# Social Factors Leading to Improper Waste Disposal in the Killam Library at Dalhousie University and the Role of Labels and Signs in Improving Waste Diversion

## Waste Diversion in the Killam Library

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## Executive Summary

The purpose of this study is to advance the Dalhousie University sustainability initiative by identifying significant avenues for improvement in waste management through conducting research in the Killam Library. The study characterizes key challenges for increasing waste diversion rates in the Killam Library, while specifically addressing influential social factors leading to improper waste disposal. Furthermore, the study sought to address the role of four-bin waste disposal station (Paper, recyclables, organics and garbage) labels and signs in improving waste diversion rates.

The study supplements existing research previously conducted in the Killam Library, and further advances knowledge concerning the current waste management practices at the Killam and more broadly at Dalhousie University. The results of this study provide recommendations for improvement in waste management at the Killam Library, and for all buildings on the Dalhousie campus, and other institutions wishing to improve waste diversion rates.

A survey was distributed to twenty individuals on each of the five floors in the Killam Library to identify key social factors leading to improper waste disposal in the four-bin waste system. The completion of the survey indicated that most individuals are very confident or somewhat confident when disposing of waste, however waste diversion rates remain relatively low. Survey applicants frequently responded that inconvenience, lack of labels and signs, carelessness, and the largest response being, uncertainty of how and where to dispose of waste, were the greatest obstacles to proper waste disposal.

In addition, two waste audits were conducted. The first waste audit assessed the current waste disposal rate which was followed by the placement of educational signs above the four-bin stations. The aim of the second waste audit was to analyze the effectiveness of additional labels and signs in improving waste diversion. The results from the waste audits clearly demonstrate a significant improvement following the placement of labels and signs with a 19.34% increase in waste diversion. The waste audits further demonstrated that coffee cups, tea bags, granola wrappers, liquid waste, aluminum, milk containers, wax paper, and water bottles are problematic items in regards to improving waste diversion.

Recommendations and solutions to improve waste diversion at the Killam Library include designing original posters addressing the problematic items listed above with creative pictures and informative labeling, and educational program initiatives, such as waste resource educational officers directing presentations during orientation week for new students at Dalhousie University. Furthermore, increasing awareness of proper waste disposal by making the *Dalhousie Guide to Materials Managemen*t more accessible around campus and conducting activities for students and staff related to proper waste diversion would be effective in improving waste diversion rates (Appendix 3). Influencing Dalhousie University to have standardized coffee cups on campus, and working to influence businesses, such as Tim Horton's to transition to standardized cups is also a worthwhile initiative.

Future research concerning the placement of labels and signs around the four-bin waste system, the placement of the four-bin waste system themselves, liquid waste solutions and the feasibility of providing educational programmes and activities on campus would be beneficial to this field. In addition, a longitudinal study concerning social factors, and individual behaviour regarding proper waste disposal, through focus groups and interviews would be significantly beneficial.

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# 1.0 Introduction

## 1.1 Background

Our paradigm of waste management and its close relationship to landfills is increasingly problematic. The reduction of waste sent to local landfills has both practical and economic impacts. Minimizing and rethinking waste has resulted in the implementation of plans that effectively decrease the need for environmentally damaging landfills. Landfills contribute to global warming when waste decomposes anaerobically and produces methane – a greenhouse gas far more potent than carbon dioxide that can itself be a danger to nearby inhabitants. Landfills pollute the local environment through the contamination of groundwater, residual soil and aquifers by leakage or sinkholes (Lesankic, 2011). Landfills are also a host for disease vectors and create regional problems due to odour and noise pollution. Furthermore, landfills are expensive to build, operate, and reclaim. Costs of waste disposal range from $45 to $105 per tonne in urban areas, depending on the level of management controls and prevailing climate (Collins, 2009). The environmental impacts, burdens on human health, and financial costs create a strong incentive for waste diversion and mitigation programs.

The ways in which we dispose of our waste, including sorting and separating materials, can significantly reduce the amount of space and landfills in an area. Reducing the amount of waste we create, reusing waste already created and properly disposing of our waste help to decrease greenhouse gas emissions and pollutants. The four R`s: reduce, reuse, recycle, and rethink present an opportunity to reclaim valuable resources and promote a transition to a green close-loop economy (Davidson & Owen, 2011; Ontario Ministry of the Environment, 2012). Canadians produce a substantial amount of waste, producing approximately 13.4 million tonnes (418 kg per person) of residential waste in 2004, of which only more than a quarter was recycled (Babooram & Wang, 2006). According to the Federation of Canadian Municipalities, approximately 80% of what we throw out is either recyclable or organic; therefore the majority of Canadian residential waste is relatively easy to divert (Federation of Canadian Municipalities, 2009).

Universities are important institutions in the waste management paradigm because they create large amounts of waste and dictate key consumption practices. Dalhousie University has the responsibility to advance sustainability initiatives on campus, and throughout the Halifax Regional Municipality (HRM). Dalhousie University contributes a significant amount of waste to HRM and as such, the university has the potential to improve diversion and waste management practices considerably in the city (Christian, et al., 2010). Dalhousie currently diverts over 60 percent of materials and aims to eventually reduce and divert 75 percent of their solid, liquid, and hazardous waste from landfills (Office of Sustainability, 2012). Dalhousie`s current waste diversion program focuses on encouraging the organization of workshops to reduce waste, community garage sales, and managing recycling and compost through the established four-bin stations. Dalhousie University also performs waste audits, which are an essential component of waste management, because they serve to collect baseline data, assist future policy formation, and help to monitor the effectiveness of past programs (Allan et al., 2011). Since 2007, through the Office of Sustainability and courses such as Environmental Problem Solving II ``Campus as a Living Laboratory`` (ENVS 3502), a number of building and campus waste audits have been conducted at Dalhousie University.

In 2008, a waste audit in the Student Union Building (SUB) attempted to evaluate the efficiency of the recycling program and find avenues to minimize costs. The results of the study demonstrated that garbage and organic streams were typically highly contaminated, which created difficulties for further diversion (Office of Sustainability, 2011). In 2010, Dalhousie introduced the four-bin waste system (paper, recycling, organics and garbage) to replace individual refuse bins. A study conducted in winter 2010 discovered that the key barrier to proper waste diversion was a profound lack of knowledge concerning recycling methods (Heathcote et al., 2010). Finally in 2011, a group of students from the ENVS 3502 class carried out several waste audits to analyze the compliance levels with the four-bin waste systems in the Killam Library (Allan et al., 2011). Similar to the results of the initial SUB waste audit, the authors found that garbage was the largest contaminant, and coffee cups, cans and liquid waste were particularly problematic (Allan et al., 2011). The research group recommended developing a liquid waste bin system and improving signs and posters above the already established four-bin waste system to improve waste management (Allan et al., 2011). The research group further

recommended that studies assessing social factors and individual behaviour leading to improper waste disposal would be beneficial to the field (Allan et al., 2011).

### 1.2 Objectives

This study characterizes key challenges involved with diverting waste, and identifies practices and techniques to increase waste diversion rates in the Killam Library at Dalhousie University. The research sought to address the social factors and individual behavior leading to bin contamination, and the effectiveness of additional labels and signs above the four bin waste systems in improving waste diversion rates in the Killam Library.

This study and research focused on four objectives:

1. Determine problematic items and materials students find most difficult to dispose of
2. Establish ratios of contamination between the paper, recycling, organics, and waste streams in the Killam Library.
3. Assess the effects of labels and signs above the four-bin waste system in improving waste diversion.
4. Develop suggestions to minimize bin contamination and improve waste diversion rates in the Killam Library.

### 1.3 Purpose

The purpose of this study is to identify avenues for improvement in waste management and diversion, and advance Dalhousie`s sustainability plan. This study provides information concerning compliance levels through examination of decision making regarding waste disposal. Improving sustainability on campus requires a detailed look at our waste management practices and a reassessment of our approach to waste reduction. The results of this study can be utilized in policy-making, strategizing, and planning related to waste management. According to the Office of Sustainability at Dalhousie University:

> The products we consume on a daily basis – in our homes and in our workplaces - have a major impact on the environment. We need to begin considering the entire life cycle of every product we use. Greater sustainability is achieved by minimizing the ecological and health impacts of the products we use at every stage of the process (Office of Sustainability, 2012).

The conclusions of this study intend to contribute data and insight to improve waste management and increase sustainable practices at Dalhousie University, through identifying challenges to current waste diversion, and analyzing the efficiency of additional labels and signs above the four-bin waste system. This study contributes directly to the Dalhousie greening initiative by identifying methods of best practice and obstacles to waste management in the Killam Library, by utilizing the Sustainability Office's rethink, reuse, recycle, and recover framework. Furthermore, the results of this study relate to other buildings on campus, and can be used to improve waste diversion rates throughout the Dalhousie campus.

## 2.0 Research Methods

### 2.1 Description of Study Design and Procedures

This study utilized both quantitative and qualitative research methods. Qualitative data was collected utilizing surveys distributed to students in the Killam Library, and quantitative data was collected through two waste audits. Surveys were distributed on Friday, March 9$^{th}$ to twenty students on each of the five floors in the Killam Library, which added up to 100 students surveyed in total. Two waste audits were conducted, the first audit analyzed data from one four bin waste system from each of the five floors (five four bin systems) without additional posters, and the second audit analyzed data from one four bin waste system from each of the five floors (five four bin systems) with additional posters.

The main objective was to obtain results enabling the comparison of social factors and individual behavior with actual waste diversion rates. Determination of these factors required comparison between qualitative and quantitative results:

> "Phenomenological inquiry, or qualitative research, uses a naturalistic approach that seeks to understand phenomena in context-specific settings. Logical positivism, or quantitative research, uses experimental methods and quantitative measures to test hypothetical generalization. Each represents a fundamentally different inquiry paradigm" (Hoepfl, 1997, pg.1).

Thus, comparison of both phenomenological inquiry, as well as logical positivism allowed for the examination of social factors that lead to improper waste disposal in the Killam Library.

The study began with the design and distribution of surveys to all five floors of the Killam Library. The survey was comprised of ten multiple choice and short answer questions designed to obtain a general understanding of the social factors inhibiting proper waste disposal in the four-bin systems in the library. The survey was conducted in order to narrow the future conducted quantitative research:

> [Qualitative research] can also be used to gain new perspectives on things about which much is already known, or to gain more in-depth information that may be difficult to convey qualitative. Thus, qualitative methods are appropriate in situations where one needs to first identify the variables that might later be tested quantitatively, or where the researcher has determined that quantitative measures cannot adequately describe or interpret a situation (Hoepfl, 1997, p.g7).

Following the implementation of the survey, the first waste audit took place on Friday, March 16th at 4 p.m. The waste was collected by the custodial staff at the Killam Library (under the supervision of Carla Hill), and placed in the mailroom of the Killam Library on the evening of Thursday March 15th. The waste collected and audited was only from the four-bin system next to the staircase on each of the five floors from the evening of Thursday March 15$^{th}$. The waste audit was designed to measure the weight ratios of the contamination levels in each of the

four bins. The waste sorting was based on the Halifax Regional Municipalities' "What Goes Where?" guide (Appendix 3). The bins used to sort and weigh the waste were weighed by themselves because the given scale was not capable of the `tare` function. The weight of the bin was recorded in order to be subtracted from the total weight of the bin and waste. Each of the waste streams was weighed separately and sorted into two bins (one for proper waste and the other for contamination). The paper, recycling, organics, and garbage were sorted from each four bin system from all five floors, which resulted in 20 bags audited from the Killam Library.

**Figure 1.0-Photograph of Conducting Waste Audit 1**

**Figure 1.1- Example of Waste Separation for Waste Audit 1**

The initial waste audit determined the diversion ratios without the implementation of additional posters. The quantitative component of the study was designed in order to determine whether additional posters with visuals and further explanation would improve waste diversion rates. Therefore, succeeding the first waste audit, on the following Monday, March 19th, in addition to the signs already on the bins (Figure 1.2 and 1.3), posters with added visuals addressing specific problem items (coffee cups, and coffee lids in particular) (Figure 1.4 and 1.5) were placed above the four bin systems on each of the five floors.

**Figure 1.2- Paper recycling and recyclables labels already on the bins (Waste audit 1)**


**Figure 1.3- Organics and garbage labels already on the bins (Waste audit 1)**

**Figure 1.4- Additional posters with added visuals addressing specific problem items discovered in waste audit 1 (Waste audit 2)**


**Figure 1.5-Additional Posters with added visuals addressing specific problem items addressed in waste audit 1 (Waste audit 2)**

The additional posters were left over the four-bin waste systems for the following week, and the second waste audit was conducted on Friday, March 23rd. Once again, Carla Hill, the custodial staff daytime supervisor was contacted and the waste from the evening of Thursday, March 22nd was collected and stored in the mailroom in the Killam Library. The methods utilized for the first waste audit were duplicated for the second waste audit. Final weight ratios from the first audit were compared to the final weight rations of the second audit to determine the effects of the additional posters. In addition, survey data was compared to final weight ratios and waste diversion rates to determine the relationship between social factors and actual waste diversion data.

### 2.2 Justification of Measurement Choices

Qualitative data was collected through the completion of a survey by twenty students on each of the five floors in the Killam library, for a total of a 100 students surveyed. Surveys rather than interviews were utilized to maximize the validity of the data collected. In other studies, "modest support was found for the hypothesis that lower levels of self-disclosure of socially undesirable information occur in an interview condition" (Locke & Gilbert, 1995). Distributing surveys attempted to avoid skewed results, through what is deemed `socially correct` and to avoid students feeling pressured to answer `correctly`. Furthermore, surveys permit effective data collection from large to small populations, allowing researchers to make optimal decisions concerning the size of their study, which is sometimes referred to as ``the universe of a study`` (Colorado State University, 2012). According to Angus and Katona, ``It is the capacity for wide application and broad coverage which gives the survey technique its great usefulness…`` (Colorado State University, 2012). Lastly, surveys are useful in describing characteristics of all population sizes, and conclude in statistically relevant results when analyzing multiple variables (Colorado State University, 2012).

### 2.3 Validity, Reliability and Trustworthiness of Research Procedures

Reliability depends on the repeatable nature of the research methods and significant results (Golafshani, 2003). Due to time constraints, a survey and two waste audits were completed in this study. The reliability of the data and results are not as profound as if a

longitudinal study were performed: “the more consistent the results given by repeated measurements, the highest the reliability of the measuring procedure; conversely, the less consistent the results, the lower the reliability” (Carmines and Zeller, 1979, p.g12). The research procedures are reliable in which they can be replicated and have the ability to yield consistent measurements. However, they were not replicated in our own research to have the ability to draw large conclusions, formulate theories, or make generalizations (Golafshani, 2003).

Validity establishes whether the results obtained meet all the requirements of the scientific method, encompass the entire experimental concept and successfully measure what the researchers intended to measure (Golafshani, 2003). The purpose of this study was to identify significant avenues for improvement in waste management by characterizing social factors that lead to improper waste disposal, and to measure the effectiveness of additional labels and signs in improving waste diversion. The study achieved its objectives by characterizing social factors and individual behaviour characteristics associated with improper waste disposal, through distributing a survey to individuals in the Killam Library. The waste audits were successful in analyzing the effectiveness of labels and signs through conducting one waste audit without additional labels and signs, and one with additional labels and signs. However, due to the small population of students surveyed (100 students), and the use of only two waste audits, external causal relationships must be considered when analyzing results. Nevertheless, the study was conducted rigorously, and the research was designed to maximize trustworthiness based on the time frame provided.

### 2.4 Limitations and Delimitations

The greatest limitation in the study and research was time. Due to the longevity of time given to complete the research and the needed space in between waste audits, only two audits were performed. Furthermore, one four-bin system per each floor (five floors) was collected for each waste audit due to time constraints. Further limitations include weather, commercial events, such as “Roll up the Rim to Win”, the possible strike, population size, liquid waste which can skew weight ratios, and the weights of specific items which can skew diversion rates. Weather acts as a limitation because on Thursday, March 22$^{nd}$ it was thirty-degrees, limiting the population size in the Killam Library during waste collection for our second waste audit on

March 23rd. "Roll up the Rim to Win" by Tim Horton's increases the amount of Tim Horton's coffee bought, and therefore resulted in a large amount of coffee cup waste in the Killam Library. Coffee cup waste and contamination would have possibly been less if the commercial event wasn't in action. In addition, during our research there was news of a conceivable strike, therefore students might have been spending less time at the library compared to 'normal times'. Our research group also had no control over the various weights of different materials, and the additional weight of liquid waste. The weight rations would have been skewed due to differences in the weights of different items. For example, there could have been a greater amount of contamination 'items', but this would not be represented in the weight ratios of the two audits.

Delimitations of the research include the chosen surveyed population, the amount of waste audits conducted (two waste audits), the auditing of only one set of bins per each of the five floors (instead of all four sets of bins per each of the five floors), and the nature of the additional labels and signs put above the bins for the second waste audit. Twenty individuals per each of the five floors was dictated as the chosen survey population due to time constraints, and the reliability and trustworthiness of the results, and two waste audits were chosen to measure the effectiveness of the labels and signs. The four-bin station (closest to the elevator and bathroom on each floor) was chosen as the collected waste for each waste audit due to the demographics of the Killam Library. For reasons of time, as listed above, all the waste on each floor could not be audited, therefore one four-bin station per floor was chosen as a representation of waste contamination in the Killam Library.

## 3.0 Results

A survey and two waste audits were conducted for this study, identifying social factors and individual behavior determinants leading to improper waste diversion in the Killam Library, and the effectiveness of additional posters and signs in reducing waste contamination. The survey concluded that most students feel very confident or somewhat confident when disposing of waste, however students consistently expressed that inconvenience, lack of labels and signs on bins, carelessness and uncertainty of where certain garbage goes in the four-bin system were the greatest obstacles to waste disposal. Furthermore, the survey concluded that the majority of students recycle at home; however, they have difficulty disposing of various items such as papers

covered in food, liquid waste, compost, electronics, coffee cups, plastic bags. The waste audits concluded that labels and signs are effective at reducing waste diversion, and that specific problem items resulting in large contamination rates were coffee cups, tea bags, granola wrappers, liquid waste, milk containers, wax paper, and water bottles.

### 3.1 Survey Results

As noted in the research methods (2.0), the survey took place on Friday, March 9th, and was completed by twenty students per five floors in the Killam library, resulting in 100 students surveyed. The survey focused on questions relating to:

- How often students frequent the Killam,
- how confident students feel when disposing of their waste,
- what students feel are the greatest obstacles to proper waste disposal, and
- general questions regarding the demographics of individuals surveyed.

The survey resulted in a range of responses, represented in graphs below:

**Figure 1.6- Weekly Visits to the Killam Library (with all floors combined)**

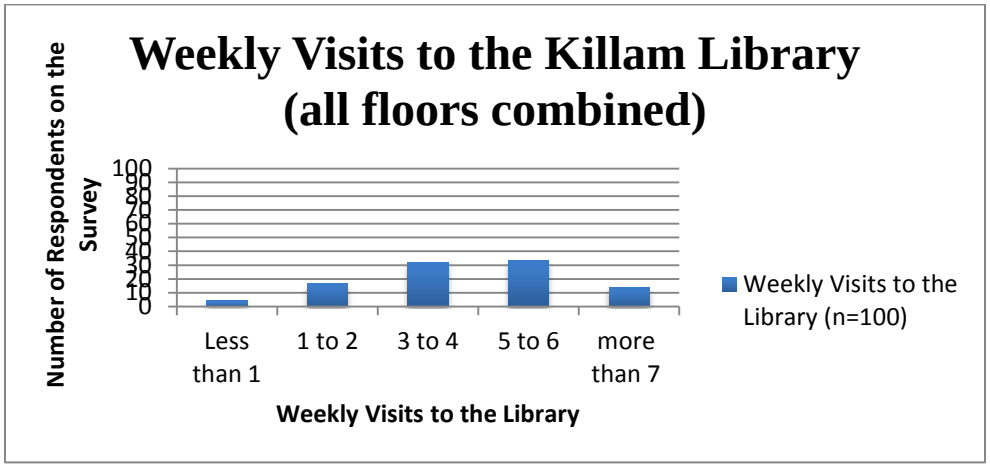


**Fig.1.6 Survey results regarding how often students frequent the Killam throughout the week, portraying that the majority of students frequent the Killam 3 to 6 times a week.**

**Figure 1.7- Level of confidence regarding proper waste disposal (with all floors combined)**

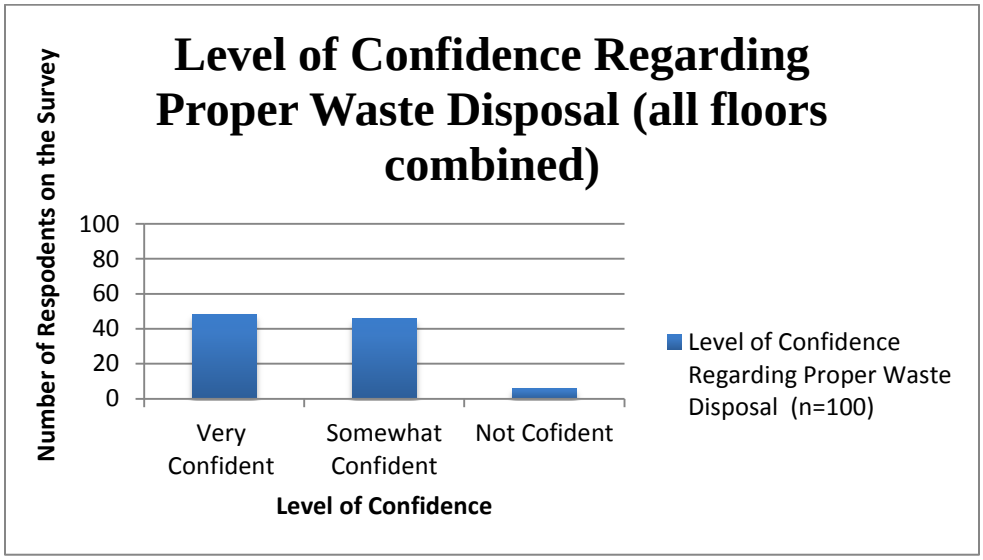


**Fig.1.7 Survey results regarding the level of confidence of each survey respondent when disposing of their waste. Results convey that the majority of the respondents are very confident or somewhat confident in their ability of properly disposing of waste.**

**Figure 1.8- The amount of students who recycle at home (with all floors combined)**

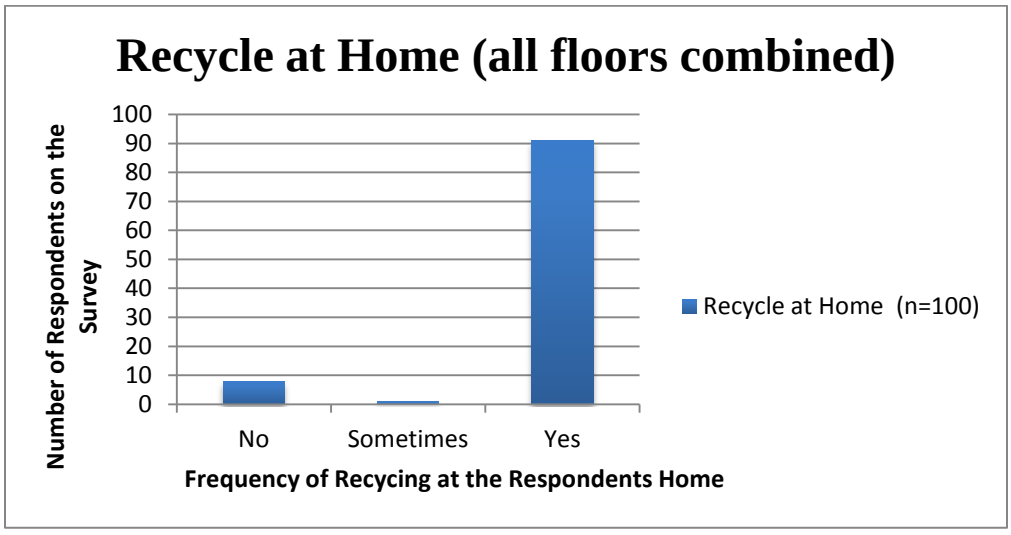


**Fig.1.8 Survey results depicting how many respondents recycle at home, demonstrating that the majority of respondents do recycle at home.**

**Figure 1.9- Survey responses regarding the greatest obstacles to proper waste disposal**


**Figure 1.9 Survey results concerning the greatest obstacles to proper waste disposal. The majority of individuals responded with a combination of answers, however the most common answer was uncertainty of where and how to dispose of garbage in the four-bin station.**

**Figure 2.0-Items respondents find most difficult to dispose of**

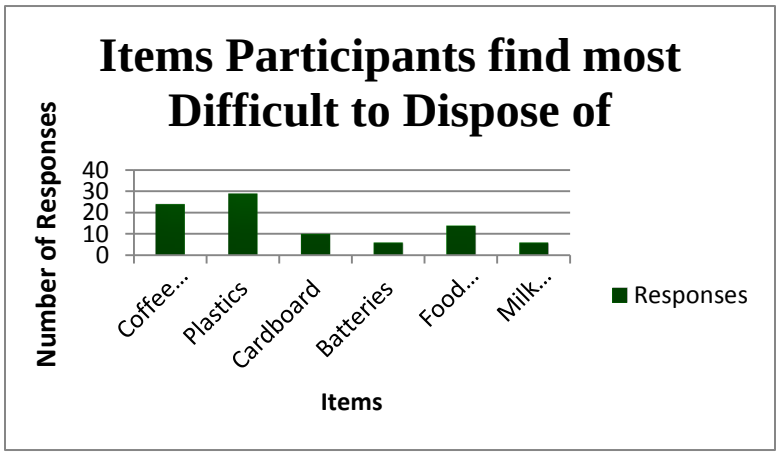


**Figure 2.0 Survey results concerning items respondents find most difficult to dispose of. The majority of individuals find coffee cups, and plastics the most difficult to dispose of.**

### 3.2 Audits

As also noted in the research methods (2.0), two waste audits were conducted in the Killam Library. One waste audit was conducted with waste from the four-bin station without additional posters, and the second waste audit was conducted with waste from the four bin station after additional posters were placed above the bins. The waste from the four-bin station closest to the elevator and bathroom was collected from each of the five floors, resulting in twenty bags audited in total per waste audit (two waste audits). The purpose of the waste audit was to determine current contamination rates compared to contamination rates after the placement of additional posters above the four-bin stations.

**Figure 2.1- Waste audit 1 contamination on each floor**

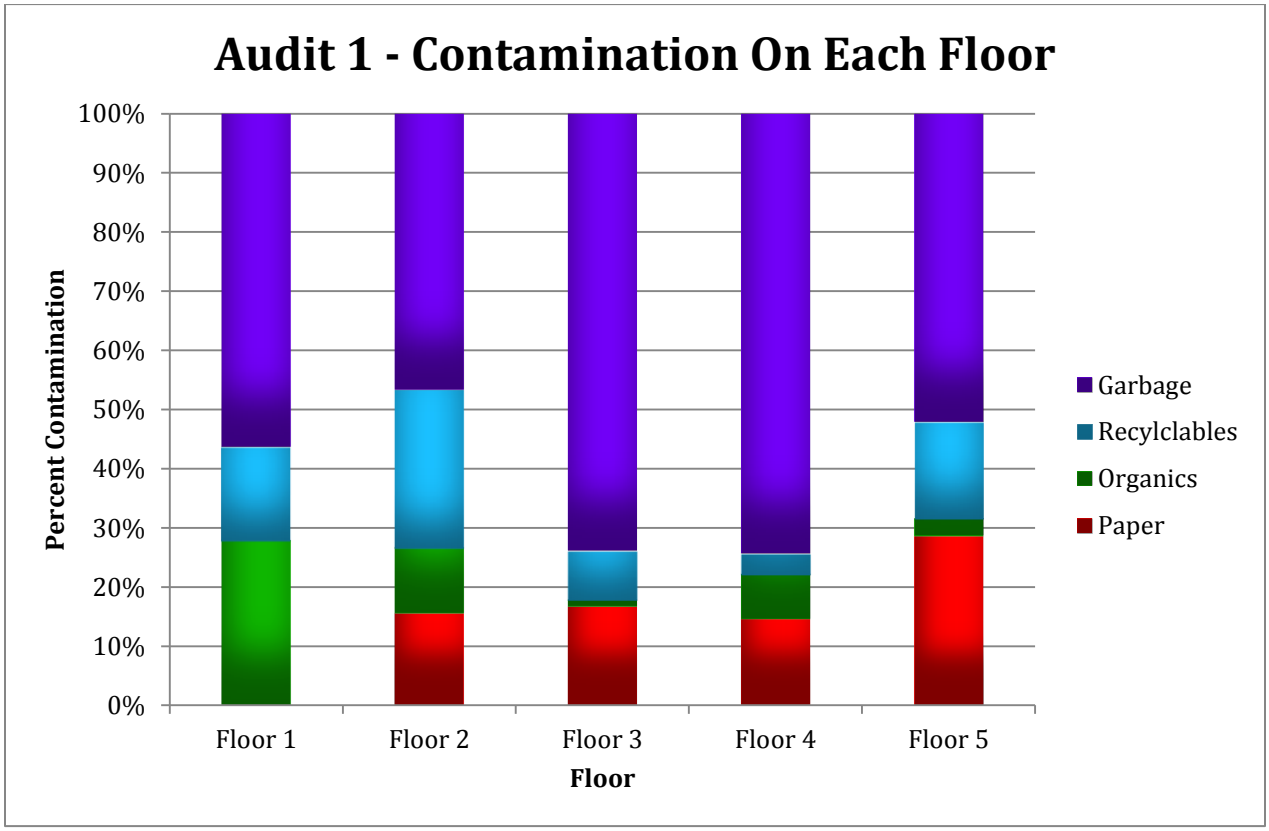


**Fig. 2.1 Results from the first waste audit demonstrating the amount of contamination per waste stream on each floor.**

**Table 1.0- Results from the first waste audit representing contamination in grams**

| Floor | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Paper | 0 | 0.07 | 0.14 | 0.21 | 0.28 |
| Organics | 0.85 | 0.05 | 0.01 | 0.11 | 0.03 |
| Recyclables | 0.48 | 0.12 | 0.07 | 0.05 | 0.16 |
| Garbage | 1.71 | 0.21 | 0.62 | 1.07 | 0.51 |

**Figure 2.2- Waste audit 2 contamination on each floor**

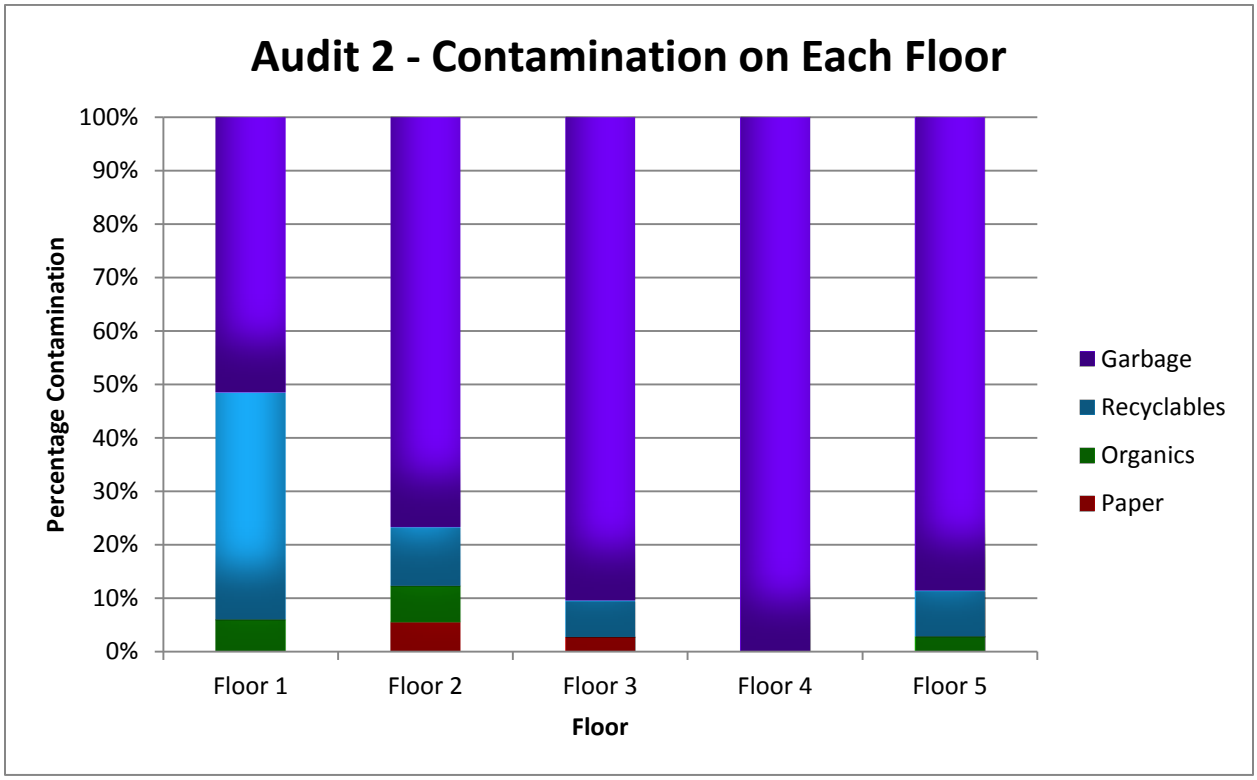


**Fig. 2.2 Results from the second waste audit demonstrating the amount of contamination per waste stream on each floor.**

**Table 1.1- Results from the second waste audit representing contamination in grams**

| Floor | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Paper | 0 | 0.04 | 0.02 | 0 | 0 |
| Organics | 0.04 | 0.05 | 0 | 0 | 0.03 |
| Recyclables | 0.28 | 0.08 | 0.05 | 0 | 0.09 |
| Garbage | 0.34 | 0.56 | 0.66 | 0.32 | 0.93 |

**Table 1.1 the table indicates the amount of contamination per waste stream on each floor, nothing a large improvement on the fourth floor, and that the garbage stream continued to have the highest contamination rate**

# 4.0 Discussion

## 4.1 Summary of Research Question and Purpose of Research

Waste diversion in public locations such as the Killam Library at Dalhousie University is strongly influenced by social factors and individual behaviour, as students, faculty, and staff make independent decisions regarding their waste disposal. In previous year's research it was noted that different floors in the Killam library experience different levels of waste diversion (Office of Sustainability, 2011) Research groups suggested performing further studies focusing on the social factors, and individual behaviour characteristics leading to improper waste disposal. By identifying social factors, and individual behaviour characteristics leading to improper waste disposal, waste management practices could be improved to decrease waste contamination. The majority of respondents expressed that inconvenience, lack of labels and signs, carelessness, and uncertainty on how and where to dispose of waste in the four-bin stations were the greatest obstacles to proper waste disposal. By addressing the social inhibitions regarding waste disposal in different locations of the Killam Library, the university becomes closer to reaching the goal of reducing and diverting 75 percent of solid, liquid and hazardous waste from the landfill (Office of Sustainability, 2012). Therefore, this study focused on characterizing the social factors and

individual behavior characteristics leading to improper waste disposal in the Killam Library, and measuring the effectiveness of additional labels and signs in improving waste diversion rates.

### 4.2 Significant Findings

The survey and waste audits both resulted in significant findings with importance to waste management and increasing waste diversion at the Killam library, and throughout the Dalhousie campus. The survey concluded that most students feel very confident or somewhat confident when disposing of their waste; however, there remains a large contamination rate (Fig 1.7 and Table 1.0). Survey respondents expressed that there are various obstacles to proper waste disposal; however, uncertainty of where to dispose of waste in the four-bin stations was the largest response (Fig. 1.9). Respondents also identified various items, such as food waste, coffee cups and plastic as the most difficult to dispose of (Fig. 2.0).

Specifically, the surveys revealed that 91% of individuals recycle at home, more than 80% of respondents are confident that they properly dispose of their waste; however, that 50% of respondents expressed that uncertainty of where to dispose of garbage is the largest obstacle proper waste disposal (Fig. 1.7, 1.8 and 1.9). The most common recommendation or suggestion by respondents was to eliminate confusion concerning waste disposal by placing informative and creative labels and signs around the four-bin stations.

The waste audits concluded that labels and signs are effective at reducing waste diversion, and that specific problem items identified in the survey caused the largest contamination rates, including coffee cups, tea bags, granola wrappers, liquid waste, milk containers, wax paper, and water bottles. The waste audits revealed that coffee cups are a severe problem in regards to waste diversion, because of their three components, including the plastic recyclable lid, paper recyclable sleeve, and the cup belonging in the garbage. The coffee cups were most often placed in the garbage with organic or liquid waste inside.

Levels in total floor contamination decreased between audit one and audit two, with the exception of floors 2 and 3, keeping in mind that additional signs were placed above the four-bin

stations after audit 1 (Fig. 2.3). Floors 1 and 5 both suffered over 50% contamination rates prior to the placement of additional labels and signs posted above the bins (Fig. 2.3). The largest decrease in contamination, at approximately 30% was seen on floor 4 (2.3). It is worth nothing that the first floor paper bin contained no paper during the first audit due to unforeseen reasons, although it contained items of contamination. The second floor experienced an increase of 0.84% in overall contamination from audit 1 to audit 2, while the fourth floor had almost an outstanding 25% increase of proper diversion (Figure 2.4). Significantly, the study experienced an overall improvement of 19.34% in waste diversion between audit 1 and audit 2.

**Figure 2.3- Waste contamination percentage per floor**

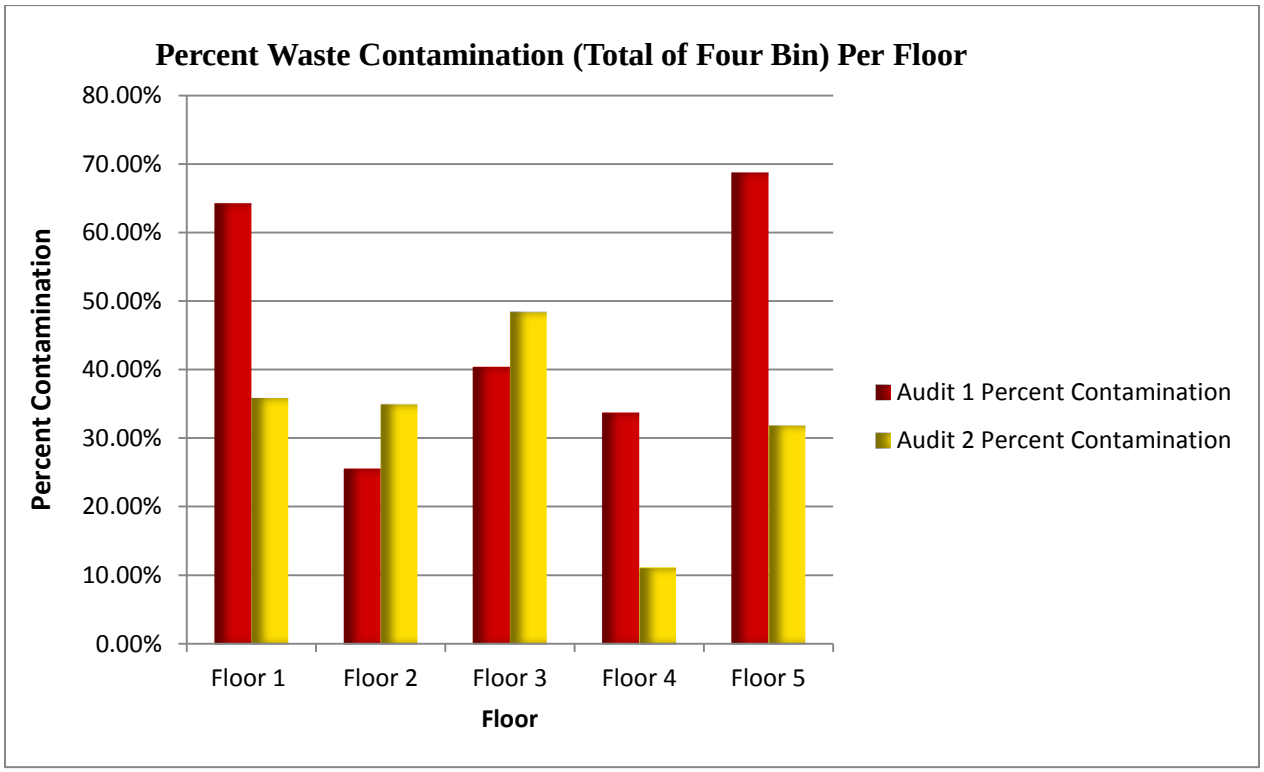


**Figure 2.3 Waste audit results comparing contamination rates between audit 1 and audit 2 of each floor in the Killam Library (five floors). All floors experienced a significant decrease in waste contamination, including floors 2 and 3.**

**Figure 2.4- Waste diversion increase per floor following the placement of additional posters**

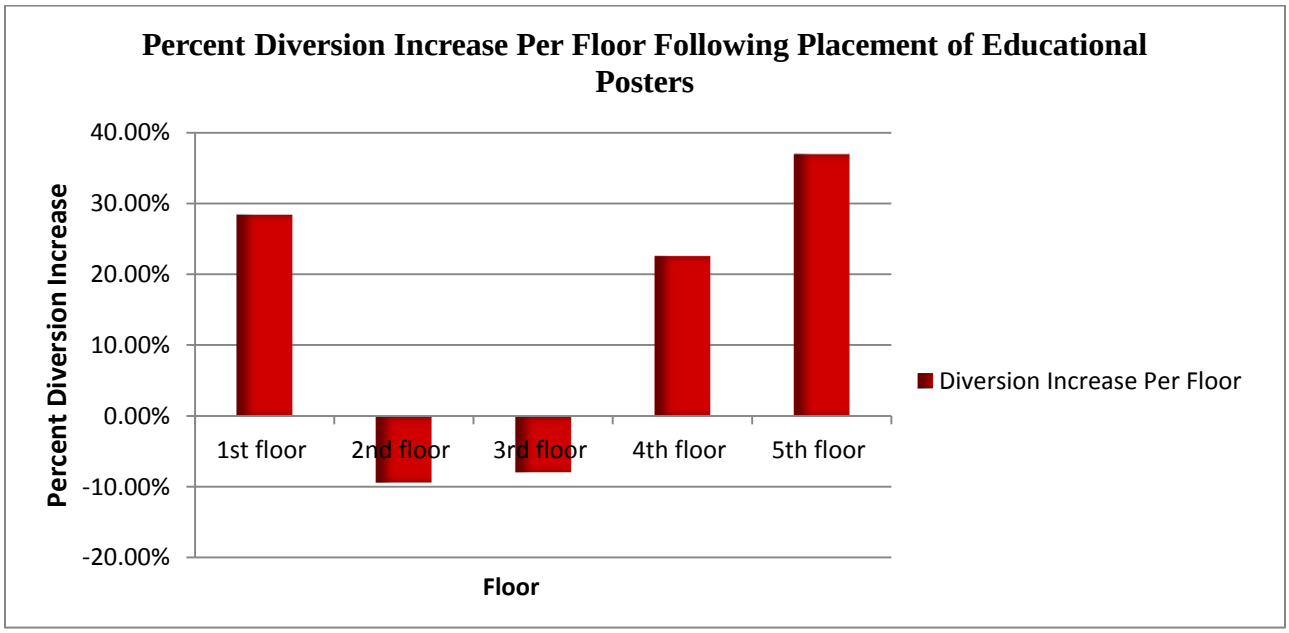


**Fig. 2.4 Waste Audit results portraying the waste diversion increase per five floors in the Killam library after the placement of additional posters. The 5$^{th}$ floor experienced a large increase in waste diversion; however, floors 2 and 3 experienced a decrease in waste diversion.**

The waste stream that experienced the most significant change in contamination rates was organics; during audit 1 there was approximately 25% contamination, and during audit 2 contamination decreased to approximately 3% (Fig. 25). It is worth nothing that a few bins reported perfect diversion rates during the audit, and that garbage contamination increased very slightly, perhaps because of confusion caused by the additional labels and signs.

**Figure 2.5- Total Percentage of Waste Contamination**

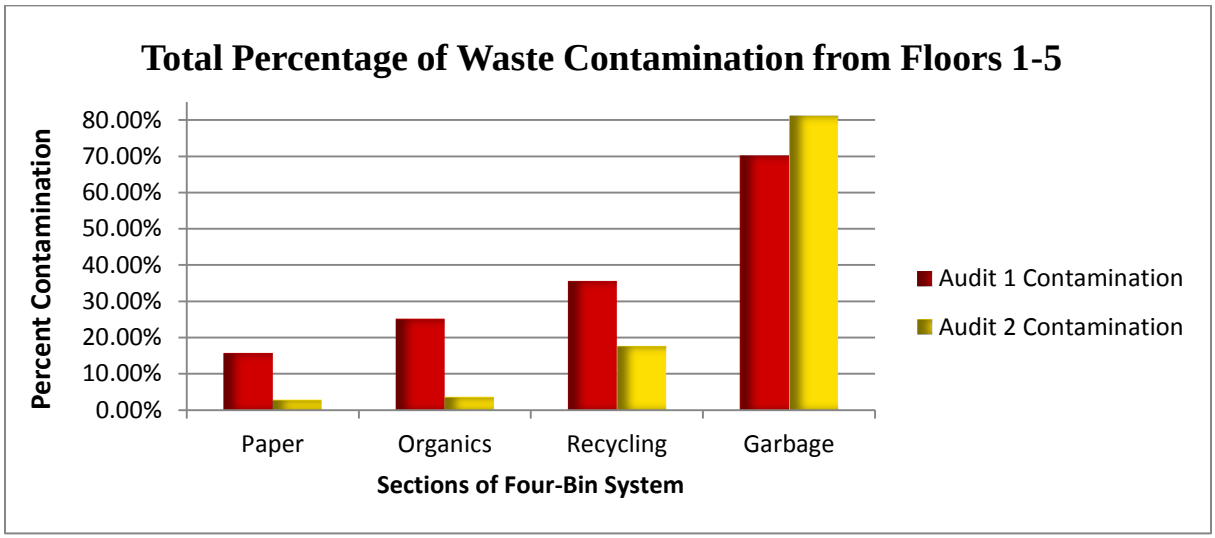


**Figure 2.5 Waste audit results comparing total percentages of waste contamination from floors 1-5 between waste audit 1 and waste audit 2.**

### 4.3 Consideration of Findings in Existing Research

Research through several online databases resulted in the discovery of other universities analyzing their waste stream, and working to improve waste management practices; however, there was no research mirroring this study. Other universities, such as the University of Florida recommended similar ideas for improvement, including, communication, accountability, sustainability prioritization, education in regards to proper waste disposal, direct outreach to new students and spatial identification of waste receptacles (Bryne, Carter, Hodoval, 2009, p. 76 - 77). The University of Florida conducted an audit in 2009, but conversely categorized their waste from their main campus into five sections: municipal solid waste, construction and demolition debris, recyclable material, medical waste and hazardous waste ((Bryne, Carter, Hodoval, 2009, pg. 75). The audit conducted was much larger than the waste audits conducted for this study; however, suggestions and recommendations were similar.

The University of Pennsylvania conducted a waste audit in 2008 which "revealed the potential for doubling the university's diversion rate of traditional recyclables by adopting campus standards for signage, receptacle design, and collection protocols" (University of Pennsylvania, 2012). The uniformity of the plan reduced confusion and allowed for the enforcement of a streamline project. Suggestions to improve waste management practices included educating students, engaging students and faculty in awareness programs concerning waste disposal, increasing communication, hosting informative events and increasing transparency in the waste system (University of Pennsylvania, 2011). After conducting continual audits, the University of Pennsylvania recorded a doubling in recycling rates from15% in 2010 to 30% in 2011 (University of Pennsylvania, 2011). Consultations with recycling vendors and replacing desk-side garbage bins with recycling bins occurred between audits (University of Pennsylvania, 2011). Such changes could be easily adopted at Dalhousie University, for instance through replacing the garbage bins with paper bins in the stacks in the Killam Library, which would further address the issue of inconvenience.

### 4.4 Implications for Theory or Practice

The study discovered that there are several social factors leading to improper waste disposal, and that additional labels and signs are effective at increasing waste diversion rates. Social factors such as inconvenience, carelessness, and uncertainty concerning where to dispose of waste can be addressed through waste management practices, by strategic placement of bins, educational programs and activities, and increased visuals around the four-bin stations. The social factors listed above, and depicted throughout this report can be minimized through transformative waste management practices, and further research focusing on social factors relating to waste disposal. Theory suggesting that addressing these issues through proper waste management practice is entertained in this situation, and was exemplified through an increase of total waste diversion by 19.34 % after additional signs and labels were placed above the bins. There is a relationship between theory and practice in regards to waste diversion and proper waste management. Dalhousie University can address improper waste disposal by working to increase awareness around campus through educational programs, presentations, and activities concerning waste management. Dalhousie can also work to create new labels and signs with

colorful and informative visuals to place above the bins in order to decrease confusion and uncertainty of where to dispose of waste. There is a positive correlation between theory and practice, specifically between awareness and waste diversion rates.

### 4.5 Findings that Failed to Support Our Hypothesis

The purpose of this study was to identify social factors and individual behavior determinants influencing improper waste disposal, and measure the effectiveness of labels and signs in improving waste diversion. This study greatly focused on visual education, through placing additional labels and signs above the four-bin systems after waste audit 1, and hypothesized that increased visual education would improve waste diversion rates. Findings that failed to support the hypothesis were data in which the rate of diversion decreased. Between waste audit 1 and waste audit 2, waste diversion rates decreased on floors 2 and 3 (Fig. 2.3). Furthermore, the garbage bins on all floors experienced an increased rate of contamination (Fig. 2.3).

## 5.0 Conclusion

Waste management is important economically, socially and environmentally. As a large institution having a significant impact on the Halifax Regional Municipality, Dalhousie University has the responsibility to advance sustainability initiatives on campus and throughout the region. This study directly contributes to the Dalhousie greening initiative by identifying methods of best practice and obstacles to increasing waste diversion through the utilization of the Sustainability Office`s rethink, reuse, recycle, and recover framework. The study was successful in analyzing the rates of contamination across the four waste streams, the effects of labels and signs on diversion rates, the social factors influencing improper waste disposal, and in developing suggestions for improved waste diversion in the Killam Library. The survey identified key social factors leading to improper waste disposal, such as inconvenience, lack of labels and signs, carelessness, and significantly, uncertainty of how and where to dispose of waste. The waste audits addressing the effectiveness of additional labels and signs proved to be an important avenue, and suggestion for improving waste diversion in the Killam Library. The

waste audits also depicted that coffee cup disposal is highly problematic, when working to improve waste diversion in a student institution.

### 5.1 Recommendations for Action

Recommendations and solutions to improve waste diversion in the Killam Library include designing new posters, implementing educational program initiatives, increasing awareness concerning waste diversion, conducting activities for students and staff related to proper waste disposal, replacing the garbage bins in the stacks with paper bins, and transitioning to standardized coffee cups on the Dalhousie Campus. Designing original posters addressing problematic items with creative pictures and informative labeling would be effective in improving waste diversion, as the data and study suggests. Educational program initiatives such as a waste resource educational officer directing presentations during orientation week for new students at Dalhousie University is a transformative method to increase awareness related to waste and inspire individuals to care about waste management. Furthermore, making the *Dalhousie Guide to Materials Management* more accessible around campus, perhaps by putting it above the four-bin waste systems, and conducting activities for students and staff related to proper waste diversion would also be effective at increasing awareness and improving waste diversion rates. Lastly, influencing Dalhousie University to have standardized coffee cups on Campus, and to organize student campaigns working to influence large businesses, such as Tim Horton`s to transition to standardized coffee cups is a worthwhile initiative directed at a problematic disposal item.

### 5.2 Recommendations for Future Research

Recommendations for future research include conducting a longitudinal study further directed at social factors influencing improper waste disposal, a study concerning the placement of labels and signs around the four-bin waste system and the placement of the four-bin waste

systems themselves, and a study focusing on liquid waste solutions. In addition, conducting a study focused on the feasibility of providing educational programmes, and activities on campus would be beneficial to the Dalhousie campus greening initiative. A longitudinal study concerning social factors and individual behavior concerning waste, through various focus groups and interviews, and observational studies would be significantly effective at improving waste management practices. This study concluded that labels and signs improve waste diversion rates, therefore providing an important opportunity to expand on existing research focusing on details of signs, color utilization, graphics, creativity and the placement of labels and signs above waste bin systems.

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## 7.0 Acknowledgements

Our research team would like to thank the following individuals for their assistance in helping complete the study. Thank you to our instructor Rochelle Owen for her insightful mentoring throughout the course of the term and providing the needed materials and proper bins, gloves and scale for conducting the waste audits, the Library Green Team, including Sandy Dwyer, Janice Slauenwhite, Jan Pelley, and Aran Silmeryn, for their continued cooperation and assistance in regards to the Killam Library facility, Carla Hill, the daytime custodial supervisor, for her assistance in organizing, labelling and collecting the waste from each floor, the daytime custodial staff, the individuals whom participated in completing the surveys and the Company House for hosting Pecha Kucha night. Your help was much appreciated, thank you!

## 8.0 Appendices

**Appendix 1- Waste Diversion Survey**

1. What floor are you studying on? _____
2. How old are you:
   18 and under____
   19-24____
   25-30____
   31 and over____
3. What year of university are you in? _____
4. Gender: M___ F____
5. What degree are you working to achieve? _____
6. How many times do you visit the Killam each week?
   Less than once____

1-2_____
3-4_____
5-6_____
More than 7 times_____

7. How confident do you feel when using the four-bin garbage system at the Killam Library?
   Very Confident____
   Somewhat Confident____
   Not Confident_____

8. What do you feel is the greatest obstacle to proper waste disposal? (Respond to all that apply)
   Inconvenient to sort garbage____
   Bins full/improperly managed____
   Lack of labels and sign on bins____
   Not sure where certain garbage goes____
   Other, please specify____

9. Do you compost and/or recycle at home?
   Yes____
   No____

10. What items do you find difficult to dispose of? _____

**Appendix 2- Data Sheets for Waste Audit 1 and 2**

**Audit 1**

**Audit 1** – Results –

| **Floor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Paper (kg)** | | 0.03 | 0.15 | 0.83 | 0.33 |
| **Contamination (kg)** | 0 | 0.07 | 0.14 | 0.21 | 0.28 |
| **Ratio of Diversion** | | 30.00% | 78.95% | 87.37% | 17.01% |

| **Floor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Organics** | 0.88 | 0.65 | 0.17 | 1.38 | 0.03 |
| **Contamination** | 0.85 | 0.05 | 0.01 | 0.11 | 0.03 |

| | | | | | |
|---|---|---|---|---|---|
| **Ratio of Diversion** | 50.87% | 92.86% | 94.44% | 92.62% | 50.00% |

| **Floor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Recycables** | 0.33 | 0.45 | 0.4 | 0.07 | 0.34 |
| **Contamination** | 0.48 | 0.12 | 0.07 | 0.05 | 0.16 |
| **Ratio of Diversion** | 40.74% | 78.95% | 85.11% | 58.33% | 68.00% |

| **Floor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Garbage** | 0.48 | 0.18 | 0.37 | 0.37 | 0.35 |
| **Contamination** | 1.71 | 0.21 | 0.62 | 1.07 | 0.51 |
| **Ratio of Diversion** | 21.92% | 46.15% | 37.37% | 25.69% | 40.70% |

**Audit 1 -** Total Weight of waste per floor in kg

| **Total floor 1** | **Total floor 2** | **Total floor 3** | **Total floor 4** | **Total floor 5** |
|---|---|---|---|---|
| 4.73 | 1.76 | 1.83 | 4.00 | 3.36 |

**Audit 1** – Total weight of proper waste diversion per floor in kg

| **Audit 1** | **Total Floor 1 Proper Diversion** | **Total Floor 2 Proper Diversion** | **Total Floor 3 Proper Diversion** | **Total Floor 4 Proper Diversion** | **Total Floor 5 Proper Diversion** |
|---|---|---|---|---|---|
| **Weight of Proper Diversion** | 1.69 | 1.31 | 1.09 | 2.65 | 1.05 |
| **Percent of Proper Diverstion** | 35.73% | 74.43% | 59.56% | 66.25% | 31.25% |

**Audit 1** – Total Weight of contamination per floor in kg

| **Audit 1** | **Total Floor 1 Contamination** | **Total Floor 2 Contamination** | **Total Floor 3 Contamination** | **Total Floor 4 Contamination** | **Total Floor 5 Contamination** |
|---|---|---|---|---|---|
| **Weight of contamination** | 3.04 | 0.45 | 0.74 | 1.35 | 2.31 |

| | | | | | |
|---|---|---|---|---|---|
| **Percent contamination** | 64.27% | 25.57% | 40.44% | 33.75% | 68.75% |

**Audit 2**

**Audit 2** – Results

| **Floor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Paper** | 0.16 | 0.39 | 0.23 | 1.04 | 0.2 |
| **Contamination** | 0 | 0.04 | 0.02 | 0 | 0 |
| **Ratio of Diversion** | 100.00% | 90.70% | 92.00% | 100.00% | 100.00% |

| **Floor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Organics** | 0.44 | 0.25 | 0.25 | 1.16 | 1.03 |
| **Contamination** | 0.04 | 0.05 | 0 | 0 | 0.03 |
| **Ratio of Diversion** | 91.67% | 83.33% | 100.00% | 100.00% | 97.17% |

| **Floor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Recyclables** | 0.55 | 0.65 | 0.13 | 0.22 | 0.77 |
| **Contamination** | 0.28 | 0.08 | 0.05 | 0 | 0.09 |
| **Ratio of Diversion** | 66.27% | 89.04% | 72.22% | 100.00% | 89.53% |

| **Floor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Garbage** | 0.03 | 0.07 | 0.17 | 0.13 | 0.25 |
| **Contamination** | 0.34 | 0.56 | 0.66 | 0.32 | 0.93 |
| **Ratio of Diversion** | 8.11% | 11.11% | 20.48% | 28.89% | 21.19% |

**Audit 2 -** Total Weight of waste per floor in kg

| **Total floor 1** | **Total floor 2** | **Total floor 3** | **Total floor 4** | **Total floor 5** |
|---|---|---|---|---|
| 1.84 | 2.09 | 1.51 | 2.87 | 3.3 |

**Audit 2** – Total weight of proper waste diversion per floor in kg

| **Audit 2** | **Total Floor 1 Proper Diversion** | **Total Floor 2 Proper Diversion** | **Total Floor 3 Proper Diversion** | **Total Floor 4 Proper Diversion** | **Total Floor 5** Proper Diversion |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **Weight of Proper Diversion** | 1.18 | 1.36 | 0.78 | 2.55 | 2.25 |
| **Percent of Proper Diverstion** | 64.13% | 65.07% | 51.66% | 88.85% | 68.18% |

**Audit 2** – Total Weight of contamination per floor in kg

| **Audit 2** | **Total Floor 1 Contamination** | **Total Floor 2 Contamination** | **Total Floor 3 Contamination** | **Total Floor 4 Contamination** | **Total Floor 5 Contamination** |
|---|---|---|---|---|---|
| **Weight of contamination** | 0.66 | 0.73 | 0.73 | 0.32 | 1.05 |
| **Percent contamination** | 35.87% | 34.93% | 48.34% | 11.15% | 31.82% |

**Audit 1 and Audit 2 Analysis**

Percent increase in diversion rate on each floor following the placement of educational posters after Audit 1.

| 1st Floor Proper Diversion | 2nd Floor Proper Diversion | 3rd Floor Proper Diversion Percent | 4th Floor Proper Diversion | 5th Floor Proper Diversion |
|---|---|---|---|---|
| 28.40% | -9.36% | -7.91% | 22.60% | 36.93% |

Review of diversion increase of all floors and all bins combined

| Audit 1 - Percentage of Proper Diversion | Audit 2 - Percentage of Proper Diversion | Percentage of Proper Diversion Increase |
|---|---|---|
| 50.60% | 69.94% | 19.34% |

**Audit 1** – Total of proper diversion and contamination per bin on all floors

| **Paper Proper Diversion** | **Paper Contamination** | **Overall Paper Weight** | **Percentage of proper** | **Percentage of contamination** |
|---|---|---|---|---|

| | | | diversion | |
|---|---|---|---|---|
| 1.34 | 0.25 | 1.59 | 84.28% | 15.72% |

| Proper Organics Diversion | Organics Contamination | Overall Weight | Percentage of proper diversion | Percentage of contamination |
|---|---|---|---|---|
| 3.11 | 1.05 | 4.16 | 74.76% | 25.24% |

| Proper Recycling Diversion | Recycling Contamination | Overall Weight | Percentage of proper diversion | Percentage of contamination |
|---|---|---|---|---|
| 1.59 | 0.88 | 2.47 | 64.37% | 35.63% |

| Proper Garbage Diversion | Garbage Contamination | Overall Weight | Percentage of proper diversion | Percentage of contamination |
|---|---|---|---|---|
| 1.75 | 4.12 | 5.87 | 29.81% | 70.19% |

**Audit 2** – Total of proper diversion and contamination per bin on all floors

| Paper Proper Diversion | Paper Contamination | Overall Weight | Percentage of proper diversion | Percentage of contamination |
|---|---|---|---|---|
| 2.02 | 0.06 | 2.08 | 97.12% | 2.88% |

| Proper Organics Diversion | Organics Contamination | Overall Weight | Percentage of proper diversion | Percentage of contamination |
|---|---|---|---|---|
| 3.13 | 0.12 | 3.25 | 96.31% | 3.69% |

| Proper Recycling Diversion | Recycling Contamination | Overall Weight | Percentage of proper diversion | Percentage of contamination |
|---|---|---|---|---|
| 2.32 | 0.50 | 2.82 | 82.27% | 17.73% |

| Proper Garbage Diversion | Garbage Contamination | Overall Weight | Percentage of proper diversion | Percentage of contamination |
|---|---|---|---|---|
| 0.65 | 2.81 | 3.46 | 18.79% | 81.21% |

**Audit 1 and Audit 2 Comparison Analysis**

Total percent increase in each bin following the placement of educational posters after Audit 1.

| First Floor Paper percent diversion increase | First Floor Organics percent diversion increase | First Floor Recyclable percent diversion increase | First Floor Garbage percent diversion increase |
|---|---|---|---|
| 100.00% | 40.80% | 25.52% | -13.81% |

| Second Floor Paper percent diversion increase | Second Floor Organics percent diversion increase | Second Floor Recyclable percent diversion increase | Second Floor Garbage percent diversion increase |
|---|---|---|---|
| 60.70% | -9.52% | 10.09% | -35.04% |

| Third Floor Paper percent diversion increase | Third Floor Organics percent diversion increase | Third Floor Recyclable percent diversion increase | Third Floor Garbage percent diversion increase |
|---|---|---|---|
| 13.05% | 14.89% | -12.88% | -16.89% |

| Fourth Floor Paper percent diversion increase | Fourth Floor Organics percent diversion increase | Fourth Floor Recyclable percent diversion increase | Fourth Floor Garbage percent diversion increase |
|---|---|---|---|
| 12.63% | 7.38% | 41.67% | 3.19% |

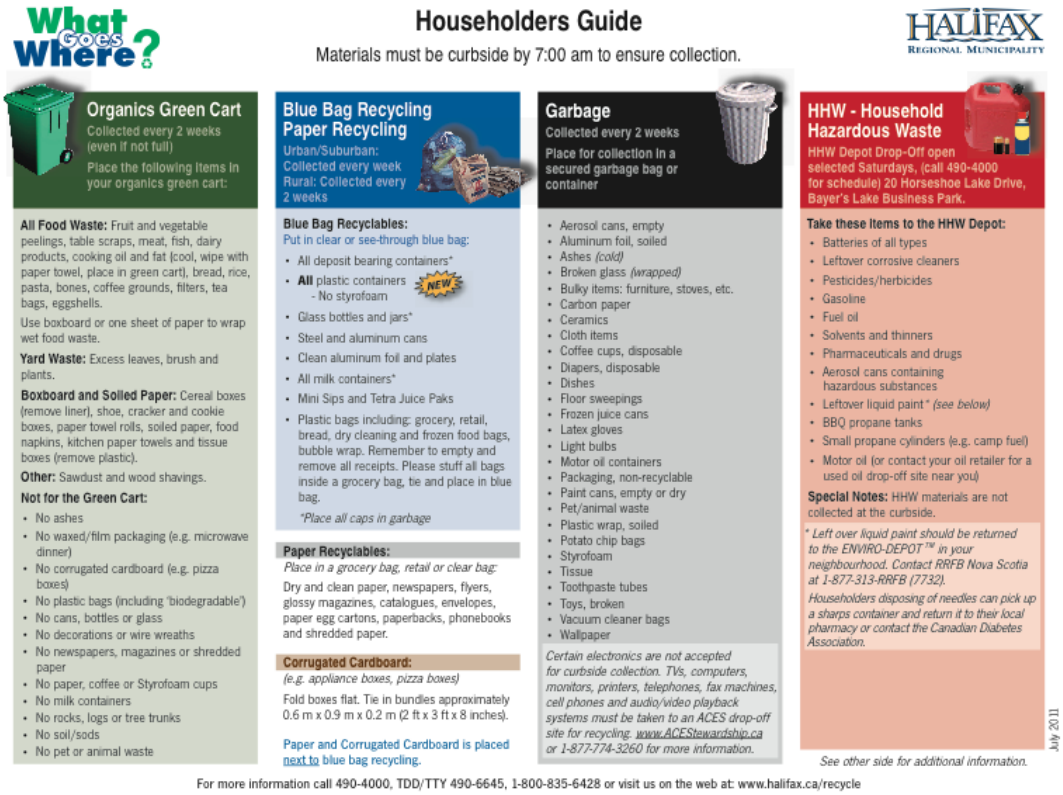
| Fifth Floor Paper percent diversion increase | Fifth Floor Organics percent diversion | Fifth Floor Recyclable percent diversion | Fifth Floor Garbage percent diversion |
|---|---|---|---|

| | increase | increase | increase |
|---|---|---|---|
| 82.99% | 47.17% | 21.53% | -19.51% |

Total percent increase in diversion rate in each bin following the placement of educational posters after Audit 1.

| Percent of Paper diversion increase | Percent of Organics diversion increase | Percent of Recycling diversion increase | Percent of Garbage diversion increase |
|---|---|---|---|
| 12.84% | 21.55% | 17.90% | -11.03% |

## Appendix 3- Halifax Regional Municipality "What Goes Where?" Householder Guide




(Halifax Regional Municipality, 2012)

**Appendix 4-Ethics Form**

**ENVIRONMENTAL SCIENCE PROGRAM**
**FACULTY OF SCIENCE**
**DALHOUSIE UNIVERSITY**
**(version 2010)**

**APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN PARTICIPANTS**
**UNDERGRADUATE THESES AND IN NON-THESIS COURSE PROJECTS**

**GENERAL INFORMATION**

**1. Title of Project:** Waste Diversion Awareness Program for the Killam Library

**2. Faculty Supervisor(s):** Jan Pelley
**Department:** Dalhousie Killam Library Green Team
**e-mail:** jan.pelley@dal.ca

**3. Student Investigator(s):**
Jessica Robinson (jessicaanner@gmail.com)
Chelsey Lightfoot (chelsylightfoot@hotmail.com)
Crystal Lee (finley.crystal@gmail.com)
Jan Kucic-Riker (j.kucic@dal.ca)
Heather Kerr (heather.d.kerr@gmail.com)

**4. Level of Project:** Non-thesis Course Project [ ] Undergraduate [ * ] Graduate [ ]
**Specify course and number:** 3502 ENVS/SUST Campus as a Living Lab

**5. a. Indicate the anticipated commencement date for this project:** March 5th 2012
**b. Indicate the anticipated completion date for this project:** April 6th 2012

**SUMMARY OF PROPOSED RESEARCH**

**1. Purpose and Rationale for Proposed Research: Briefly describe the purpose (objectives) and rationale of the proposed project and include any hypothesis(es)/research questions to be investigated**

The Killam Library on Dalhousie Campus is experiencing great difficulty with waste separation, and cross-contamination in the four types of bins. These four bins, located on all five floors of the library, separate waste into organic material, recyclables, paper products and

garbage. It is predicted that there are social factors contributing to the contamination; namely carelessness or a lack of awareness. This project is aimed at determining the factors leading to contamination, as well as comparing weight ratios between the bins before and after posters are set up on all of the floors.

**2. Methodology/Procedures**

**a. Which of the following procedures will be used? Provide a copy of all materials to be used in this study**.

[ ] Survey(s) or questionnaire(s) (mail-back)
[ * ] Survey(s) or questionnaire(s) (in person)
[ ] Computer-administered task(s) or survey(s)]
[ * ] Interview(s) (in person)
[ ] Interview(s) (by telephone)
[ ] Focus group(s)
[ ] Audio taping
[ ] Videotaping
[ ] Analysis of secondary data (no involvement with human participants)
[ ] Unobtrusive observations
[ ] Other, specify _____

**b**. **Provide a brief, sequential description of the procedures to be used in this study**. **For studies involving multiple procedures or sessions, the use of a flow chart is recommended.**

1. Survey the student and staff population in the library to determine whether or not people are aware of how to separate waste into the four bins.
2. With permission from the custodial staff, collect all waste from the day, and measure the weight ratios of contaminated materials in the four types of bins.
3. Design posters to place above the bins as a visual aid, in hopes to assist people in properly disposing of their waste.
4. Re-weigh the contaminated materials.
5. Draw comparisons between 'before and after', before the posters were put up, and after the students and staff had a chance to use the posters to properly dispose of their waste.

**3. Participants Involved in the Study: Indicate who will be recruited as potential participants in this study**.

Dalhousie Participants:

[ * ] Undergraduate students
[ * ] Graduate students
[ * ] Faculty and/or staff

Non-Dal Participants:
[ ] Adolescents
[ ] Adults
[ ] Seniors
[ ] Vulnerable population* (e.g. Nursing Homes, Correctional Facilities)

* Applicant will be required to submit ethics application to appropriate Dalhousie Research Ethics Board

**b**. **Describe the potential participants in this study including group affiliation, gender, age range and any other special characteristics. If only one gender is to be recruited, provide a justification for this**.
All students and staff who are present in the Killam Library on the day of the survey will be asked if they wish to participate. The survey will be written, and will not ask for the participants to disclose their names.

**c. How many participants are expected to be involved in this study?** 100-150

**4. Recruitment Process and Study Location**
**a**. **From what source(s) will the potential participants be recruited?**
[ * ] Dalhousie University undergraduate and/or graduate classes
[ * ] Other Dalhousie sources (specify)_____Professors, library staff and facilities management _____
[ ] Local School Boards*
[ ] Halifax Community
[ ] Agencies
[ ] Businesses, Industries, Professions
[ ] Health care settings*
[ ] Other, specify (e.g. mailing lists)
_____

* Applicant may also require ethics approval from relevant authority, e.g. school board, hospital administration, etc.

**b. Identify who will recruit potential participants and describe the recruitment process.** Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, advertisement(s), letter(s), telephone and other verbal scripts in the appendices section.

*****INSERT SURVEY*********

**5. Compensation of Participants**: **Will participants receive compensation (financial or otherwise) for participation?**
**Yes [ ] No [*]** If **Yes**, provide details:

**6. Feedback to Participants**
**Briefly describe the plans for provision of feedback and attach a copy of the feedback letter to be used**. **Wherever possible, written feedback should be provided to study participants including a statement of appreciation, details about the purpose and predictions of the study, contact information for the researchers, and the ethics review and clearance statement. Note: When available, a copy of an executive summary of the study outcomes also should be provided to participants.**

Feedback will be given to the Killam Library Green Team, with hopes of providing feedback to the students and staff.

**POTENTIAL BENEFITS FROM THE STUDY**

**1. Identify and describe any known or anticipated direct benefits to the participants from their involvement in the project**.
The one direct benefit from their involvement will be the design of the posters, and what information they feel is lacking in terms of how to properly dispose of waste.

**2. Identify and describe any known or anticipated benefits to society from this study.**
The less contaminated waste in the bins, the more that can be properly recycled or composted, and less garbage is being put in landfills.

**POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY**

1. **1. For each procedure used in this study, provide a description of any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic, legal, etc. risks/stressors and burdens.**

[ ] No known or anticipated risks Explain why no risks are anticipated:
[ * ] Minimal risk * Description of risks: There is potential risk in sorting waste, as there is a chance that something could cause harm to us conducting the research (being cut by glass, for example), but there is no anticipated risk for the participants.
[ ] Greater than minimal risk* Description of risks:

***** This is the level of risk associated with everyday life. ** This level of risk will require ethics review by appropriate Dalhousie Research Ethics Board

**2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stresses identified in Question 1.**
While sorting the waste, it is important to be prudent in avoiding broken glass, and wearing gloves to protect hands from being injured, also included will be full suits and eyewear.

**INFORMED CONSENT PROCESS**
Refer to: http://pre.ethics.gc.ca/english/policystatement/section2.cfm**;**
**1.** What process will be used to inform the potential participants about the study details and to obtain their consent for participation?
[ ] Information letter with written consent form; provide a copy
[ ] Information letter with verbal consent; provide a copy
[ ] Information/cover letter; provide a copy
[ * ] Other (specify) _____Verbal consent, as in agreeing to complete the survey, will be the extent of consent given. The participants will not be affiliated with their responses. It is important to keep the survey neutral to avoid bias so that participants are not persuaded to provide a certain answer. The participants will only be asked to specify their age, gender and area of study. _____

2. If written consent cannot be obtained from the potential participants, provide a justification.

**ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA**
**1. Explain the procedures to be used to ensure anonymity of participants and confidentiality of data both during the research and in the release of the findings.**
We will not ask for the names of participants, nor will we be able to distinguish who placed the waste where.

1. **2. Describe the procedures for securing written records, questionnaires, video/audio tapes and electronic data, etc.**
Questionnaires will be secured throughout the length of the project, no video/audio tapes will be recorded.

1. **3. Indicate how long the data will be securely stored as well as the storage location over the duration of the study. Also indicate the method to be used for final disposition of the data.**
[ * ] Paper Records
[ ] Confidential shredding after _____
[ * ] Data will be retained until completion of specific course.
[ ] Audio/Video Recordings
[ ] Erasing of audio/video tapes after _____
[ ] Data will be retained until completion of specific course.
[ ] Electronic

[ ] Erasing of electronic data after _____
[ ] Data will be retained until completion of specific course.
[ ] Other _____
_____
(Provide details on type, retention period and final disposition, if applicable)

**Specify storage location:** Storage will either be with the Killam Green Team, or secured with one of the members of the group.

**Appendices: ATTACHMENTS** Please **check** below all appendices that are attached as part of your application package:
[ ] **Recruitment Materials**: A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants.
[ ] **Information Letter and Consent Form(s)**. Used in studies involving interaction with participants (e.g. interviews, testing, etc.)
[ ] **Information/Cover Letter(s)**. Used in studies involving surveys or questionnaires.
[ * ] **Materials**: A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests used to collect data.