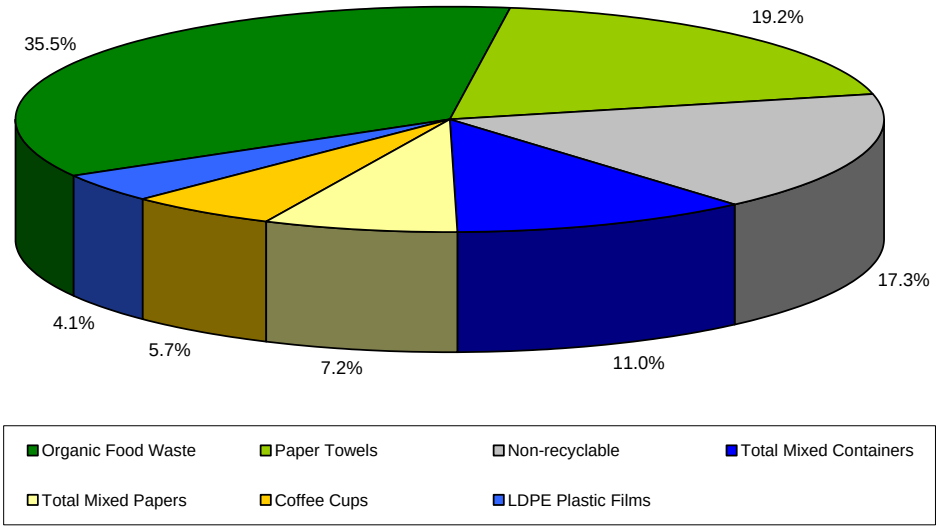
**Figure 32: Kenmore Centre 2017 Trash Composition Summary**




### 3.3.30 Alphie's Trough

Figure 33 summarizes the trash composition determined at Alphie's Trough in October 2017. Organics represented 35.5% of the entire sample. Paper towels, non-recyclables and mixed containers represented 19.2%, 17.3% and 11.0% of the sample respectively.

**Figure 33: Alphie's Trough 2017 Trash Composition Summary**



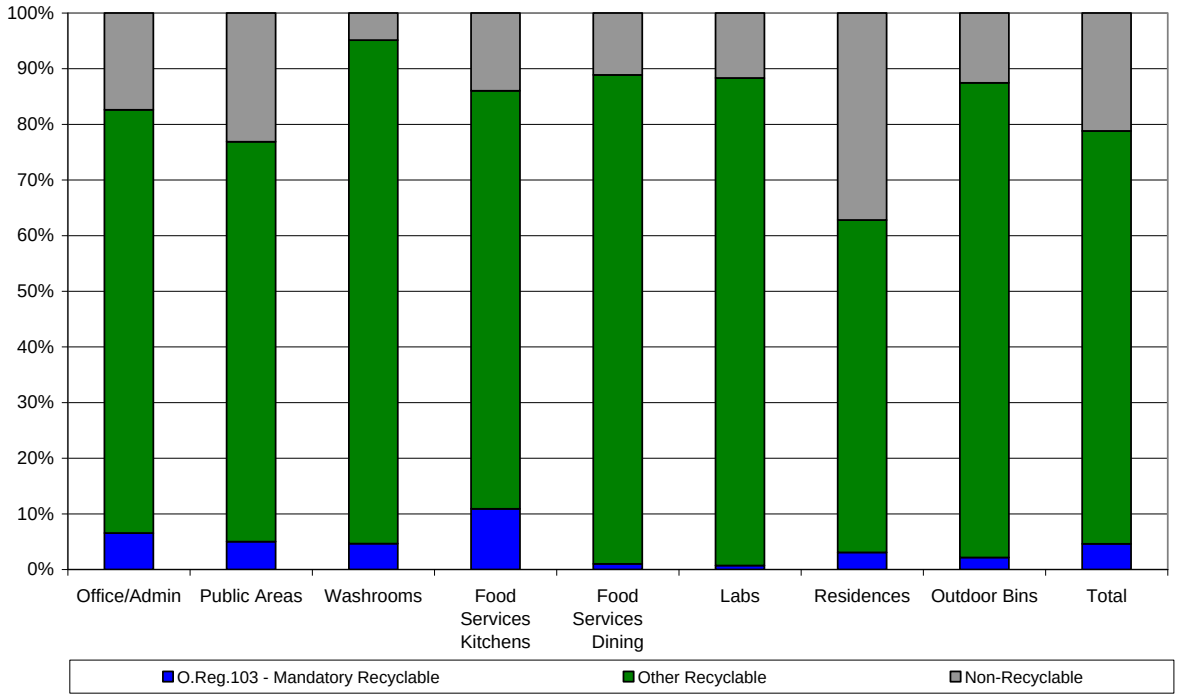

## 3.4 Percentage of Recyclables in Trash

O.Reg. 103/94 requires that "educational institutions" source separate the following materials (at a minimum):

- Aluminum food or beverage cans (including cans made primarily of aluminum);
- Cardboard (corrugated);
- Fine paper;
- Glass bottles and jars for food or beverages;
- Newsprint; and
- Steel food or beverage cans (including cans made primarily of steel).

Figure 34 summarizes the quantity of these "mandatory" recyclable materials compared to "other recyclable" and "non-recyclable" materials found in the 2017 waste audit samples.

**Figure 34: Percentage of Recyclable in Trash**




The data suggests that BrockU has a low 'mandatory' recyclable content of 4.6% in the combined garbage of the university. The main 'mandatory' recyclable materials were fine papers, aluminum cans and newsprint. 'Other Recyclables' represented 74.2% of the sample and consisted mainly of organics, paper towels, various non-mandatory paper fibres and coffee cups. Non-recyclables represented approximately 21.2% of the sample.

## 3.5 Recyclable Material Distribution

Samples of source separated recyclables were collected from the following functional areas within campus buildings during the fall waste audit period:

- Office / Administrative Areas
- Public Areas
- Washrooms
- Food Service – Kitchens
- Food Service – Dining Areas
- Food Service – Tenant Areas
- Self-Contained Residences
- Outdoor Bins

Table 6 ranks recyclables generated per building functional area based on the audit results.

**Table 6: 2017 Waste Audit – Recyclables Generated per Functional Area**

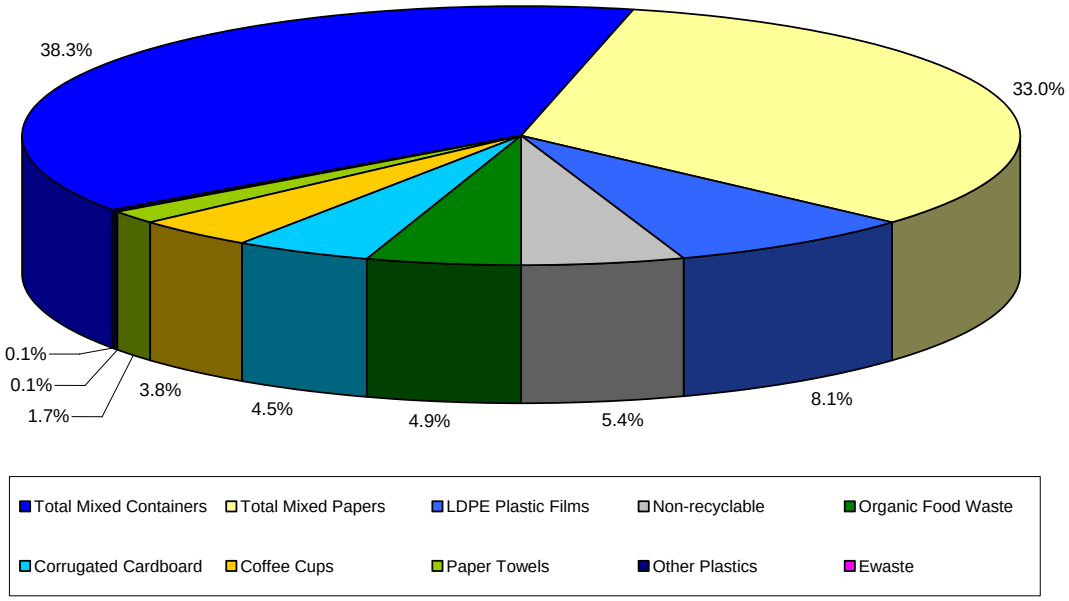
| Functional Area | 24-h Sample Quantity kg | Percentage % |
|---|---|---|
| Public Areas | 163.97 | 31.8% |
| Food Services Dining | 115.82 | 22.5% |
| Food Services Kitchens | 102.87 | 19.9% |
| Outdoor Bins | 73.85 | 14.3% |
| Residences | 27.17 | 5.3% |
| Food Services Tenant Space | 15.93 | 3.1% |
| Office & Admin | 15.39 | 3.0% |
| Washrooms | 0.67 | 0.1% |
| **Total** | **515.67** | **100.0%** |

Based on the 24-hr samples collected for the waste audit, Public Areas, Food Service Areas and Outdoor Bins generated approximately 88% of the collected recyclables. Please note however that these results reflect only traditional recyclables collected at recycling stations, and they do not include items such as cardboard, confidential papers, organic food wastes, scrap metals, etc which could change the percent distribution.

## 3.6 Recyclable Material Composition

The total weight of recyclables collected and sorted for the audit was approximately 515.67 kg. Figure 35 summarizes the overall composition of the audited sample. The recyclable sample had a contamination rate of 14.2%, which consisted mainly of non-recyclable materials, organics and coffee cups.

**Figure 35: Recyclable Material Composition Summary**



Summary tables for each building per waste generation functional area, including waste composition, weights and percentages, are included in Appendix B. Please note that the overall sample size collected of source separated recyclables compared to trash was quite low, representing approximately 23% of the entire sample. This suggests that extrapolating the audit findings over a one-year period based on operating days will underestimate the quantity of recyclables generated on campus. Based on a review of number of bins, bin size and service frequency, it was estimated that the quantity of traditional recyclables (i.e. cardboard, mixed papers and containers) collected over a year period was more than the amount of trash generated over a typical year.

# 4 Diversion Programs & Waste Systems

## 4.1 Waste Diversion Programs

Recycling programs have been initiated at Brock U to recycle/reuse/compost a wide range of materials as described below.

Cardboard: Cardboard recycling is provided across campus. Cardboard boxes are flattened and placed in large receptacles or smaller totes. Cardboard is brought by Brock U staff to their on-site baler. Cardboard bales are serviced by Cascades. Some front-end service is also provided by Modern.

Mixed Containers: Mixed containers include assorted plastics food and beverage containers (PET, HDPE, LDPE, PP, and PS), aluminum and metal cans, glass food and beverage containers, and aseptic containers (gable top containers, tetra paks, etc). Mixed containers are collected throughout campus in dedicated recycle depots, primarily concentrated in high waste generating areas. Collected materials are disposed into 95 gallon totes by Brock U staff. Totes are serviced up to three times per week by Niagara Recycling.

Mixed Papers: Mixed papers include a range of items such items as (but not limited to) newspapers, fine papers, envelopes, magazines, brochures, boxboard, packing paper, shipping/receiving supplies, paper bags and other clean food paper products. Mixed papers are collected throughout campus in dedicated recycle depots, primarily concentrated in high waste generating areas. Collected materials are disposed into 95 gallon totes by Brock U staff. Totes are serviced up to three times per week by Niagara Recycling.

Confidential Papers: Confidential papers are collected mainly in office/administrative areas in secure consoles or totes. In 2017, consoles were serviced by private contractor on a weekly basis. All shredded materials were recycled.

Scrap Metals: Recyclable ferrous metals are collected at the CUB by Brock U staff. Larger pieces of metal recovered through the repair and recovery of broken and old equipment are deposited in a lugger box. Scrap metal recycling service is provided by Sam Adelstein and Co.

Organics: Organic based food waste is collected at the following locations for composting: Alumni Center, Cairns, CUB, DeCew Dock, Inniskillen Hall, International Centre, Lowenberger, Tower Dock and Walker Complex. Organic waste is mainly generated from the preparation of food. Scrap

materials are placed in 32 gallon or 64 gallon totes provided by Davidson Environmental. Organic waste from various food vendors is also placed in receptacles at the back of the Tower complex. Davidson Environmental services the organic bins up to six days per week. An organics pulping unit is installed in the newly renovated market cafeteria in the Tower Complex.

Coffee Cups: Coffee cups are collected on campus in specified recycle containers. Brock U added new dedicated coffee cup recycle bins in 2016, bringing the total on campus to eight. Bagged coffee cups are collected by Davidson Environmental on a weekly basis. The coffee cups are to be shredded and blended into the composting organic materials, acting as a bulking agent.

Oil & Grease: Oils & greases are collected from food service areas across campus, and stored in dedicated containers. Service is provided by Rothsay as required.

Bulbs & Ballasts: Fluorescent bulbs and ballasts are collected across campus and stored in dedicated totes. Service is provided by Aevitas as required.

Electronics/eWastes: Electronic wastes are collected across campus and stored in dedicated locations. Service was provided by Greentec as required.

Batteries: Batteries are collected in small dedicated containers across campus. Collected batteries are stored in dedicated totes. Service is provided by Raw Materials Company Inc as required.

Yard Wastes: Yard wastes are collected across campus during the various seasons of the year. Approximately six (6) 40-yd roll-off bins of loosely packed yard wastes are recycled/composted per year.

Wood Pallets: Wood pallets/skids are returned to suppliers or removed for reuse. Based on discussions with Brock U, pallets are removed on a weekly basis.

Printer Toner Cartridges: Brock U's Printing Services returns all empty toner bottles from the new MFD (Multi Functional Devices) to Xerox for recycling. It is estimated that approximately 200 bottles per year are recycled. Printer toner cartridges are collected from various areas across campus and sent to private contractor to be processed.

Used Furniture: Brock U collected and stored used furniture for on-campus reuse or for donations to local charities. In 2017, approximately eight (8) to ten (10) 5-ton cube trucks were used to collect used furniture.

Amber Bottles: Labs on campus have implemented an in-house reuse program. The quantity of amber bottles collected for reuse was unknown.

Scrap Woods: A scrap wood program was implemented on-site in 2013 at the CUB. Due to the infrequent use of the bin, the service was cancelled in 2014.

LCBO/Beer Store Returns: Brock U returns glass beer, wine and spirit bottles via the LCBO/Beer Store return program.

Water Bottle Filling Stations: Brock U added new water bottle refilling stations on campus. These stations help the university reduce the amount of plastic water bottles used on campus. The program kept approximately 813,906 water bottles from landfill in 2017. Assuming a 500 ml water bottle weighs approximately 10 g, it can be estimated that the water bottle refilling stations reduced a total of approximately 8.1 metric tonnes of plastic from landfill.

Textbook Collection: In 2017, BrockU collected numerous textbooks, all of which were donated, repurposed and/or recycled.

Table 7 summarizes the annual amount of waste diverted from landfills due to waste diversion programs implemented at Brock U.

**Table 7: 2017 Waste Audit - Annualized Waste Diversion Summary**

| Waste Material | Reused or Recycled | Total Diversion Metric Tonnes |
|---|---|---|
| Cardboard | Recycled | 70.7 |
| Mixed Recycling | Recycled | 169.9 |
| Mixed Containers | Recycled | 164.6 |
| Mixed Papers | Recycled | 414.0 |
| Confidential Papers | Recycled | 50.6 |
| Scrap Metals | Recycled | 34.4 |
| Organics | Recycled/Composted | 260.4 |
| Coffee Cups | Recycled/Composted | 0.9 |
| Oil & Grease | Recycled | 11.4 |
| Bulbs & Ballasts | Recycled | 1.8 |
| Electronic wastes | Recycled | 19.8 |
| Batteries | Recycled | 2.2 |
| Yard Wastes | Recycled/Composted | 73.6 |
| Wood Pallets | Reused | 8.1 |
| Printer Toners | Reused | 1.2 |
| Used Furniture/Equipment | Reused | 22.9 |
| Amber Bottles (Labs) | Reused | unknown |
| LCBO/Beer Bottle Returns | Reused | 44.8 |
| Text Books | Reused/Recycled | 12.5 |
| Clothing Donations | Reused | 0.2 |
| Water Bottle Filling Stations | Reduced | 8.1 |
| **Total Waste Material Diverted** | | **1372.1** |

Therefore, the total amount of waste material diverted from landfill in 2017 was approximately 1372 metric tonnes. Evidence of annual quantity data obtained from Brock U and/or service providers is

provided in Appendix A. Waste diversion programs implemented at Brock U exceed the requirements of O.Reg.103/94 for educational institutions.

## 4.2 Waste Disposal Systems

Regular solid non-hazardous waste is collected across campus by Brock U staff and placed in either front-end bins or compactors located in designated waste handling areas. A summary of front-end bins and compactors is provided in Appendix A. Modern Corporation is responsible for the collection of waste weekly depending on the waste generating area. The total quantity of solid non-hazardous waste disposed to landfill in 2017 was estimated to be approximately 538.5 metric tonnes.

Please note that the Modern garbage summary attached in Appendix A uses an assumed waste density of 60 kg/yd$^3$. This value was replaced with Brock U's site specific density of 26.53 kg/yd$^3$ that was determined in 2014.

In 2014, Brock U reduced front-end bin pick-up frequency and/or bin size at a number of locations on campus. In addition, Brock U conducted two density tests with Modern to better estimate the density of garbage. The tests were done in April and during the Summer of 2014. These were done by conducting a garbage collection run at the university, noting what bins were picked up, and knowing the initial and final weight of the collection truck. The densities were combined with 2013 density study results for an average of 26.53 kg/yd$^3$. Since not all garbage bins are 100% full for each collection run, the calculated average density of 26.53 kg/yd$^3$ includes a utilization factor to adjust for bins not completely full. The densities found from the various density studies are consistent with other institutions that have implemented recycling programs similar to Brock U and achieve a high waste diversion rate. It is recommended that Brock U conduct a follow-up waste density test in 2018 to confirm the campus garbage density determined in 2014.

In addition to front-end service, Brock U has two (2) compactors located on campus. These include one (1) 35-yd$^3$ unit at Schmon Tower and one (1) 8-yd$^3$ unit at Central Receiving. The 35-yd$^3$ compactor is weighed prior to disposal. Weights of the Central Receiving compactor was estimated based on the number of pick-ups, campus garbage density and a 3:1 compaction ratio.

## 4.3 Waste Diversion Rate

Waste Diversion Rate is the percentage of waste materials that a facility diverts from landfill due to reduce, reuse and recycling (i.e. 3Rs) initiatives versus the total amount of waste generated (i.e. 3Rs plus disposed). According to the Ontario Ministry of the Environment and Climate Change (MOECC), Waste Diversion Rate is calculated as follows:

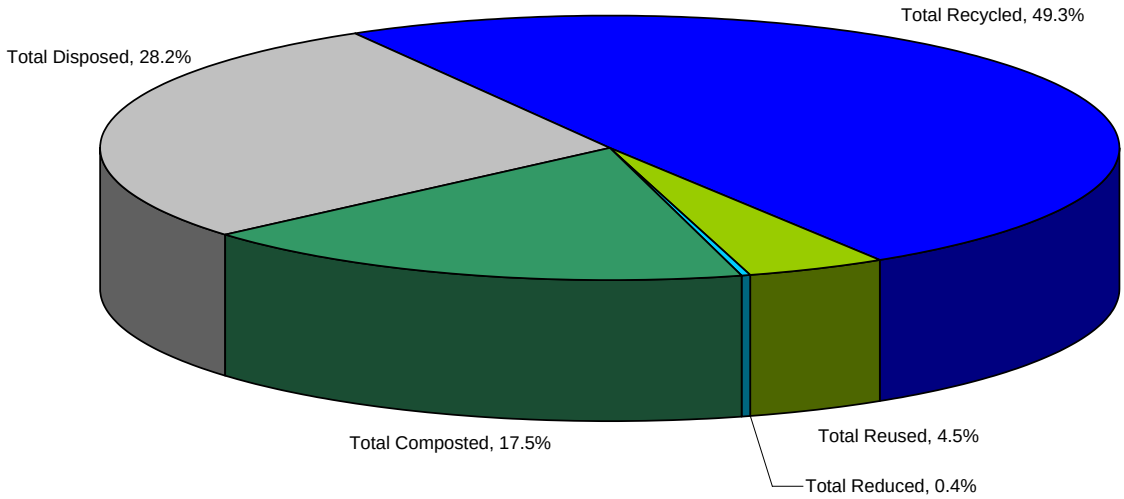
$$Waste\ Diversion\ Rate = \frac{Total\ Waste\ Diverted\ (3Rs)}{Total\ Waste\ Generated} * 100\,\%$$

Based on the total annual amount of waste generated and materials reduced, reused and recycled, the 2017 waste diversion rate through existing programs at Brock U was approximately 71.8%. Table 8 and Figure 36 summarize the quantities of wastes reduced, reused, recycled and disposed. Brock U's 2017 waste diversion rate exceeds the MOECC's provincial objective of 60% waste diversion.

**Table 8: Annualized Quantities of Materials Reduced, Reused, Recycled and Disposed**

| Material | Total Waste | |
|---|---|---|
| | Metric Tonnes | Percent |
| Disposed to Landfill | 538.5 | 28.2% |
| Materials Reduced | 8.1 | 0.4% |
| Materials Reused | 86.9 | 4.5% |
| Materials Recycled | 942.3 | 49.3% |
| Materials Composted | 334.8 | 17.5% |
| **Total Waste Generated** | **1910.7** | **100.0%** |
| **WASTE DIVERSION RATE** | | **71.8%** |

**Figure 36: 2017 Waste Audit Summary**




## 4.4 Capture Rate

Capture rate is the proportion of divertible waste materials which are successfully diverted from disposal compared to the total amount of the divertible waste materials generated. According to the Recycling Council of Ontario, Capture Rate is calculated as follows:

$$Capture\,Rate = \frac{Total\ \ Divertible\,Material\,Captured\,(3Rs)}{Total\,Divertible\,Material\ \ Generated} * 100\,\%$$

Thus, capture rate assists in determining the effectiveness of recycling programs. Table 9 summarizes the capture rate for the main divertible materials at Brock U.

**Table 9: Capture Rate Summary**

| Divertible Material | Annualized Material Generated Metric Tonnes | Annualized 3Rs Quantity Captured Metric Tonnes | Capture Rate Percent |
|---|---|---|---|
| Cardboard | 73.0 | 70.7 | 96.8% |
| Mixed Containers | 264.8 | 212.9 | 80.4% |
| Mixed Papers | 574.6 | 535.6 | 93.2% |
| Confidential Papers | 50.6 | 50.6 | 100.0% |
| Scrap Metals | 36.5 | 34.4 | 94.2% |
| Organics | 454.0 | 260.4 | 57.4% |
| Coffee Cups | 27.2 | 0.9 | 3.2% |
| Oil & Grease | 11.4 | 11.4 | 100.0% |
| Bulbs & Ballasts | 1.8 | 1.8 | 100.0% |
| Electronic wastes | 20.5 | 19.8 | 96.9% |
| Batteries | 2.5 | 2.2 | 88.2% |
| Yard Wastes | 73.6 | 73.6 | 100.0% |
| Wood Pallets | 8.1 | 8.1 | 100.0% |
| Printer Toners | 1.3 | 1.2 | 93.0% |
| Used Furniture/Equipment | 23.2 | 23.2 | 100.0% |
| LCBO/Beer Bottle Returns | 46.4 | 44.8 | 96.4% |
| Text Books | 12.5 | 12.5 | 100.0% |
| Water Bottle Filling Stations | 8.1 | 8.1 | 100.0% |
| **Overall Facility** | **1690.0** | **1372.1** | **81.2%** |

Capture rates of most materials are high ranging from approximately 57% to 100%. Coffee cups had the only value less than 57%, being approximately 3.2%. The overall capture rate of all recyclables on campus is considered to be high at approximately 81.2%.

## 4.5 Year over Year Change in Waste Generation

Waste diversion rate and capture rate do not always demonstrate how effective a site's 3R programs are operating. This is due to the continual change of many important factors involved in waste and recyclable material generation on campus, such as number of students enrolled, floor area of buildings, etc. As student numbers change or more buildings are added to the campus, quantities of waste and recyclables change making it difficult to have a direct comparison of data between years. In 2012, Brock U start tracking 'Year over Year' changes in the amount of wastes disposed and/or materials recycled per standard unit. This allows direct comparison of data from year to year, thus assisting the university in gaining an understanding of the effectiveness of their 3Rs programs. For Brock U, the most applicable standard unit is Full-time equivalent students, or FTE.

### 4.5.1 Year-over-Year Change in 3Rs Quantities

The 'Year-over-Year Change in 3Rs Quantities' is the indicator of the amount of materials diverted from disposal through reduce, reuse and/or recycle activities per FTE compared to previous data. Table 10 summarizes the results for the 2017 year compared to 2016, 2015, 2014, 2013, 2012 and 2011. A positive year-over-year change indicates 3Rs programs are improving over time.

**Table 10: Yr-over-Yr Change in 3Rs Quantities**

| Period | Total Materials Reduced, Reused Recycled (MT) | FTE | Annual 3R Quantity (kg/FTE) | Yr-over-Yr Change in 3Rs Quantity (kg) |
|---|---|---|---|---|
| 2011 | 1267.8 | 15905.1 | 79.7 | -- |
| 2012 | 1316.7 | 16386.9 | 80.4 | +0.7 |
| 2013 | 1266.3 | 16714.8 | 75.8 | -4.6 |
| 2014 | 1237.1 | 17139.4 | 72.2 | -3.6 |
| 2015 | 1392.4 | 17217 | 80.9 | +8.7 |
| 2016 | 1383.1 | 16957 | 81.9 | +1.0 |
| 2017 | 1372.1 | 17215.8 | 79.7 | -2.2 |

### 4.5.2 Year-over-Year Change in Trash Disposed

The 'Year over Year Change in Trash Disposed' is the indicator of the amount of reduction in waste materials disposed to landfill due to reduction, reuse and recycling activities on campus. Table 11 summarizes the results for the 2017 year compared to 2016, 2015, 2014, 2013, 2012 and 2011. A reduction in the year over year value will indicate the university is continually reducing wastes disposed to landfill.

**Table 11: Yr-over-Yr Change in Trash Disposed**

| Period | Total Materials Disposed to Landfill (MT) | FTE | Annual Disposed Quantity (kg/FTE) | Yr-over-Yr Change in Disposed Quantity (kg) |
|---|---|---|---|---|
| 2011 | 470.0 | 15905.1 | 29.6 | -- |
| 2012 | 868.2 | 16386.9 | 52.9 | +23.3 |
| 2013 | 673.7 | 16714.8 | 40.3 | -12.6 |
| 2014 | 643.5 | 17139.4 | 37.5 | -2.8 |
| 2015 | 640.3 | 17217 | 37.2 | -0.3 |
| 2016 | 674.9 | 16957 | 39.8 | +2.6 |
| 2017 | 538.5 | 17215.8 | 31.3 | -8.5 |

## 5 Changes at Brock U in 2017

In 2017, Brock U continued to improve all existing waste diversion programs implemented on-site.

## 6 Waste Audit Summary & Waste Reduction Work Plan

Refer to Appendix C and Appendix D for the Waste Audit Summary and the Waste Reduction Work Plan respectively. The last page of each set of forms in the appendices need to be signed by an authorized person at the University.

According to O.Reg. 102/94, the Waste Reduction Work Plan (Appendix D) or a summary of the plan must be posted at the University in a place where staff/students can review it. If a summary is posted, the entire Work Plan should also be made available for review by any staff/student upon request.

## 7 Conclusions & Recommendations

Based on the results of the solid non-hazardous waste audit conducted for Brock U, the following conclusions can be made. Recommendations presented below are intended to assist Brock U in maximizing their waste diversion potential.

- In 2017, Brock U disposed of approximately 538.5 tonnes of solid waste in landfills. Approximately 1372.1 tonnes of waste materials were diverted through existing reduce, reuse and recycling activities. This represents a waste diversion rate of approximately 72%. The provincial objective is 60% waste diversion.
- Brock U maintains diversion programs for cardboard, mixed containers, mixed papers, confidential papers, scrap metals, organics, coffee cups, oil and grease, bulbs and ballasts, electronic wastes, batteries, yard wastes, wood pallets, printer toners, used furniture/equipment donations, amber bottles (labs), LCBO/Beer Store returns, clothing donations, textbook reuse/recycling and reductions due to water bottle refilling installations.
- Waste diversion programs implemented at Brock U exceed the source separation requirements of O.Reg.103/94 for educational institutions.
- Based on the results of the 2017 waste audit, Schmon Tower, Thistle, Plaza/Bookstore, North Decew Residence, MacKenzie Chown, and South Block were the most significant generators of waste on campus, accounting for approximately 50% of the garbage stream.
- Public areas, self-contained residences, washrooms, office areas and dining areas generated the most trash on campus, accounting for approximately 90% of the garbage stream.
- Brock U has a 'mandatory' recyclable content of 4.6% in the combined garbage of the university. The main 'mandatory' recyclable materials were fine papers, aluminum cans and newsprint. 'Other Recyclables' represented 74.2% of the sample and consisted mainly of organics, paper towels, various non-mandatory paper fibres and coffee cups. Non-recyclables represented approximately 21.2% of the sample.
- Capture rates of most materials are high ranging from approximately 57% to 100%. Coffee cups had the only value less than 56%, being approximately 3.2%. The overall capture rate of all recyclables on campus is considered to be high at approximately 81.2%.
- Based on the waste audit results, it was estimated that approximately 35.9% (or 194 tonnes) of solid waste disposed to landfill consisted of organic materials (i.e. food wastes). Organics were found in relatively high amounts in food service tenant areas, food service kitchen areas, food service dining areas, residences, public and office areas. An organics compost program exists at

Brock U in some designated areas. The results suggest that improved and/or expanded collection systems, improved signage, program promotion and/or student/staff education programs may be required to improve the capture rate of this material. Organics are not a mandatory recyclable material per O.Reg.103/94.

- Based on the waste audit results, it was estimated that approximately 17.8% (or 96 tonnes) of solid waste disposed to landfill consisted of paper towels. Washrooms and labs generated the highest quantity of paper towels. This data suggests that improved collection systems, labels, program promotion and/or student/staff education programs may be required to improve the capture rate of this material. Paper towels are not a mandatory recyclable per O.Reg.103/94.
- Based on the waste audit results, it was estimated that approximately 9.6% (or 52 tonnes) of solid waste disposed to landfill consisted of mixed containers (aluminum cans, glass jars, plastic bottles, tetra packs, milk cartons, etc). Food service and office areas generated the highest quantities of mixed containers. The most common types of materials found were various plastic bottles, steel and gable top containers. A mixed container recycling program exists at Brock U. This data suggests that improved collection systems, labels, program promotion and/or student/staff education programs may be required to improve the capture rate of this material. Glass, steel and aluminum food and beverage containers are mandatory recyclables per O.Reg.103/94.
- Based on the waste audit results, it was estimated that approximately 7.2% (or 39 tonnes) of solid waste disposed to landfill consisted of mixed papers (fine papers, newsprint, boxboard, etc). Public areas, residences and office areas generated the highest quantity of mixed papers. The most common types of materials found were fine papers and newsprint. A mixed paper recycling program exists at Brock U. This data suggests that improved collection systems, labels, program promotion and/or student/staff education programs may be required to improve the capture rate of this material. Fine paper and newsprint are mandatory recyclables per O.Reg.103/94.
- Based on the 24-hr recycling samples collected for the waste audit, Public Areas, Food Service Areas and Outdoor Bins generated approximately 88% of the collected recyclables. The recyclable sample had a contamination rate of 14.2%, which consisted mainly of non-recyclable materials, organics and coffee cups.
- In 2017, Brock U generated 79.7 kg/FTE of recyclables which is 2.2 kg/FTE less than in 2016. This result suggests Brock U's waste diversion programs were not as efficient in 2017.
- In 2017, Brock U generated 31.3 kg/FTE of trash which is 8.5 kg/FTE less than in 2016. This result suggests Brock U's waste reduction programs were more efficient in 2017.
- It is recommended that Brock U continue to conduct studies to verify the density of wastes disposed to landfill. This includes verification of the weight of the Central Shipping compactor loads.
- It is recommended that a study be conducted to verify mixed container and mixed paper tote weights as well as to conduct an inventory of bins on-campus. It is recommended that the total number of totes picked-up per week be verified.

- It is recommended that a study be conducted to verify organic tote weights as well to conduct an inventory of bins on-campus. It is recommended that the total number of totes picked-up per week be verified.
- It is recommended that Brock U conduct studies to add and improve reduction and reuse weights to improve the university's diversion rate. For example, reduction credits can include reduced coffee cup weight disposed to landfill due to the implementation of a reusable coffee mug program on campus or reduced paper weight due to double-sided photocopiers operating on campus.
- Continue to make use of multi-compartment containers (i.e. recycling depots) for waste collection and recycling as much as possible. Remove all "solitary" waste bins at the facility. We recommend only having waste bins that are attached to or close to multi-compartment recycling containers.
- It is recommended that signs be continually updated on all garbage and recycling bins to assist students/staff in sorting wastes easily and correctly. Signs should be easily visible and instructive, such as those having pictograms. Signs are a very effective method of increasing participation, reducing contamination and increasing capture rate.
- Ensure Brock U's Environmental Policy is clearly visible in all common areas throughout campus. Emphasize Brock U's commitment to environmental stewardship in its newsletters, brochures, annual reports and contracts. Regular newsletters promoting the school's waste reduction programs, goals and concerns will increase student/staff cooperation.
- Continue to increase awareness of current recycling programs through staff and student education programs. Such programs can include brief training programs as well as placement of posters in strategic locations around campus, and posting information regarding campus goals and recycling, reuse, and reduction rates at the school. A suggestion box and/or email address may be helpful in communicating student/staff concerns and suggestions when developing or changing existing diversion programs.
- It is important that all staff and students at Brock U be made aware of all available recycling programs. Brock U staff should provide easy access to contact information for questions and/or help regarding the various recycling programs. The recycling programs should have as much consistency as possible across campus.
- Throughout the year, waste should be collected in clear plastic garbage bags instead of black garbage bags. This practice allows cleaning staff to monitor waste collection, as well as to ensure that separated waste streams are disposed of in the correct containers/areas. Some of our clients find it beneficial to use clear bags that have a slight blue tint for use in recycling containers.
- Support and encourage the purchase and use of "environmentally friendly", reusable or recyclable materials and packaging, and/or those that contain recycled content.
- In order to be successful, the waste diversion program must have the full support of Brock U's management team.
- According to O.Reg. 102/94, the Waste Reduction Work Plan (Appendix D) or a summary of the plan must be posted at the facility in a place where it can be viewed. If a summary of the work

plan is posted, the full Work Plan must be made available for review upon request by any of the university's staff or students.

- The waste audit report and waste reduction work plan must be retained on file for a minimum of five years.
- A waste audit report and waste reduction work plan must be conducted and updated annually.