



Waste Audit Report 2018



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Summary

A solid waste audit was completed at McMaster University by six Busch Systems employees and school staff members from December 5th to December 7th 2018. The purpose of this audit was to analyze and understand the contents of refuse generation within the university's residence halls. Specifically, differences in the diversion rate of a residence building that recently implemented organics collection, and compared to a residence hall without organic collection. Hedden Hall is the residence that collects waste and recycling, whereas McKay Hall is the residence that recently implemented organic collection, and also collects waste and recycling.

This waste audit was executed by measuring the weights of refuse material from similar floors of McKay and Hedden for comparison. The residence hall set up is individual rooms with multiple occupants per room with communal areas including kitchens, common spaces, and washrooms. Hedden Hall houses 389 students across five floors and McKay Hall houses 270 students across six floors. The sample of material that was studied came from a common room, a garbage room, and five washrooms from the fourth-floor of each building. On these floors refuse was collected, weighed, and recorded over a three-day period. A composition audit was also completed for common rooms in both buildings to identify what material contributes to the refuse profile and to account for contamination. The sample area did not include kitchens, study rooms, activity rooms, and remaining washrooms.

Results show that McKay Hall has an average 70% diversion rate, while Hedden Hall averages a 31% diversion rate. Through the composition study at Hedden it was found that 72% of the common room waste stream is organic material. This study also revealed that 42% of the recycle stream is organic material. This highlights the success of the organics program in McKay as well as the potential that organics collection has to increase diversion in Hedden Hall.

Introduction

McMaster University is located in Hamilton, Ontario occupying an area of 300 acres. The school has a continuously growing community with a population of around 32,000 students, majority of which are undergraduates. International students accounted for 24% of the graduate student body as of fall 2017.

There are twelve residence buildings that house a total of approximately 3,600 students on campus. Recently, an organics stream was added to the collection program in three residence buildings. This has started as a pilot program within these residence halls with the intention to be rolled out to all twelve in the future. In order to assess the impact of the pilot, Busch Systems partnered with McMaster to complete a waste audit. This study compares refuse generation of McKay Hall, which has organics collection, and Hedden Hall which has only waste and recycling. The location of the buildings where data was collected on campus is seen in Figure 1.

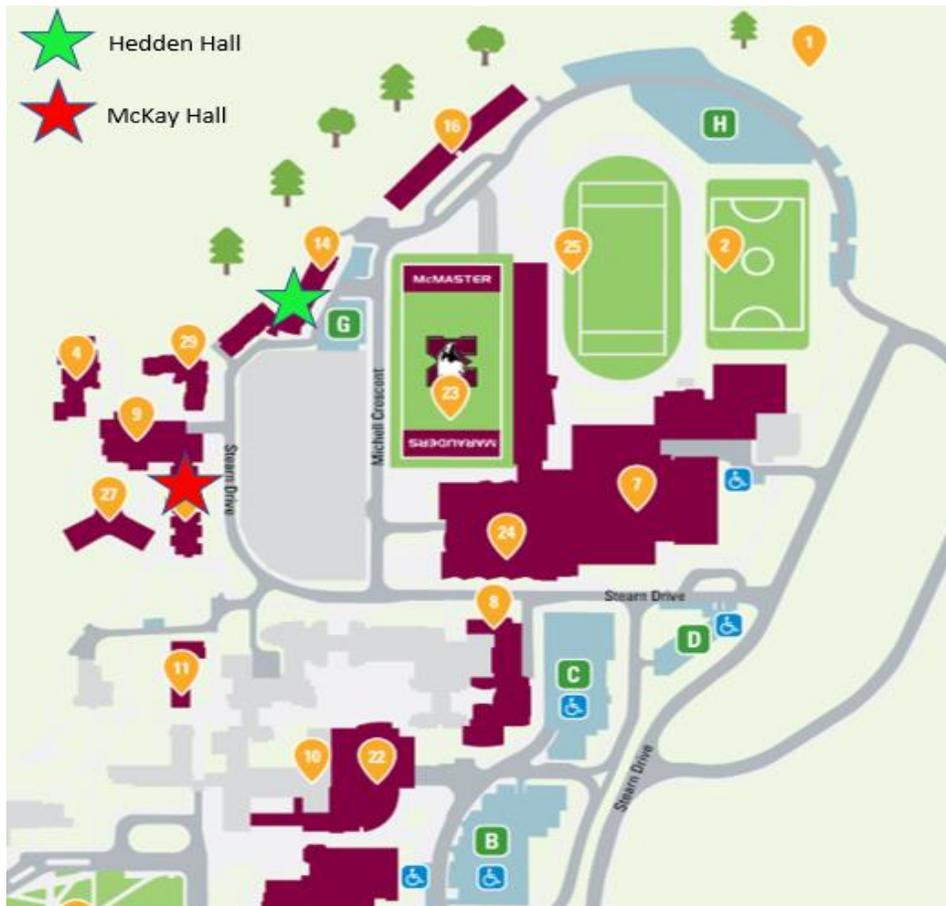


Figure 1: McMaster University campus map, outlining location of Hedden and McKay residence halls.

The data collected through this study was inputted into Busch Systems collection analytics software, called The Resource Centre. This software program generated location-specific reports and graphs reflecting the data trends of the residence halls collection system. Comparing diversion rates and composition of the streams, allowed for recommendations to be made regarding improvements of the collection system in residence buildings.

Terminology

- **Contamination:** presence of non-accepted material in a specified diversion stream, such as waste in the recycling or organics stream.
- **Composition:** the specific materials that make up the total refuse profile.
- **Diversion Rate:** expressed as a percentage; the amount of refuse diverted from landfill by recycling and organics collections.
- **Division:** a high-level grouping of the areas being audited. There are several different stations within each division. Example: the common room is a station that exists in the Hedden Hall division.
- **Ecological Footprint:** the impact of human activity on natural resources. Refers to the area of land and water needed to support the production of goods and consumption related to said activities.
- **Organics:** biodegradable material, including food waste that can be collected for composting or animal feed.
- **Recycling:** scrap materials that can be reprocessed into feedstock to make other new products or packaging materials.
- **Refuse:** a broad, overarching term that applies to anything that is left over after it is used; both recyclable and non-recyclable material.
- **Station:** one group of waste collection bins; each station is made of two or three streams of refuse. Example: waste, recycling and organics make up the common room station.
- **Stream:** the categorization and separation of similar refuse; common streams include waste, organics, and recycling.
- **Waste:** disposed material that cannot be recycled or composted; sent to the landfill.

Current Collection Procedure

All residence buildings presently collect both waste and mixed recycling from students living on campus. Stations are set up within the residence buildings encouraging the separation of recyclable material from waste. Recently, three out of the twelve existing residence halls on campus have incorporated organics collection to maximize their pre-existing collection program.

Student occupants are responsible for taking waste, recycling, and organics (if applicable) from residence rooms to centralized garbage rooms on each floor. These collection rooms have four 32-gallon round garbage bins, a 65-gallon recycling cart, and a 32-gallon organics bin (Figure 2). Signage is located on the wall of the garbage rooms outlining what material is accepted in the recycling stream (Figure 3).

From the garbage rooms, material is collected daily by servicing staff and brought down to dumpsters outside where materials are picked up by haulers.

Residence halls that are part of the organics program use the company Planet Earth, to pick up the material after collection. This hauler collects organic refuse from the outdoor bins and takes it to a Walker Industries facility where it is composted. A special arrangement is in place in order for coffee cups to be accepted as compostable. The end result is high quality compost which is highly desired by farmers, landscapers, and gardeners. The recycling and waste is picked up from centralized dumpsters outside the building by Waste Connections.

There are additional containers in public areas of the residence halls including washrooms, kitchens, common



Figure 2: Garbage room in Hedden hall showing set-up of waste and recycling bins.



Figure 3: Recycling signage in a garbage room from Hedden hall.

rooms, study rooms and activity rooms (Figure 4). The servicing staff also empties these containers daily into centralized garbage rooms.

McKay has a three-stream collection system consisting of Busch Systems Spectrum containers. These containers are consistent throughout the common spaces of the residence hall and each stream has a 10-gallon capacity.

The University's communications department has designed signage for the front panels of the Spectrum containers. The signage communicates to the user, statistics that are specific to the University's diversion program. There is additional signage above the bins outlining what goes in each stream.

The station set up is consistent in terms of bin colour and signage above the containers indicating what goes where. Some areas have the signage on the front panel while some have it above the bins. Majority of stations have three spectrum bins, one for each stream. However, stations in areas with high generation of food have an extra organics bin (Figure 5).



Figure 4: Washroom waste bins (45 quart).



Figure 5: Busch Systems' Spectrum station in McKay Hall common room.

Methodology

Six Busch Systems employees conducted a waste audit at McMaster University on Wednesday December 5th (Figure 6). Seven stations of collection were analyzed on the fourth-floor of each residence building. The streams collected at each station differ based on location and are outlined below.

McKay Hall Stations

- 1 common room (waste, recycling, and organics)
- 1 garbage room (waste, recycling, and organics)
- 5 washrooms (organics only)

Hedden Hall Stations

- 1 common room (waste and recycling)
- 1 garbage room (waste and recycling)
- 5 washrooms (waste only)

Prior to the audit, labels were created to identify station, stream, and time of collection (Figure 7). The university servicing staff gathered and labeled bags from five washrooms, a garbage room, and a common area on the fourth floor on December 4th. The bags were then stored in a centralized location for the audit team to measure the following day.

The auditing procedure began in McKay Hall and included data collection of waste, recycling, and organic streams. The stored bags from all stations were weighed on a mailing scale and weights were recorded in pounds onto preprinted audit sheets. The audit team only completed a composition audit of the common room. Bags of waste, recycling, and organics from the common room were sorted by material in order to assess composition and contamination (Figure 8). These more specific categories of refuse were weighed and recorded separately, on preprinted composition audit sheets. Groups of material that were too small to register a weight on the scale were alternatively documented in the “Unmeasurable Contents” section of this report.



Figure 6: Busch Systems Staff weighing labeled refuse bags.



Figure 7: Labelled bag of refuse identifying station, stream, and time.



Figure 8: Material sorted from McKay common room recycling stream for the composition portion of the audit.



Figure 9: Refuse being weighed using mailing scale.

The same auditing procedure was followed in Hedden Hall, where refuse material had also been stored from the previous day. As there was no organics collection in this building, only waste and recycling streams were weighed and recorded (Figure 9). A composition audit was also completed for Hedden Hall, where the waste and recycling bags collected from the fourth-floor common room were sorted by material and weighed.

Members of McMaster sustainability staff were present throughout the audit in order to observe the steps of a waste audit. These individuals continued the audit independently, following the same protocol on Thursday December 6th and Friday December 7th. The data collected on these days was added to the waste audit sheets and provided to Busch Systems staff when complete.

When the audit process was complete the raw data was inputted into the Resource Center analytic software. Graphs were generated from this data, outlining diversion rates, composition, capacity efficiency, and more for comparison.

Composition Study

A composition study was done for one common room in each residence hall on December 5th. The common room was selected as the location for the composition study as it was the room that provided the most encompassing representation of the residence halls. As all rooms were not considered in the composition audit, resulting data may not reflect the entire building. The refuse from each stream was manually emptied and sorted further by specific material. Some common categories were food waste, paper towels, cardboard, and take-out containers. Each material-specific category was then weighed and the weight data was recorded.

This analysis provided a deeper understanding of the type of refuse being generated in the residence halls as well as highlighting common contaminants. Refer to Table 1 in the appendix for raw data from the composition study.

Hedden Hall

Eighty seven percent of the waste stream material could be recycled or composted if properly sorted (Figure 10). Frequently observed materials in Hedden's common room waste stream included food waste, paper towels, take out containers, and take out cups. The majority of the food waste observed was from pre-prepared cafeteria food such as salads and chicken wings. Forty percent of the recycle stream was non-recyclable contaminates, primarily food waste, paper towels, and compostable food containers (Figure 11). The lack of an organics collection program in this building resulted in a high amount of compostable material being sent to the landfill in the waste stream, or contaminating the recycle stream instead.

HEDDEN HALL COMMON ROOM RECYCLING STREAM

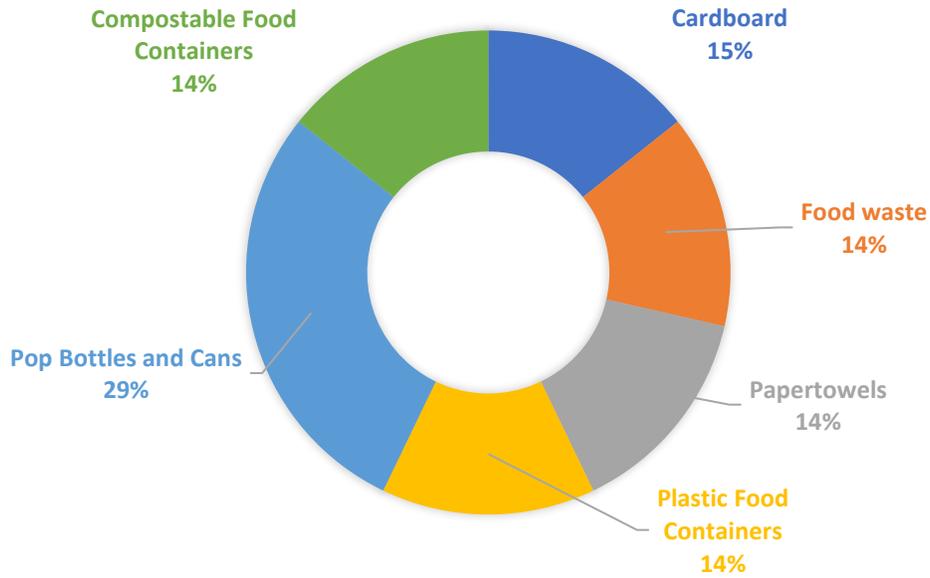


Figure 10: Breakdown of the waste stream composition of Hedden Hall common area from December 4th.

HEDDEN HALL COMMON ROOM WASTE STREAM

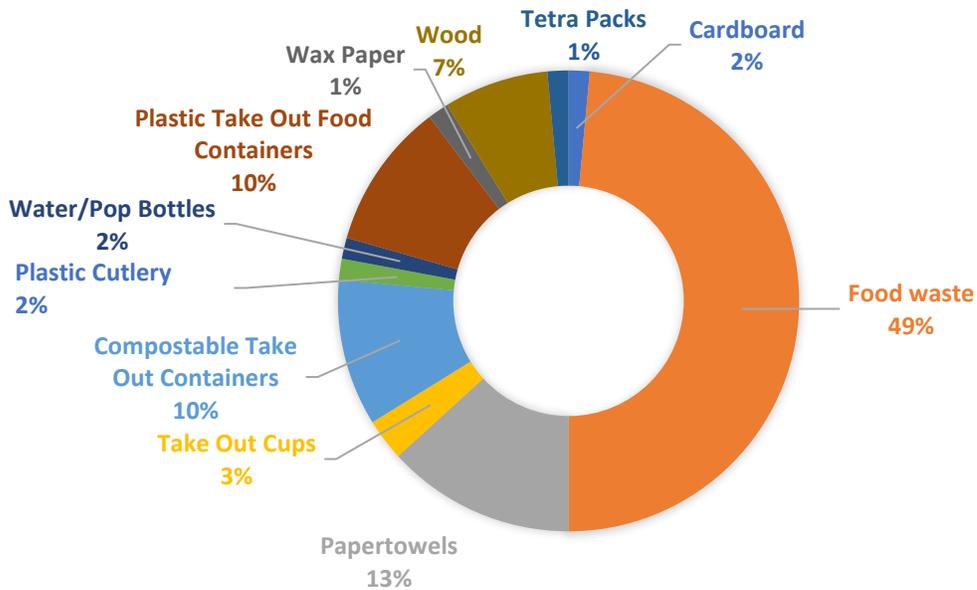


Figure 11: Breakdown of the recycle stream composition of Hedden Hall common area from December 4th.

McKay Hall

Seventy nine percent of McKay Hall waste stream was refuse that could have been diverted if properly sorted (Figure 12). Organic waste made up 46% of the waste stream in McKay’s common room, consisting of food waste, paper towel and coffee cups (Figure 12). Since an organics stream was available to the students, this 46% of material could have been diverted. Common materials in McKay’s common room recycling stream include compostable take out containers, fountain drink cups, paper towels, and food scraps, all of which are considered to be contaminants (Figure 13). This contamination degrades the recycled content and can result in it being refused by recycling facilities. Food waste made up 93% of the material in the organics stream, with the other 7% being contaminated with plastic take out containers (Figure 14).

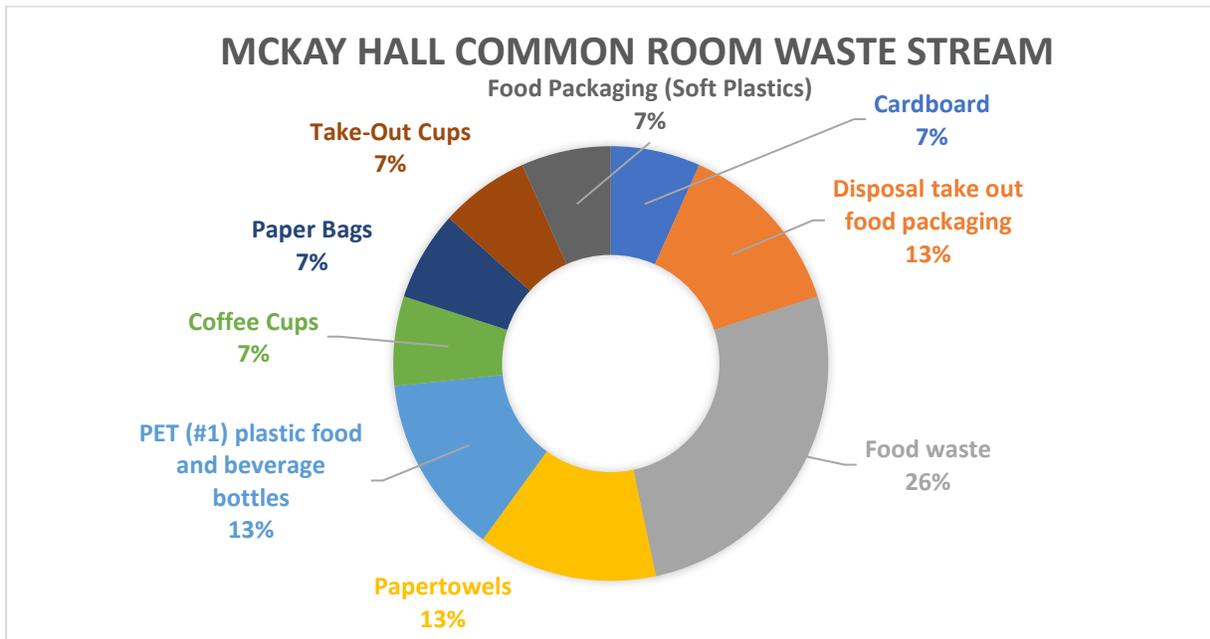


Figure 12: Breakdown of the waste stream composition of McKay Hall common area from December 4th.

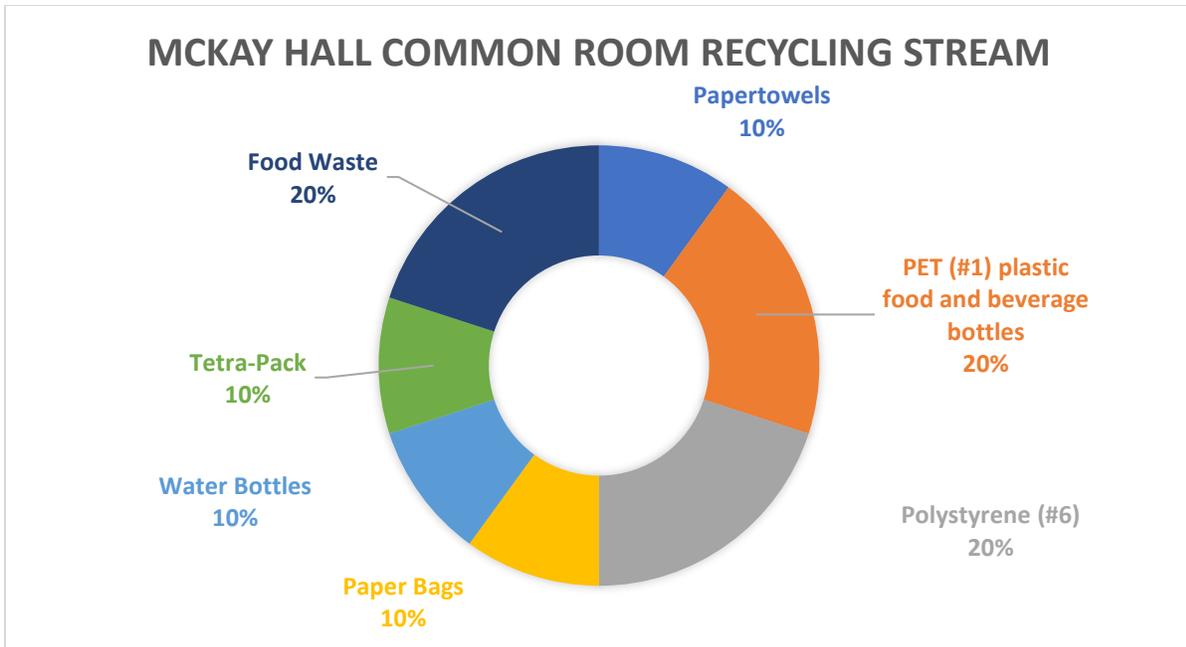


Figure 13: Breakdown of the recycling stream composition of McKay Hall common area from December 4th.

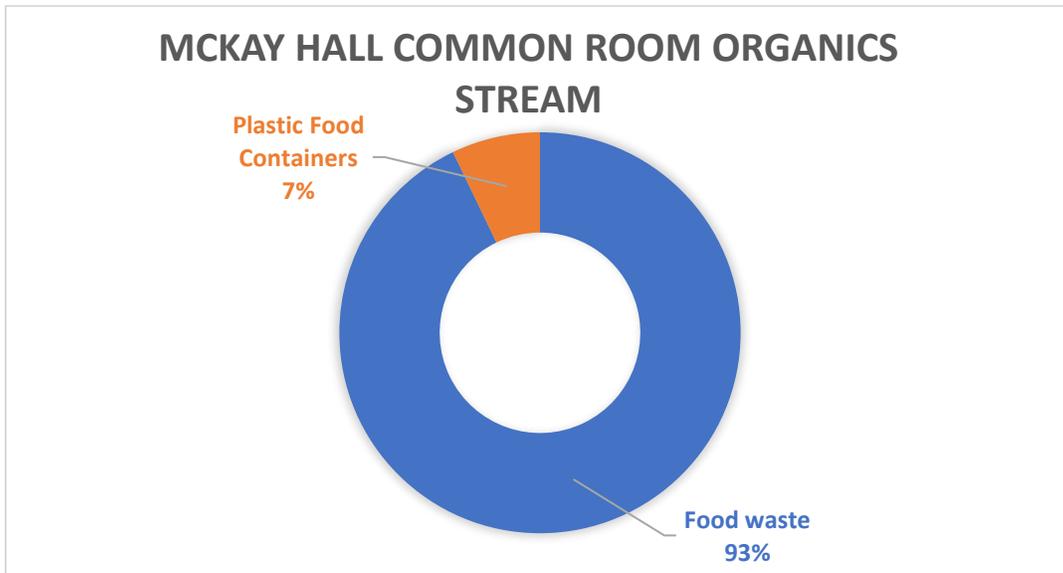


Figure 14: Breakdown of the organics stream composition of McKay Hall common area from December 4th.

Unmeasurable Contents

While analyzing stream composition in the common rooms of McKay and Hedden, the amount of certain sorted materials was too small to obtain measurable weight data. These materials were classified “unmeasurable” and alternatively were documented through photographs outlined below.

McKay Waste: N/A

McKay Recycling (Figure 15):

- Coffee cup lid
- Condiment packets
- Tea bag package
- Granola bar wrapper
- Drink cup (lid and straw)



Figure 15: Unmeasurable content of McKay recycling stream.



Figure 16: Unmeasurable contents of McKay organics stream.

McKay Organics (Figure 16):

- Polystyrene food container
- Paper towel
- Aluminum take-out food container
- Condiment packaging
- Plastic fork
- Cardboard packaging
- Clear plastic wrap

Hedden Waste (Figure 17):

- Drink lids and straws
- Food packaging



Figure 17: Unmeasurable content of Hedden waste stream.

Hedden Recycling (Figure 18):

- Pringle container
- Plastic fork
- Seasoning packets
- Bottle cap



Figure 18: Unmeasurable content of Hedden recycling stream.

Benchmark Observations

In the diversion rate comparison between Hedden and McKay hall (Figure 19), it is evident that McKay Hall’s diversion rate is substantially higher because of the additional organic collection. Due to the relatively small sample size, it is likely that there are statistical outliers within the data.

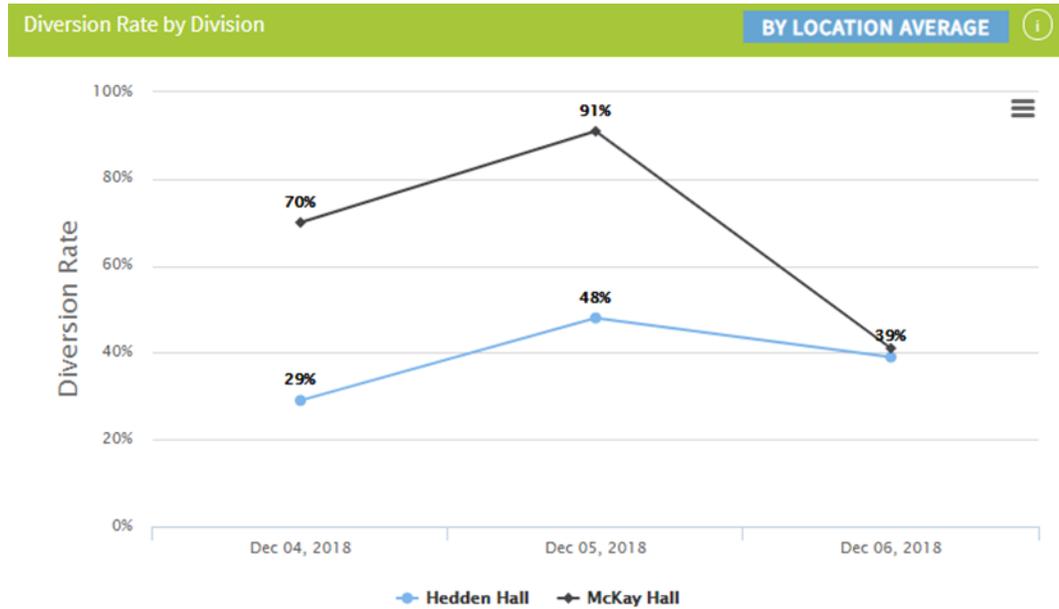


Figure 19: Diversion rate comparison between McKay Hall and Hedden Hall.

McKay Hall

The total amount of refuse generated in the McKay Hall sample area over the three-day period was 30.1 lbs of waste, 41.31 lbs of recycling, and 30.11 lbs of organics. This resulted in an average 70% diversion rate for the fourth-floor sample area. As seen in Figure 20, the weights of each stream translate to 41% recycling, 30% waste, and 29% organics.

From the station breakdown (Figure 23), the garbage room produces the most amount of refuse, with 86% of the waste, recycling, and organics being generated in this room.

McKay Total Refuse

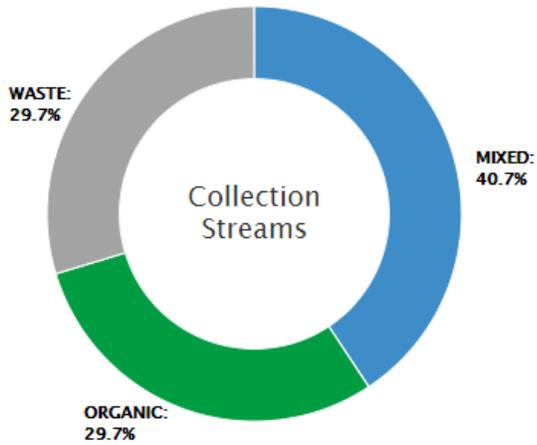


Figure 20: McKay Hall sample area refuse breakdown.

Hedden Total Refuse

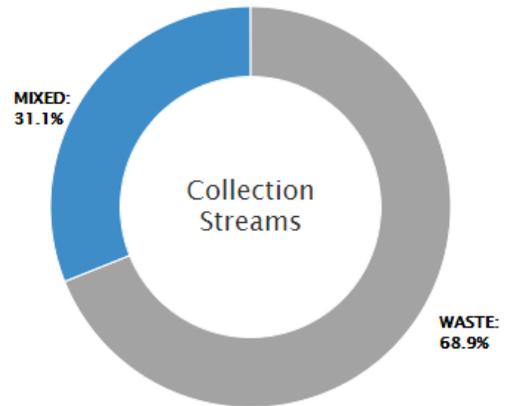


Figure 21: Hedden Hall sample area refuse breakdown.

Hedden Station Refuse

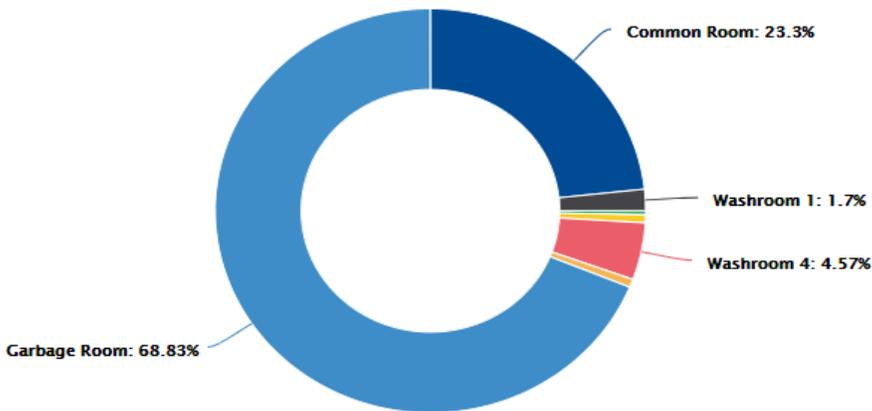


Figure 22: Hedden Hall refuse generation by station.

McKay Station Refuse

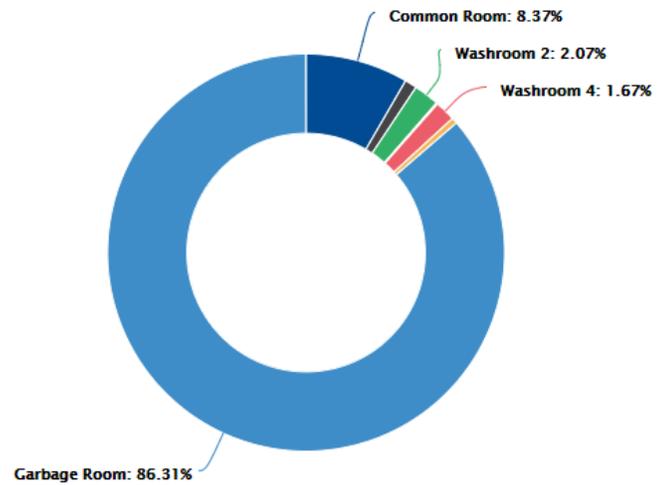


Figure 23: McKay Hall refuse generation by station.

Hedden Hall

The total amount of refuse generated in the Hedden Hall sample area over the three-day period was 64.81 lbs of waste and 29.2 lbs of recycling. This resulted in an average diversion rate of 31%. As seen in Figure 21, the weights of each stream translate to 31% recycling and 69% waste.

In the station breakdown at Hedden Hall, the garbage room produced the most amount of refuse, 69%, followed by the common room at 23% (Figure 22).

Conclusions

Recently McMaster University made the decision to implement organic collection in select residence halls. The purpose of this pilot project was to test the impact on diversion rate with the introduction of the organic containers. With help from Busch Systems' Waste Diversion Team, this study successfully compared the diversion rates of buildings with and without organics collection. Through the results of the waste audit it is evident that diversion rates were much higher where organics collection was in place.

From December 5th-7th the waste audit determined that the sample area of McKay Hall diverted 71.4 lbs of organic waste. As this volume of organics was diverted from only seven selected sample stations in McKay, the amount diverted from the entire building is much higher. Overall, the study shows McKay Hall diverts an average of 70% of total refuse from the landfill. This was made possible highly by the organics pilot program and the fact that organic refuse was able to be composted.

The need for organic collection in the Hedden Hall was apparent, as organic material made up 72% of the waste stream, none of which was diverted. Considering waste and recycling alone, the study shows Hedden Hall has an overall diversion rate of 31%. This leaves much room for improvement regarding Hedden Hall and the additional eight residence halls that similarly do not have an organics program. Implementing an organics collection system to every residence will greatly increase McMaster's overall diversion rate.

Environmental Impact

The size and population of McMaster University speaks volumes to the level of environmental impact campus operations have. By implementing a successful waste diversion program, McMaster is able to reduce the overall ecological footprint of the campus.

Consistent inputting of McMaster’s waste audit data into the Resource Center will allow for generation of data regarding the positive impact of the diversion program on the environment. These graphics highlight energy, landfill space, and GHG emissions saved through waste diversion efforts.

The waste diversion efforts of the sample areas of McKay and Hedden combined for this three-day period alone, saved 195.04 KWh of energy and prevented 290 pounds of greenhouse gases from entering the atmosphere. The amount of waste diverted during this short period also saved 0.8 CuYds of landfill space.

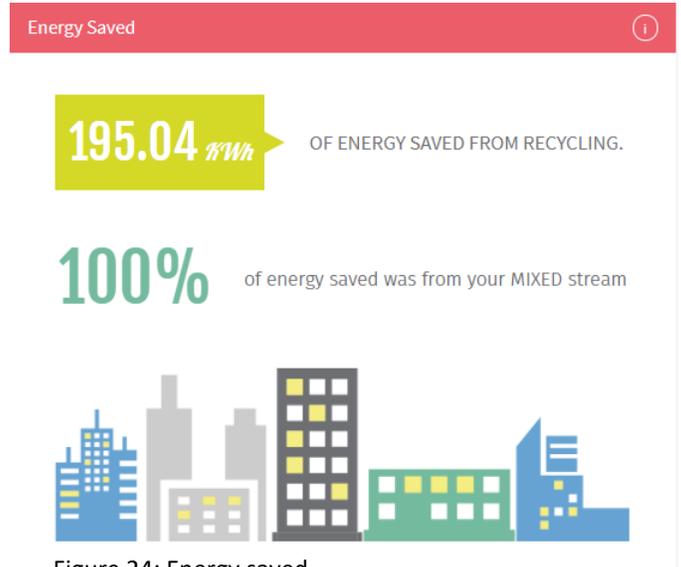


Figure 24: Energy saved.

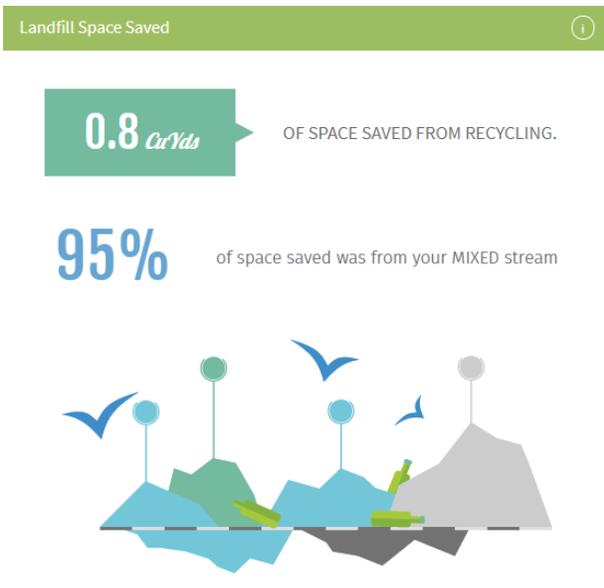


Figure 25: Landfill space saved.



Figure 26: Emissions prevented.

Recommendations

Based on the results of the waste audit the following recommendations have been made to help improve the diversion rate of McMaster University's residence buildings. These recommendations are made with the intention of eventually be applied campus-wide.

Organics Pilot: Results from the waste audit data comparison of McKay and Hedden Hall, highlights the success of the organics pilot. This supports the recommendation that organics collection is expanded to every residence building on campus and eventually on a campus-wide level. This will increase McMaster's diversion rate and reduce the amount of organic material found in residence waste streams that do not currently have organic bins available.

Dorm Room Bins: Providing students with a small kitchen composter bin to keep in their rooms will make the refuse sorting a simpler process for the students. As the occupants are responsible for sorting any refuse generated in their rooms and emptying it in common garbage rooms, having organics pre-separated will result in increased success in the diversion program.

Standardization: It is recommended that refuse containers and signage are standardized throughout the residence halls and ideally campus-wide. This includes having consistent signage and bin station set-up in all refuse collection areas. Consistency in refuse collection programs has been shown to lead to more successful diversion efforts as it results in more clarity and understanding on what is accepted per stream.

Garbage Rooms: The sorting process should be quick and easy for students emptying their personal refuse at these locations. Centralized refuse collection rooms should follow the previously suggested standardized set-up. This includes signage for all three streams identifying what material is acceptable in each stream.

Education: Further education for students on campus regarding what goes in each stream would help McMaster reach their waste diversion goals. This education should be provided upon students moving into the residence halls. Continuing with the existing statistic signage campaign is encouraged to continue engaging and educating students on the importance of waste diversion.

Auditing: Setting goals for increased diversion and implementing tactics to reach these goals is recommended for McMaster's future refuse collection program. Following up with a waste audit once per semester is a great way to track the progress of the waste diversion system. Consistently inputting this

data into the school's existing Resource Center account will make tracking campus waste diversion quick and easy. The graphics and data that the Resource Center provides can also be used to promote the university's sustainability achievements.

Cafeteria: During the day of the Busch Systems audit, it was discovered that the cafeterias on campus do not have organic collection. It is recommended that the sustainability team at McMaster works towards achieving organic collection in these areas as a next step from residence halls. This implementation would result in a huge positive impact on campus diversion and decrease in compostable food waste sent to the landfill.

Sources

Statistics for McMaster University were found here:

- https://www.mcmaster.ca/opr/html/opr/fast_facts/main/about.html
- <https://future.mcmaster.ca/student/residence/>

Appendix

Composition Study Material

Material	McKay Waste (lbs)	McKay Recycling (lbs)	McKay Organics (lbs)	Hedden Waste (lbs)	Hedden Recycling (lbs)
Cardboard	0.1			0.1	0.1
Disposable Take-out Food Packaging	0.2		0.1	0.7	0.1
Food Waste	0.4	0.2	1.3	3.3	0.1
Paper Towels	0.2	0.1		0.9	0.1
PET #1 Plastic Beverage Bottles	0.2	0.3		0.1	0.2
Coffee Cups	0.1				
Paper Bags	0.1	0.1			
Take out cups	0.1			0.2	
Soft Plastics	0.1				
Polystyrene		0.2			
Carton		0.1		0.1	
Compostable Take out Containers				0.7	0.1
Plastic Cutlery				0.1	
Wax Paper				0.1	
Wood				0.5	

Table 1: Composition study materials and weight data.