Watching People Throw Out Garbage:

Food service waste management in Squamish, B.C.

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Abstract

Waste management research primarily focuses on either waste composition analysis through modeling or auditing, or consumer attitudes and intentions about recycling practices. However, no previous research has investigated disposal choices and behaviours as they occur to understand waste management practices. To address this gap, customer disposal choices and behaviour were observed at 29 food service institutions. First, the type of item and disposal stream were recorded, and choices were assigned a binary variable: “correct” if the item matched the stream, and “incorrect” if it was a contaminant. Next, 6 variables assessing contamination levels, customer disposal behaviours, and the types of items disposed were computed from these results. Then, characteristics of the food service institution and its waste system were modeled with these variables using logistic regression to determine what aspects of a food service waste system impact contamination and disposal behaviours. The key institutional characteristics predicting contamination and behaviour were the service type provided at the institution’s waste station, and the quality of signs. An important behaviour that varied at different institutions were “grouped” disposals, where customers disposed of a many types of waste items in a single disposal choice. Additional data for unique institutions is also reported. The findings suggest that effective signage is important for source-separation waste disposal, and that waste systems must be designed to suit the institution’s services. The methodology used in this study is widely applicable. Moreover, it is more cost-effective than a comprehensive waste audit and gathers unique behavioural information to inform waste system design at any institution.

Keywords: solid waste management, source-separation, food service institutions, consumer behaviour, signage

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Introduction

Waste Management Research

Current waste management research in North America and Europe focuses primarily on waste composition analysis through auditing or modeling (Allesch & Brunner, 2014; Bucuroiu & Petrescu, 2017; Korfmacher, 1997; Wilson et al., 2015; Wilson, Rodic, Scheinberg, Velis, & Alabaster, 2012), or on consumer intentions or attitudes about waste management systems through self-reporting and surveys (Arı & Yılmaz, 2016; Cimen & Yilmaz, 2015; Prestin & Pearce, 2010; Saladié & Santos-Lacueva, 2016). Many studies have identified a gap between consumer intention to recycle and actual recycling behaviour; they attribute this gap to either education or infrastructure challenges within the waste management system (Arı & Yılmaz, 2016; C. J. Li, Huang, & Harder, 2017; Zhang, Zhang, Yu, & Ren, 2016). Challenges involving education and awareness have been analyzed in relation to factors such as income level and geographic distribution (Z. Li & Zhao, 2017), and lack of education is often addressed through social norm interventions (Cotterill, John, Liu, & Nomura, 2009; Geislar, 2017; McKenzie-Mohr, 2000). Otherwise, access to infrastructure is found to be a major factor in recycling behaviour, with factors such as travel distance and bin/service locations inhibiting both people who intend and who do not intend to recycle (Geislar, 2017; C. J. Li et al., 2017; Zhang et al., 2016). Additionally, characteristics of the waste station such as lid shape and colour impact peoples' recycling attitudes and practices (Keramitsoglou & Tsagarakis, 2018).

Intersecting both educational and infrastructural aspects of waste management is signage. It is clear through signage research across a variety of disciplines that signs prompt behaviour, and effective signs are familiar to viewers (Keramitsoglou & Tsagarakis, 2018; Meis & Kashima, 2017), placed appropriately to prompt correct behaviour (Chen, Wang, Lin, & Guo, 2018; Higgins, Brewster, Buxcey, & Robinson, 2015; Marschall, Granquist, & Burns, 2017), and are accompanied by either formal or multi-media education and campaigning (Meis & Kashima, 2017; Werner, Rhodes, & Partain, 1998; Werner, Stoll, Birch, & White, 2002; Werner, White, Byerly, & Stoll, 2009). In addition, the information presented on effective signs usually inspires critical engagement with the sign's message through validation of the observer's experience (Werner et al., 2002, 2009), or by providing observers with ontological knowledge (Marschall et al., 2017). Moreover, effective intervention through signage requires continual updating of the media strategy to keep people engaged (Cotterill et al., 2009; Jambeck, 2012; Werner et al., 2009). Social norms have a strong influence on behaviour, and norm-activation as part of a media strategy has proven effective in recycling and composting interventions (Geislar, 2017; C. J. Li et al., 2017; Nomura, John, & Cotterill, 2011). Thus, waste disposals made in public locations like food service institutions can be influenced by a variety of factors, such as validating sign messages (Werner et al., 2002), employee engagement with customers about waste disposal (C. J. Li et al., 2017), seeing other customers make disposal choices at visible waste stations, or other social and self-imposed pressures to dispose of waste correctly (Keramitsoglou & Tsagarakis, 2018).

Food service Institutions

Most waste at food service institutions is comprised of food or compostable paper products, making this sector critical for improving organic waste diversion from landfill (District of Squamish, 2017, 2018a; MetroVancouver, 2014). These institutions produce waste in two realms: back-of-house, or kitchen and food preparation waste; and front-of-house, or disposals made by customers after they have finished their meals. Often, front-of-house waste is provided by the kitchen or servers with the food, with options to add their own condiments or sugar. The most common food service institutions that require customers to dispose of their own waste are cafés and fast food restaurants. In regions with recycling programs, customers are also required to sort their waste upon disposal, a waste system called "source-separation" (Peacock, 2018). With this type of system, contamination is common because customers may be confused, find sorting recyclable items challenging, or are simply not interested in recycling (Resource Recovery Fund Board, 2003).

Disposing unsorted waste into landfill causes increasing challenges in regions like Squamish, BC, which has almost maximized the capacity of its landfill with no local expansion options (District of Squamish, 2018a). In addition, the methane produced by landfilled compostable waste contributes to the global greenhouse gas effect (Bucuroiu & Petrescu, 2017; Rujnić-Sokele & Pilipović, 2017). To address these issues, many regions in North America have developed organics collection programs (OCPs) to compost organic waste and create soils for farming and land development (District of Squamish, 2018d; Geislar, 2017; C. J. Li et al., 2017). However, regions introduce these programs with varying levels of effectiveness to both Residential, and Institutional, Commercial, and Industrial (ICI) sectors. Without effective education, media, and infrastructure, regional waste diversion programs relying on source-separation will still receive considerable amounts of recyclable and compostable material that contaminate landfills.

Research Context

The District of Squamish (DOS, Squamish) is located on the traditional and unceded territory of the Skwxwuu7mesh First Nation, at the top of Howe Sound in BC. Squamish is one of BC's fastest growing communities, with a strong tourism industry that brings seasonal residents. Because of these rapid changes, waste management and other public services are currently challenged to provide effective systems (CBC News, 2018). In September 2017, the DOS passed Solid Waste Utility Bylaw No. 2547, 2017, which requires all ICI sector businesses to sort waste below 20% contamination in each stream, with a goal of reaching less than 5% contamination by 2020 (District of Squamish, 2017). This bylaw results from the Province of BC's commitment to removing all new addition of organic waste to landfill by 2020 as part of a strategy to reduce greenhouse gas (GHG) emissions (B.C. Laws, 2003; Environmental Reporting BC, 2018). According to the DOS, 80% of landfill waste comes from the ICI sector, including strata and apartment buildings. Additionally, over 65% of landfill waste could have been recycled or composted (District of Squamish, 2018a). The bylaw relies mainly on financial incentives to reduce contamination. For example, there is a high "mixed-waste" tip fee ($320/tonne) for contaminated landfill waste, whereas compost tip fees are only 75$/tonne and all recyclable materials are tipped free of charge (District of Squamish, 2018c). In addition to high fees, fines for any waste stream with over 20% contamination are charged. These fines are directed at the ICI sector, but apply to any household waste brought to the Landfill Depot. Financial incentives such as these are common; however, their effectiveness in changing consumer disposal behaviour is limited (Geislar, 2017; C. J. Li et

al., 2017). Additionally, institutions usually do not pay tip fees directly, but rather rent large waste bins for their in-house materials that are collected weekly.

During summer 2018, the DOS and local non-profit organizations provided workshops to inform and aid businesses to transition to new waste management systems during a 1-year grace period before bylaw fines are imposed. Thus, the DOS is engaging business-owners in an educational and outreach program to provide them with resources, such as signs and bin infrastructure suppliers, and community-based incentives to transition their waste systems (District of Squamish, 2018a, 2018b). However, with limited human resources and institutional capacity to evaluate stream contamination from all businesses, and to impose fines where necessary, the DOS faces challenges in inducing the constraints of the bylaw widely in Squamish. Particularly, the fine system is difficult to enforce because for the waste collection system to be cost-effective, waste collection at small ICI sector components are grouped and cannot be frequently assessed for individual contamination. Some components of the bylaw attempt to address this challenge: for example, requiring all waste to be disposed in clear bags will allow employees of the DOS waste management contractor to assess contamination visually on-site and report fines accordingly (District of Squamish, 2017). This report is intended to aid food service institutions in this bylaw transition by providing site-specific assessment of and feedback for their existing waste management systems. In addition, this report will provide Squamish with data to inform critical areas for general waste system improvement during the transition process.

Research Goals

By observing disposal choices as they occur, it is possible to obtain not only an estimate of waste system contamination, but also insights to how customers interact with the available waste station and media. First, by assessing a variety of food service institutions, insights are gained about general customer disposal patterns when faced with diverse types of systems. By identifying common items that are disposed incorrectly, and common failings of waste management systems, the gap between consumer intention and disposal behaviour is filled. Second, by assessing each food service institution in-depth and comparing it to similar places, it is possible to develop recommendations to improve for each food service institution by summarizing their unique data and comparing it to disposal patterns seen in other institutions. This opportunity is valuable because managers at these institutions can improve their waste systems without investing in large-scale auditing services. Moreover, the simplicity of this methodology is adaptable to diverse institutional and regional waste system requirements. Thus, managers within food service institutions can implement a waste system monitoring and improvement strategy by dedicating a small amount of time to “watching people throw out garbage”.

This report will first describe the methodology used to gather and analyze data. The processes for determining institution characteristics (independent variables), calculating and summarizing contamination and customer disposal behaviours, and finally modeling these variables together will be described. Then, results will be analyzed and reported, followed by some examples of specific institutions and recommendations. Finally, the applicability of this methodology to a variety of research questions and institutions will be discussed, along with additional observations and general recommendations for next steps.

Definitions

In this report, "waste" refers to any items that are disposed post-consumption and is not limited to solely non-recyclable or non-compostable items. In contrast, the terms "garbage", "trash", and "landfill" all refer to non-recyclable items. The term "recyclable" when used generally applies also to compostable waste, as resources are recovered post-consumption for further use. Waste stream titles are designated with a capital-lettered title, whereas general types of waste items use a lower-case title.

Methods

Institution Selection

Twenty-nine (29) food service institutions were selected from a total of 71 possible locations in Squamish, based on criteria outlined in Table 1. Each institution was observed three times over seven weeks, with each observation period lasting one hour. Observation periods occurred between 8am and 2pm, depending on peak hours, which were determined at each location using Google's business "visit data" where possible (Google My Business Help, 2018), and otherwise using local knowledge and assumptions based on service type. For example, institutions serving lunch menus were typically visited around the lunch hour, whereas coffee shops were typically popular early or mid-morning. For observation days, institutions were clustered in groups of three by location and street address, which assumes that customers would not visit two similar institutions within two or three hours of each other (see Appendix E). In institutions with more than one waste disposal station, the station closest to what was identified as the main door was observed under the assumption that it would have the greatest number of customers. After the first round of observations, priority businesses were identified if less than 10 observations were made. Further assessment of peak hours specific to certain weekdays, or weather patterns, were considered to attempt to increase observation numbers during the second and third rounds.

Table 1: Selection criteria and description.

Criterion	**Description**
Order-at-counter	Institutions which require customers to order and/or pick up food at a counter will be included.
Non-serviced tables	Institutions that do not bus tables, thus requiring customers to dispose of their own waste, will be included. Institutions that provide dishes but still require customers to return dishes and waste to a central bussing station will be included.
Eat-in service	Institutions that provide indoor seating for customers to eat/drink at will be included. If the primary service is take-out, the institution will not be included; however, take-out service alongside eat-in service is acceptable.

Waste Stream and Item Identification

Waste streams at each institution were identified by the labels on their own signs insofar as they align with waste streams accepted in Squamish under Recycle BC and Sea to Sky Soil requirements (District of Squamish, 2018d; Recycle BC, 2015). Some institutions also collected a Refundables stream,

which is processed by Return-It Bottle Depot (Encorp Pacific Canada, 2018). Where it was unclear whether a recycling stream was Recyclable Containers or Refundables, the stream was assumed based on the composition of items sold by the institution (i.e. if only refundable beverage containers were sold, the stream was identified as Refundables). Where no text-based signs existed, streams were identified as recyclable or refundable if the bin was clearly purposed for these items, through evident blue colouring, recycling symbol, or items clearly present in the bin, and as Landfill in all other cases. For example, some waste stations had an image of a person throwing out waste on the lid, others had no labels but multiple holes, and others still had only a single black bin underneath the coffee station (see Appendix C). In cases where signs did not clearly align with Recycle BC streams, judgement was based on the items offered by the institution. Contamination of these streams were evaluated based on which stream they were assumed to be collected under.

Regarding item disposal, recyclable containers or paper wrappers with food or liquid waste in them were considered correct in the recycling bins, but the remaining drink or food were considered contaminating choices unless present only in small amounts. In other words, if the food or drink waste items could have been dumped into a compost bin, they were considered a separate, contaminating disposal choice. Additionally, when napkins were disposed alongside other items, they were recorded only as a single napkin unless the customer clearly made multiple choices with different napkins. This accounts for the discrepancy between institutions which serve anywhere from 0-5 napkins at one time. Importantly, napkins cannot be recycled in the Paper stream (Recycle BC, 2015), so only napkin disposals in a Compost stream were considered correct.

Observation Methods

Waste stations were observed from a nearby table to allow the researcher an unobstructed view of the bins or holes, and customers' hands, but not close enough to disrupt user flow around the waste station. During each observation period, the types of items and streams they were disposed in were recorded by hand on a datasheet. The disposal choice was assigned a "1" if the item was disposed in the correct stream, and a "0" if not. If a customer disposed of multiple items at separate times, the disposals were connected using a colour-coding system and later given the same Customer ID. If a customer disposed of multiple items at a single time, the disposal was recorded as a "grouped" disposal, and the items were summarized in the Comments column in the same row as the disposal. Initially, grouped disposals were marked as "0", but in later analysis were broken apart by item and given a "percent correct disposals" value within the grouped disposal (Table 2). Any disposals that occurred where the researcher could not see either the item or the stream was identified as NA, marked "0" for incorrect, and later excluded from analysis.

Table 2: Sample datasheet from Burger King with process for determining "Average Correct Choice" (# Correct / # Items) from grouped disposals.

# Disposals	Customer ID	Item	Stream	Average % Correct Choice	Components	# *Items*	# *Correct*
1	101	napkin	Landfill	0.00		1	0
2	101	napkin	Landfill	0.00		1	0
3	102	grouped	Landfill	0.14	paper tray mat, napkins, paper wrapper, receipt, r-cup, r-lid, plastic straw	7	1
4	103	napkin	Landfill	0.00		1	0
5	104	grouped	Landfill	0.00	paper tray mat, receipt, napkins, food waste, 2x paper wrapper	6	0

Data Entry and Standardization

Data were entered into spreadsheets and items were standardized to ease calculation and formulae creation. First, all disposed items were expanded and linked to a Customer ID, to evaluate the percent of items disposed correctly and thus approximate stream contamination by different types of items. On a separate sheet, grouped disposals were collapsed and new columns were added to quantify the number of items per disposal, and the number of items disposed correctly per disposal, within each institution. Using these two values, a "percent correctness" per disposal was calculated to reflect customer disposal correctness whether their disposal behaviour was "grouped" or "individual" items (Table 2).

Independent Variables

Five independent variables (IVs) were determined for each institution to describe their meal and waste disposal services. These characteristics were chosen because they are assumed to influence disposal behaviours of customers. All variables are summarized clearly in Table 4. First, the number of customers (IV1) observed disposing waste were counted to approximate each institution's service volume relative to the others. This variable is important because its relationship with other variables can provide insight as to whether institution busyness affects waste stream contamination and disposal choices. Second, the number of different types of items available (IV2) from the institution were counted to understand whether a larger variety of waste items impacts disposal behaviours and choices. Third, the number of streams (IV3) was counted for each institution. Streams were considered different from each other if they had signs, symbols, or were obviously distinct, and if they were also aligned with Recycle BC waste streams. These variables are all "count" data.

In addition, each institution was categorized by two key characteristics of its disposal system. First, the type of service (IV4) the disposal station provided was categorized, where "1" represents a "Drink Station" and "2" represents a "Meal Disposal" station. Second, the quality and completeness of waste station signage (IV5) was divided into 4 categories ranging from no signage to complete, text-

based signage (Table 3). All stations were ranked by sign completeness with text as the primary indicator of a complete sign. Although solely text-based signs are not the most effective sign type (Town & Folk-Blagbrough, 2018), this quality was selected because few institutions even had signs, much less a variety in their design beyond text variation.

A Chi-Square test for independence was completed for each pairing of IVs to determine any significant relationships. This information was used to interpret results from logistic regression with DVs. An alpha level of 0.05 was used for all statistical tests.

Table 3: Values and qualities of each categorical independent variable (IV4, IV5).

Category	Range	Value	Description
Service Type	Drink Station	1	Waste station is located within or near a drink service station. Often these stations are characterized by a counter on which coffee fixings are placed. This category also includes the Booster Juice waste station, which is primarily used for straw wrapper disposals.
	Meal Disposal	2	Waste station may be located near a drink service station, but the primary purpose of the waste station is for customers to clear their waste after finishing a meal.
Sign Quality	No Signs	1	Waste station bins do not have signage indicating streams or items. This category does not include the standard icon of a person throwing out garbage, nor presence of any blue/recycling bins. Quiznos, which has no text identifying a waste bin, but the label "Please do not throw away baskets," is included in this category (see Appendix C).
	No Complete Signs	2	Waste station bins have symbols that indicate with a recognizable icon that waste is supposed to go there, but no descriptive text on any of the signs. This includes the icon of a person throwing out trash, the text "Thank You" or similar waste bin indicators, as well as any stations that have a blue/recycling bin. Pizzalicious is included in this category, though their Refundables collection bin is indicated clearly by the items in it rather than a recycling symbol (see Appendix C).
	Some Complete Signs	3	Waste station bins have some signs with text indicating which items are supposed to go there. This does not include the signs with, “Thank You” on them, or the signs with a standard waste icon. Signs must identify or describe the streams/items. Fuel & Forest Cafe is included in this category, though their sign simply indicates to place all waste in bus bins rather than in the drink station waste bin (see Appendix C).
	Complete Signs	4	All waste station bins are labeled with signs indicating which stream and/or which items belong in each bin. Signs may combine icons/images with text, but text is the key determinant.

Dependent Variables

Six key dependent variables (DVs) were calculated for each institution based on observation data. All variables are clearly described in Table 4. A correlation matrix was created to determine any significant relationships between DVs. This information was used to inform further analysis of the logistic regression results. An alpha level of 0.05 was used for all statistical tests. Both Spearman’s *rho*

and Pearson's *r* statistics were calculated to determine which correlation method was best suited to the data as some variables did not appear to follow a normal distribution. If a strong correlation was found between correlation results of both methods, Pearson's *r* would be used for simplicity in analyzing the small dataset. Otherwise, Spearman's *rho* would be used to account for non-normal distributions in the data (Anglim, ars, & Hyndman, 2010; Laerd Statistics, 2018).

Table 4: Key variables, formulae, and descriptions. IVs are identified using count or categorical data, whereas all DVs are numeric data calculated from disposal and customer observations.

Independent Variables		
Variable	*Formula*	*Description*
# Customers (IV1)	NA	Unique Customer IDs counted and totaled per institution, determined during observation periods. Identifies whether institution busyness affects results.
# Types of Items Available (IV2)	NA	Total number of different types of items available for sale per institution, determined during observation periods.
# Streams (IV3)	NA	Total number of waste streams identified per institution. This value does not indicate the number of waste bins available for disposal.
Service Type (IV4)	NA	Categorical variable identifying what service the waste station provides (Meal Disposal or Drink Station). (See Table 3 for description of categories).
Sign Quality (IV5)	NA	Categorical variable qualifying the level of sign completeness at each station. (See Table 3 for description of categories.)
Dependent Variables		
% Correct Items Disposed (DV1)	(Total Correct Item Disposals) / (Total Item Disposals)	Percent of disposals where waste items were placed in the correct waste stream, calculated per institution. Identifies contamination.
% Grouped Disposals (DV2)	(# Grouped Disposals) / (# Disposals Made)	Percent of disposals with than one item disposed at once ("grouped"), calculated per institution. Identifies grouped disposal behaviours.
Average # Items/Disposal (DV3)	[SUM (Items)] / (Total # Items Disposed)	Average number of items in each disposal, calculated per institution. Identifies general disposal behaviour (grouped or individual) at each institution.
Average % Correct Items/ Disposal (DV4)	[SUM (Average % Correct Choice)] / (Total # Disposals made)	Average percent of items correctly disposed in each disposal (whether grouped or individual items), calculated per institution. Identifies contamination.
Average Items Disposed/Customer (DV5)	(# Items Disposed) / (# Customers)	Average number of items disposed by each customer, calculated per institution. Identifies range of items used by each customer in all grouped and individual disposals.
Average Disposals/Customer (DV6)	(Total # Disposals Made) / (# Customers)	Average number of disposals made by each unique customer, calculated per institution. Identifies whether customer disposals are primarily grouped or individual.

Logistic Regression Analysis

A logistic regression analysis was completed for each DV with all IVs using a general linear model (glm) in R statistics programming software (R Core Team, 2016). These models were created to determine key institutional and waste system characteristics that affect customer disposal behaviours and waste system contamination.

Contamination Levels

Institutions were categorized by "% Correct Items Disposed" (DV1) into percentiles indicating whether they had a high or low value for waste stream contamination. A division into five percentile categories was selected to reflect the DOS acceptable contamination level of maximum 20%. Thus, any locations with "% Correct Items Disposed" values >80% have a system which overall meets DOS bylaw requirements.

Results

NA Values

Removing NA values did not alter the % items disposed correctly by more than 10%. In cases where difference between values including NAs and not including NAs was greater than 1.0%, it is likely attributable to either a small number of total observations, a high number of NAs, or a high number of correct disposals (Table 5). This relatively small impact caused by NA disposals indicates that the observation methodology is suitable for collecting data about disposal choices relating to item and stream disposal.

Table 5: Institutions with largest % difference between "% Correct Items" after NA values are removed. Only seven locations had a difference greater than or equal to 1.0%.

Institutions	# Items Disposed (with NAs)	# NAs	% Correct Items (with NAs)	% Correct Items (no NAs)	Difference (%)
Green Moustache	33	3	66.7	73.3	6.7
Tim Hortons (Dentville)	23	4	26.1	31.6	5.5
Freshii	54	2	75.9	78.8	2.9
Booster Juice	57	2	45.6	47.3	1.7
Sunflower Bakery Café	24	1	33.3	34.8	1.4
McDonald's	142	12	13.4	14.6	1.2
Tim Hortons (Garibaldi)	100	4	24.0	25.0	1.0

Independent Variable Relationships

A Chi-Squared test for independence between all pairs of categorical variables showed that only IV3 and IV5 were significantly related (X^2=37.38, df=9, p=2.25E-5). This is likely because only nine of the 29 institutions provided three or more streams, and each had primarily text-based signs (i.e. "Sign Quality" = 4) that were non-standardized. It seems intuitive that the more streams provided, the more likely there are to be signs. However, since the quality of signs is an important target of this study and no other variables were related, both variables were included in the logistic regression analysis.

Table 6: Pearson's Chi-Square Test values relating independent categorical variables. Only IV3 and IV5 values were significantly related to each other. Duplicate values and perfect relationships between identical variables are omitted from the table for clarity.

Pearson's Chi-Square Test	# Customers (IV1)			# Types Items Available (IV2)			# Streams (IV3)			Service Type (IV4)		
	X^2	df	*p*	X^2	df	p	X^2	df	*p*	X^2	df	*p*
# Types Items Available (IV2)	384.3	384	0.487									
# Streams (IV3)	74.2	72	0.406	49.94	48	0.396						
Service Type (IV4)	245.0	24	0.406	15.65	16	0.478	5.07	3	0.167			
Sign Quality (IV5)	84.1	72	0.156	52.94	48	0.289	37.38	9	**2.25e-05 *****	3.699	3	0.296
Note: *p<0.1, **p<0.05 , ***p<0.01												

Dependent Variable Relationships

Pearson's Product-Moment Correlation was used to compare DVs. The correlation matrix computed from these variables indicates that four DVs are significantly correlated. First, DV1 has a significant relationship with DV4 (r=0.986, p<2.2E-16). Since DV1 is calculated by individual items, whereas DV4 is calculated using percent correctness in a grouped disposal, this relationship simply confirms that whether an item is disposed individually or within a group, it will either be correct or incorrect depending on the stream it is disposed in. Second, DV5 correlates significantly with DV2 (r=0.847, p=6.8E-9) and DV3 (r=0.945, p=1.4E-14). Additionally, DV2 and DV3 correlate (r=0.839, p=1.3E-8). Together, the positive correlations between DV2, DV3, and DV5 indicate that institutions with a large percentage of grouped disposals also provide a high number of items that most customers tend to dispose at once. These results indicate that future modelling may omit any of these correlative variables based on the needs of the research question. However, because this research is investigating underlying patterns of waste disposal, all variables were assessed using logistic regression.

Table 7: Pearson's Product-Moment Correlation values relating dependent numerical variables. DV5 correlates significantly with DV2 and DV3, which also correlate with each other. DV1 and DV4 correlate significantly as well. Duplicate values and perfect relationships between identical variables are omitted from the table for clarity.

Pearson's Product-Moment Correlation	% Correct Items Disposed (DV1)		% Grouped Disposals (DV2)		Average # Items/Disposal (DV3)		Average % Correct Items/Disposal (DV4)		Average Items Disposed/ Customer (DV5)	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
% Grouped Disposals (DV2)	0.096	0.622	--	--	--	--	--	--	--	--
Average # Items/Disposal (DV3)	0.079	0.685	0.839	**1.3e-8 *****	--	--	--	--	--	--
Average % Correct Items/Disposal (DV4)	0.986	**<2.2e-16*****	0.084	0.666	0.040	0.836	--	--	--	--
Average Items Disposed/Customer (DV5)	0.067	0.729	0.847	**6.8e-9 *****	0.945	**1.4e-14 *****	0.022	0.908	--	--
Average Disposals/Customer (DV6)	-0.023	0.907	0.032	0.869	-0.073	0.706	-0.035	0.857	0.189	0.325
Note: *p<0.1, **p<0.05 , ***p<0.01										

Logistic Regression Analysis

Results of the logistic regression using glm reveal that IV4 has a significant relationship with DV1 (*p*=0.013), DV2 (*p*=5.5e-5), DV3 (*p*=0.006), DV4 (*p*=0.016) and DV5 (*p*=0.001). Considering that DV2, DV3, and DV5 correlate, this pattern is not surprising. Similarly, IV4 and IV5 are both significantly related to the correlating variables DV1 (*p*=0.013 and *p*=0.031 respectively) and DV4 (*p*=0.016 and *p*=0.025 respectively) (Table 8). These results indicate that key predictors of contamination and grouped disposal behaviours are the Service Type (IV4) and Sign Quality (IV5). Interestingly, though IV3 (# Streams) and IV5 were related, only IV5 significantly predicted the DVs. This may indicate that multiple streams are less effective if they are not well-labeled. Together, these relationships indicate that fewer DVs would reveal the same relationships with institution and waste station characteristics. In addition, IV2 has a borderline significant relationship with DV5 (*p*=0.072). This result indicates that some institutions which provide a larger variety of items to customers may expect more item disposals per customer.

Table 8: Logistic regression results using glm, modelling each DV with all IVs. Significant values are bolded with indicators in asterisks.

	Dependent Variables					
	% Correct Items Disposed (DV1)	% Grouped Disposals (DV2)	Average # Items/Disposal (DV3)	Average % Correct Items/Disposal (DV4)	Average Items Disposed/ Customer (DV5)	Average Disposals/ Customer (DV6)
	p-value	p-value	p-value	p-value	p-value	p-value
# Customers (IV1)	0.702	0.810	0.971	0.552	0.600	0.620
#Types Items Available (IV2)	0.271	0.252	0.236	0.103	**0.072***	0.697
# Streams (IV3)	0.684	0.454	0.728	0.723	0.899	0.179
Service Type (IV4)	**0.013****	**5.5e-5*****	**0.006*****	**0.016****	**0.001*****	0.354
Sign Quality (IV5)	**0.031****	0.194	0.948	**0.025****	0.574	0.207
Residual Deviance	0.503	0.494	13.739	0.613	19.931	1.210
Deg. Fr.	23	23	23	23	23	23
AIC	-21.3	-21.8	74.6	-15.6	85.4	6.3
						Note: *p<0.1, **p<0.05 , ***p<0.01

Contamination Levels

Most institutions (n=19) have less than 20% of items disposed into correct streams (Figure 1). In addition, only 2 institutions have greater than 60% of items disposed correctly, with no institutions achieving more than 80% correct disposals. To achieve < 20% contamination, per the SWU Bylaw, 2017, institutions would need 80-100% of items correctly disposed. However, these results show that no institutions are likely achieving the required maximum contamination level in their front-of-house operations. Since the solid waste contractor measures contamination by visual assessment or weight instead of customer choices, these values represent a conservative estimate in overall stream contamination. In addition, because only four institutions provide a Compost stream, these values largely represent Landfill stream contamination mostly by compostable items.

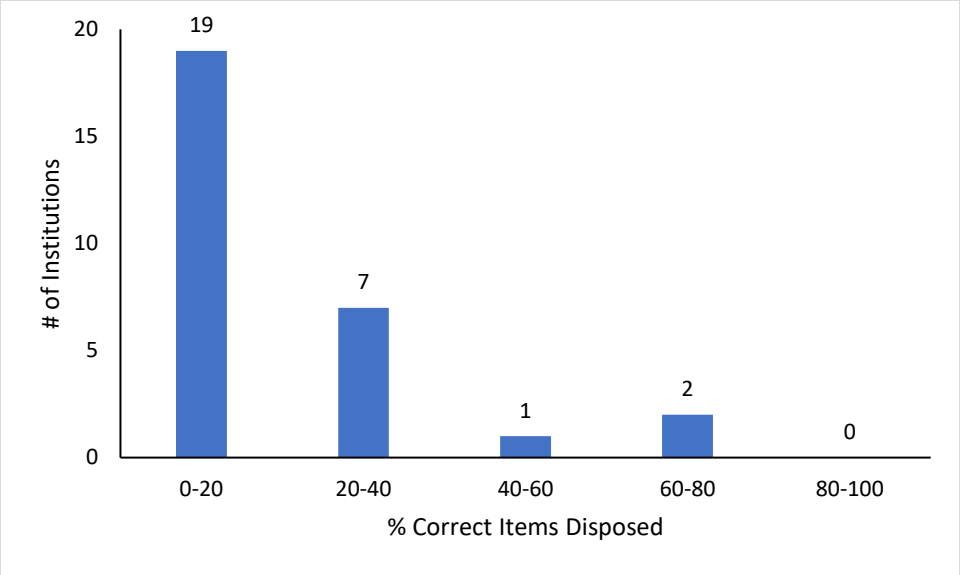

Figure 1: Percent Correct Items Disposed at all institutions (n=29). Most institutions have 0-20% correct item disposals, which is not sufficient to meet DOS Solid Waste Utility Bylaw, 2017, stipulations requiring >80% correct disposals (i.e. <20% contamination) (District of Squamish, 2017).

The top 10 institutions with the highest % correct disposal choices (i.e. lowest % contamination) range from 78.8 to 22.6% correct disposals (Table 9). This wide range demonstrates the variability between these places, and the high number of institutions with <20% correct disposals (i.e. >80% contamination). Of these top 10, Freshii (1st), Green Moustache (2nd), Sunflower Bakery Café (5th), and Wendy's (6th) provide a Compost stream to their customers. In third place is Pizzalicious, which only provides a Landfill and Refundables stream. At Booster Juice (3rd), the most frequent items were paper straw wrappers (n=47), which were most evenly disposed in Paper and "Straws/Garbage Only" (Landfill) streams. The high percentage (47.3%) of correct disposal choices at Pizzalicious (4th) is attributable to their provision of paper foil wrappers for wraps, which cannot be recycled or composted and are thus "correct" only in the Landfill stream. Both Tim Hortons' (Dentville, 7th; Garibaldi 9th) provided well-labeled "Recycling" (Refundables) and Paper streams, with most items disposed comprising of paper products. The Sea to Sky Gondola Basecamp Café (8th) also provided well-labeled waste streams, with many paper items properly disposed. In addition, this café provided non-compostable straws and plastic utensils which were commonly disposed in the Landfill stream, and some visitors brought external packaging which also could only be disposed in Landfill. Finally, Subway (Squamish) (10th) also provides many non-recyclable plastic items (n=8; from 20 total items), resulting in a high percentage of "correct" disposals as these items are placed in Landfill. Of all institutions, only Freshii and Green Moustache exceed 50% correct disposals.

Table 9: Institutions and key characteristics ordered by values of "% Correct Items Disposed" (DV1) for all institutions achieving over 20% correct disposals. Only 10 of 29 institutions meet this value.

Rank	Institution	Service Type* (IV4)	Sign Quality* (IV5)	% Correct Items (no NAs) (DV1)
1	*Freshii*	2	4	78.8
2	*Green Moustache*	2	4	73.3
3	*Booster Juice*	1	4	47.3
4	*Pizzalicious*	2	2	36.4
5	*Sunflower Bakery Café*	1	4	34.8
6	*Wendy's*	2	3	34.2
7	*Tim Hortons (Dentville)*	2	4	31.6
8	*Sea to Sky Gondola Basecamp Café*	1	4	26.4
9	*Tim Hortons (Garibaldi)*	2	4	25.9
10	*Subway (Squamish)*	2	1	22.6

*See Table 3 for category descriptions and values.

Discussion

Limitations

Some key limitations in this study may be accounted for and assessed by future studies following similar methodology in a variety of ways. First, the way variables were modeled in this study does not account for any changes to the waste stations or item availability between observation periods. This limitation only affects data from two institutions. First, at Sunflower Bakery Café, on the final observation day the positions of the Landfill and Compost bins switched, resulting in a higher percent of "correct" disposals overall. Second, at Pizzalicious paper plates were replaced with reusable plastic plates after the first observation day, thus removing paper plates from the inventory of available items. This change likely impacted contamination data because a higher percent of disposals were paper foil wrappers that are "correct" in the Landfill stream, rather than paper plates which are "incorrect". The impact of these changes on the institution's final ranking in "% Correct Disposals" is evident (Table 9). Thus, future studies may create intentional interventions like these changes to evaluate the impact of bin position and/or item availability on customer disposal choices and contamination.

The second limitation is that IVs describing characteristics of the institutions did not account for variation within available signs. As such, the impact of having a sign that says "Straws / Garbage Only" (Booster Juice) is weighted equally against signs that say "Trash" (Caffe Garibaldi) or "Recycling" (Tim Hortons), even though these signs describe different streams and types of items. This equal weighting was necessary because most Squamish food service institutions have no signage at all, making it difficult to compare more signage aspects than described in Table 3. However, this limitation can be accounted for in future studies where intervention is possible, and the key research question addresses aspects of signs such as use of icons, combinations of text and images, and colour-coding. Moreover, additional characteristics of businesses that are important for different research questions may be described and analyzed in other contexts, as there are no current best practices for characterizing food service institution waste stations as done in this study.

Third, the data analysis process did not distinguish between customers and employees who regularly came out to service waste stations and often dispose of items left behind by customers. This limitation is acceptable under the current study because regardless of who the person is and how many items they dispose of, their choice and the resulting contamination is still linked to their behaviour. In addition, institutions where employees made many disposal choices did not have more than one or two streams, such as Mag's 99, McDonald's, and Pizzalicious. As such, it is unlikely a customer would have made a different choice than the employee, even though the employee should be should be trained about which waste items belong where. An additional issue is when customers disposed of items for each other – such as a parent cleaning up after a child, or one partner disposing of the other partner's waste – the items by disposal were assigned to that individual customer. This practice particularly impacts the "Average Items Disposed/Customer" (DV5) and "Average Items/Disposal" (DV6) variables and could explain why the two variables did not correlate (Table 7), though intuitively they seem like they should. Another factor impacting this relationship could be large disparities between single disposals and the number of items in grouped disposals, especially when comparing institutions that serve meals with institutions that serve mainly drinks.

Other issues to consider in future research that were not accounted for in this study are the end-of-life destination of to-go items, such as drink cups and paper wrappers. These items may be disposed in locations such as an office, a public park, or a residential waste system, thus complicating waste item generalizations. Additionally, the impact of these items contaminating other systems is not currently connected to the institutions that provide the waste. This challenge is currently being discussed on national and regional scales, with ideas to implement extended producer responsibility (EPR) programs that require producers of material goods to collect and recycle their products at end-of-life (Environment and Climate Change Canada, 2018; Recycling Council of British Columbia, 2011). Next, in larger studies or at institutions which provide observational challenges, it may be necessary to develop other methods to include missed disposal observations (NAs) for more robust analysis. In some cases, assigning default item assumptions to NA observations based on the most commonly-sold or disposed waste items may be appropriate. However, in the smaller sample size of this study, assuming NA observations are "incorrect" or assigning them random items would likely skew values more than simply removing NA observations would. Finally, this study only assesses front-of-house disposal, and thus cannot provide a complete estimation of waste production and contamination for a given institution. In food service institutions, back-of-house disposal practices are distinct from front-of-house disposals, and likely produce a higher volume of organic waste because of the food preparation process (Resource Recovery Fund Board, 2003). As institutions develop their waste management systems, they must address both realms to reduce waste production and contamination.

Item Variety

An interesting challenge to effective waste management in food service institutions is the wide variety of waste items. Grouped disposals highlight this challenge in waste disposal, as customers would make a single disposal choice, but the resulting contamination would often implicate 3 or more waste streams. For example, Table 10 breaks down some common grouped item disposals. Having a wide variety of items available (IV2) was found to be somewhat related to the average number of items disposed by each customer (DV5). Grouped items such as to-go drink cups or sandwich wrappers are included in this disposal behaviour. Similarly, the service type category (IV4) which reflects both the use of the waste station as well as the type of food service the institution provides (i.e. meals or drinks and

snacks), was significantly related to DV5, indicating that more complex services result in more waste stream contamination. Thus, institutions may consider decreasing their item variety to improve waste stream contamination levels.

Table 10: Sample grouped disposal breakdown. When napkins were observed in grouped disposals, only 1 was recorded though multiple napkins were likely present. In addition, to-go bags were only counted as grouped disposals if there were other items evidently in the bag, or if typical food institution service included items such as a napkin in every paper to-go bag regardless of order.

Mixed Item	**Components**	**Correct Stream(s)**
Tray Dump (McDonald's)	paper tray mat	Paper; Compost
	receipt	Paper; Compost
	2x paper wrapper	Paper; Compost
	food waste	Compost
	4x small condiment container	Landfill
	recyclable cup (r-cup)	Recyclable Containers
	recyclable lid (r-lid)	Recyclable Containers
	plastic straw	Landfill
	2x plastic utensil	Landfill
	napkin	Compost*
Hot Beverage Container	r-cup	Recyclable Containers
	r-lid	Recyclable Containers
	paper sleeve	Paper; Compost
Cold Beverage Container	r-smoothie cup	Recyclable Containers
	r-lid	Recyclable Containers
	plastic straw	Landfill;

* Napkins are not recyclable as paper items according to Recycle BC.

This challenge regarding item availability is exemplified at the Sea to Sky Gondola Basecamp Café, which provides a mixture of certified compostable, biodegradable, and plastic utensils for customers. Many of its to-go and plastic products are certified compostable; however, adding to the challenge is that the Basecamp Café does not provide a Compost stream. Metro Vancouver produced a waste management resource package specifically for food service industries, and recommends streamlining all waste items within a single use category, such as utensils, as much as possible (MetroVancouver, 2014). Thus, the Sea to Sky Gondola Basecamp Café could vastly decrease its waste system contamination by providing a Compost stream and ensuring that all utensils and to-go dishware are certified compostable. This recommendation applies in part or totality to all food service institutions in Squamish, along with the suggestion to add signs to waste stations.

Exemplifying the former recommendation, A&W has reduced the variety of items available to customers, both by reducing the amount of packaging food comes in and providing most meals in paper products that are compostable (Figure 2). Considering these changes and its commitment to environmental sustainability (A&W, 2018), the restaurant should ensure that its paper waste is composted or recycled properly and without contamination. Additionally, A&W should source to-go drink cups, lids, and straws from certified compostable product manufacturers, and eliminate use of to-go condiments packaged in soft plastic wrappers. With all-compostable waste items, A&W could

maintain a single-stream waste system, except all waste would be composted instead of sent to landfill. This option of reducing all item types to compostable waste and providing only a Compost stream is applicable to many food service institutions.

Figure 2: A meal tray at A&W, with reusable metal meal containers and paper products that advertise A&W's environmental sustainability commitment.

Compost and Landfill Stream Changes

The greatest stream contamination from food service institutions is compostable waste entering the Landfill stream. A compelling solution to this problem is to replace all Landfill streams with a Compost stream. Two specific cases from this dataset exemplify the potential of this solution. First, on the third observation day at Sunflower Bakery Café, the positions of the Compost and Landfill bins switched so that the Compost bin was now directly underneath the coffee station, and the Landfill bin was further back (Appendix C). As a result, the number of items disposed correctly was higher than on the first and second days. Customers were not observed to exhibit any behavioural changes: they would pour in sugar, stir their coffee, and dispose these items in the closest bin without looking at the sign. This change between observation days was not accounted for in the data analysis and likely skewed Sunflower Bakery Café's position compared to other institutions whose waste stations did not change. However, contamination of the waste system overall decreased, as most items disposed in the compost bin were either food waste or compostable paper products (Figure 3). Similarly, over all three observation days, Wendy's had added a Compost sign to one of their three standard waste disposal bins. Customer behaviour around choosing where to empty their trays was not obviously altered by the presence of the sign, possibly because it was low on the side of the bin and difficult to see, as well as unexpected. However, as a result Wendy's' percent of correctly disposed items was much higher than it would have been without a compost bin.

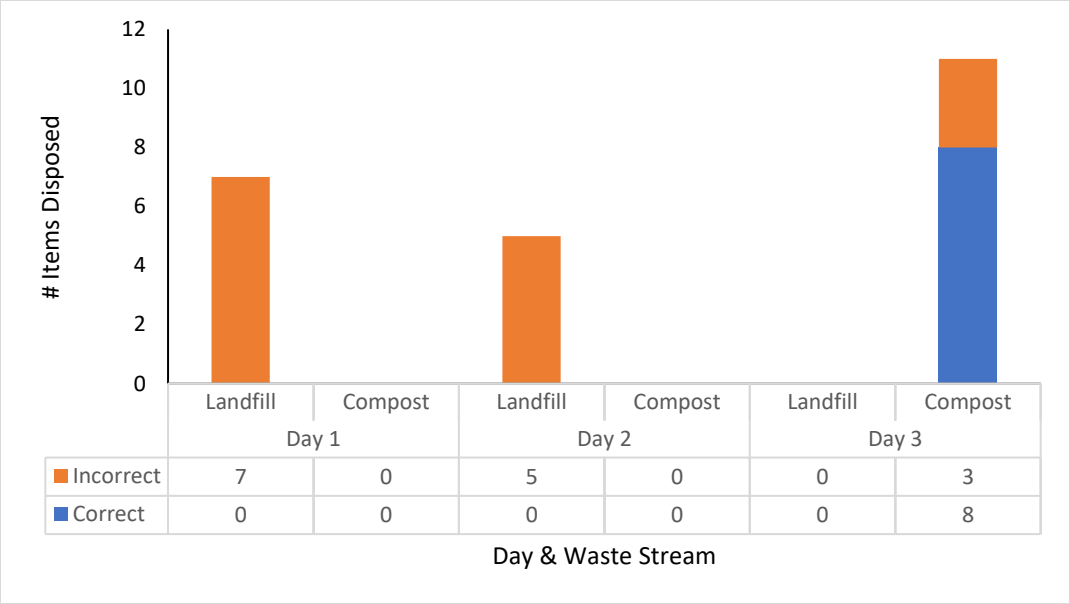

Figure 3: Sunflower Bakery Café item disposal choices each observation day. There is a higher percent of correct choices in Day 3, when the positions of the Compost and Landfill streams were switched.

To investigate whether simply replacing all Landfill streams with Compost streams would be effective in every institution, a new datasheet was created that replaced all Landfill disposals with Compost disposals. Disposal choice "correctness" was adjusted to reflect the "new" waste stream. As a result, many more institutions (n=14) exceeded DOS Solid Waste Utility Bylaw, 2017, requirements of having <20% waste stream contamination (Figure 4). This hypothetical intervention shows that if no aspect of the waste system was changed except to replace a Landfill stream with a Compost stream, institutions would experience a large increase in correctly disposed waste items. This change is largely due to the mass provision of paper products to package and serve food. However, certain items such as recyclable drink cups, recyclable lids, plastic straws, and soft plastic sugar packaging would contaminate this Compost stream, so institutions would need to provide alternative streams and/or replace current non-compostable items with certified compostable plastic alternatives. Consequently, customers would not have to change any behaviours, and the institution would still only need to provide a single stream to improve waste diversion and reduce contamination.

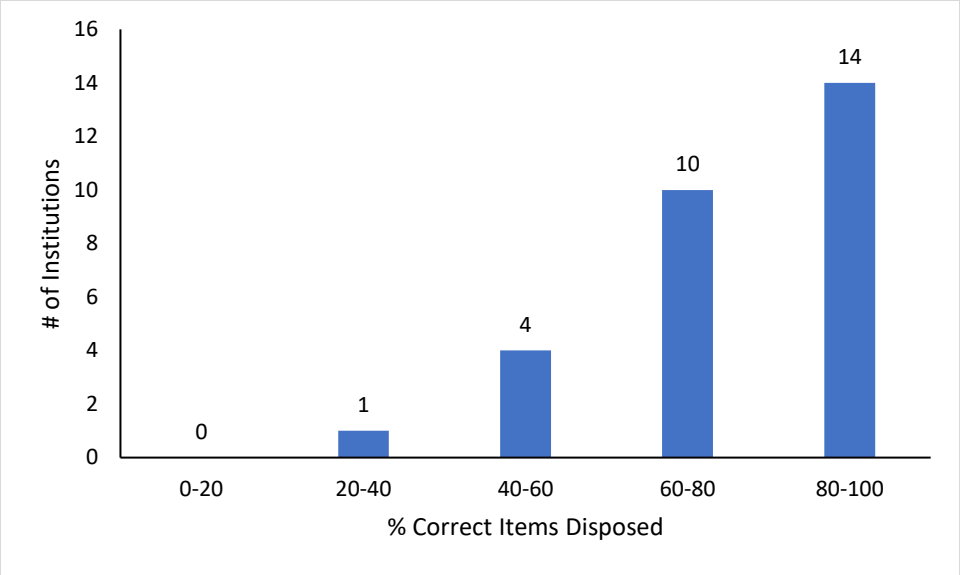

Figure 4: % Correct Items Disposed at all institutions (n=29) *if all Landfill disposals had been into a Compost stream instead*. (Compare to Figure 1). If each institution were to provide a Compost stream in place of their current Landfill streams, many more institutions (n=14) meet DOS bylaw requirement of less than 20% contamination, since they would have >80% correct choices (District of Squamish, 2017).

Bin Position, Lid Shape, and Signage

Bin position is another principal factor in effective waste management. The example of Sunflower Bakery Café is described above, but another institution where bin placement appeared to be important is Booster Juice. The primary waste item at Booster Juice was paper straw wrappers (n=47, from total disposals n=55). The waste station contained 3 streams and 4 bins; the two closest bins to the straw holder were labeled “Straws / Garbage Only” and “Garbage Only”, with both streams considered as “Landfill” in this study. The other two streams were labeled “Cups / Lids Only” and “Paper Only”. During observations, paper straw wrappers were equally disposed in either the “Straws/Garbage Only” or “Paper” streams. Two hypotheses explaining this disparity are: bin placement, where the position of two Landfill bins closest to where the customers receives the waste item biases choice to those areas; and sign labels, where the word “Straws” prompts a disposal choice by a connection between “straw wrapper” and “straw”. Likely, these two hypotheses work together as the customer is looking for the nearest correct stream to dispose their waste, and “Straws / Garbage” is the first stream that seems to describe their waste item.

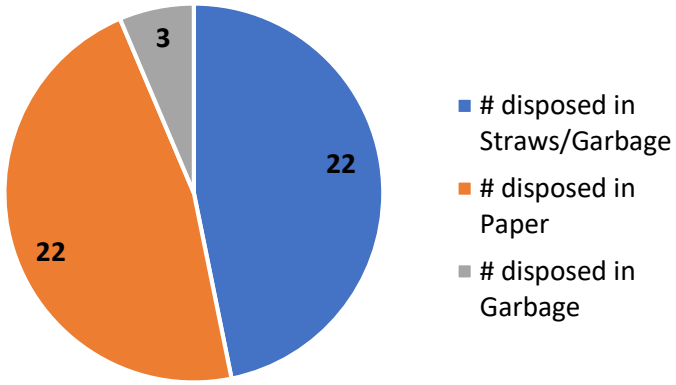

Figure 5: Total paper straw wrapper disposals (n=47) at Booster Juice. An equal number of paper straw wrappers were disposed in "Straws/Garbage" as in "Paper".

Similarly, note the Sea to Sky Gondola Basecamp Café's, "Plastic Recycling" stream: most items disposed in that stream were compostable, mainly napkins, stir sticks, and food waste. This outcome could result from a number of factors: first, the waste station is set up so that the "Plastic Recycling" stream is closest to the exit door and eating area, so it is the first stream customers encounter; second, the signs on all bins are very small with simple black text on white paper, possibly making it difficult for customers to identify that there are different streams; third, the Sea to Sky Gondola is a well-known tourist attraction (Whitsed, 2017) and thus may receive visitors from regions which do not have comprehensive recycling and organics collection programs. In addition, Composting is was only recently introduced to Squamish residents in 2015 (Carney's Waste Systems, 2015; Taylor, 2004) and they may not be used to identifying compostable waste or looking for a Compost bin at a food service institution. Future study of these and other factors may provide further insight to recycling behaviour changes at a food service institution. For example, if the Sea to Sky Gondola Basecamp Café were to add a Compost stream, it would be interesting to re-evaluate the quantity of compostable waste contaminating each of the other streams to discern any disposal habit changes because of the new stream. If customers were familiar with composting through other platforms, they may be more likely to dispose compostable waste correctly.

Table 11: Components of the Sea to Sky Gondola Basecamp Café's "Plastic Recycling" stream (n=20). Only items designated as acceptable "Containers" recycling according to Recycle BC were counted as correct disposals in this stream.

"Plastic Recycling" Stream Component	**# of Items**
Containers	3
Refundables	0
Compost	14
Paper	0
Landfill	3

Other infrastructural factors that alter waste disposal are lids. Obstructive and shape-restrictive holes have been found to encourage correct disposal (Keramitsoglou & Tsagarakis, 2018) and are used in many recycling systems to decrease contamination. The Locavore Food Truck uses this method for its two Refundables streams, “Plastic Bottles and Cans” and “Glass Bottles”, which are placed next to a bear-safe outdoor Landfill bin (Appendix C). However, composition of these two streams are similar, resulting in high contamination of the “Glass Bottles” stream (Table 12). This may result from the visual similarity between both the “Glass Bottles” and “Plastic Bottles and Cans” waste bins, which are both black with two can- or bottle-sized holes in the lid. Signs for each are black text on white background, faded from being outdoors, and located on the wall behind the bins above eye level. In addition, customers were observed trying to fit items such as paper fibre clamshells and recyclable coffee cups through these holes. Most often, after a few failed attempts customers noticed the Landfill bin and placed their items in there. However, a few customers lifted the Refundables bins lids to dispose of their compostable items. These observations suggest that customers were not prompted by signs, but rather by bin location and lid shape. More research is needed to understand the choice differences between using the Refundables bins and the bear-safe Landfill bin.

Table 12: Disposal and stream composition for The Locavore Food Truck (n=99). Most items were disposed in Landfill, but behaviours around the “Glass Bottles” and “Plastic Bottles and Cans” streams suggest customers did not generally look at waste station signs. There were no refundable glass bottles disposed during the observation periods.

Types of Items (Stream)	**Landfill Composition**	**"Glass Bottles" Composition**	**"Plastic Bottles & Cans" Composition**
Containers	16	1	0
Refundables (plastic bottles and cans)	0	3	9
Compost	29	0	1
Paper	31	2	0
Landfill	7	0	0
Stream Total	**83**	**6**	**10**

One change A&W directed at waste management was to remove the “tip-in lid” at their waste stations. Instead of a bin where the customer can easily push their tray into a lid that tips inward to empty their tray’s contents, customers must now fit each waste item into a small rectangular hole and sort their reusable dishes on top of the waste station (see Appendix C). This researcher noted customers who, still habituated to using tip-in lids, would push their tray against the waste station’s sealed lids, and end up dumping their tray contents onto the floor. Customers who suffered this appeared to be frustrated and embarrassed, which is unfortunate for an immediate customer experience. However, interventions that challenge peoples’ habits and activate social norms have proven very successful in waste management (Geislar, 2017; Jambeck, 2012; Nomura et al., 2011). These customers may remember their embarrassment and change their behaviour the next time they are in a similar disposal

situation. Other institutions have found that a "trayless dining" strategy effectively reduces food waste produced by customers (Ecker & Yang, 2017), so A&W and similar food service institutions that provide large trays to customers may consider experimenting with this infrastructural change.

Unfortunately, current waste stations at food service institutions in Squamish did not allow this study to assess different aspects of sign design, like text/image combinations, and their impact on customer choices more thoroughly. However, there are some key examples of effective and ineffective signage that can be considered in context of the results. First, Freshii is a model example of descriptive signage as each of their 3 streams is labeled using a stream title, photo images of items that belong in each stream, and further text description reinforcing waste management and environmental sustainability messages (Appendix C). Likely due in large part to their signs, as well as to the streamlined items they provide customers, Freshii has the highest percent of items correctly disposed (n=52, 78.8% correct disposals), and thus the lowest waste system contamination in Squamish. Green Moustache is similar (n= 28, 73.3% correct disposals): its signs rely primarily on words, but most of its waste items are compostable and that information is communicated clearly by the waste signs and the staff.

Tim Hortons (in both Dentville and Garibaldi) had "Complete Signs" (Sign Quality category 4, see Table 3), where the "Recycling" (i.e. Refundables, based on text and items pictured on the sign) and Paper streams had images of items purchased in-store, but the Landfill stream had only the word "Waste" on the sign, with no images. Though in this study these signs are considered "Complete" on the text-based criteria, future research should compare "text only" and "text + images" waste station signs to determine which sign designs are most descriptive and effective at prompting customers to sort waste correctly. However, this process may not be perfect. Customers often disposed paper items in the Landfill stream (Table 13), possibly because the images Tim Hortons provides of their crisp, clean paper wrappers do not resemble how paper wrappers appear after they have been used and crumpled up (see Appendix C). This theory complies with previous research, which found that item form distortion decreased recycling behaviour, perhaps due to a lower perceived "usefulness" of the product after it has been used and altered (Trudel & Argo, 2013). As such, Tim Hortons may consider providing post-consumption images of their products on waste stream signs to improve correct disposal.

Table 13: Tim Hortons (Dentville and Garibaldi locations combined) stream composition. Landfill designates their "Waste" stream, Paper their "Paper" stream, and Refundables their "Recyclables" stream, as only Refundable containers and not recyclable plastics were accepted according to Tim Hortons signs.

Types of Items (Stream)	Landfill Composition	Paper Composition	Refundables Composition
Containers	22	14	3
Refundables	0	0	1
Compost	12	8	1
Paper	29	15	0
Landfill	7	0	1
Stream Total	**70**	**37**	**6**

Since most food service institutions in Squamish did not provide descriptive signage for any waste streams, all institutions should post signs as a first step to improving their waste management systems. The Squamish-Lillooet Regional District (SLRD) and Metro Vancouver both provide free, downloadable signs describing different Recycle BC waste streams. These signs use a combination of colour, text, and icons to communicate their message, and are thus widely applicable to a variety of institutional needs (MetroVancouver, 2018; Squamish-Lillooet Regional District, 2018). Institutions that wish to further improve their waste management could develop a system like Freshii, with specific signs that picture and describe all waste items available in the institution and which streams they should be disposed in. However, providing any signs at all is an important first step. If all food service institutions along the Sea to Sky Corridor applied versions of these signs to their waste management systems, customers would become quickly familiar with their responsibility to source-separate their waste and more likely to sort properly. Practiced enough, correct waste sorting would become a habit that spills into other aspects of their lives, improving waste management throughout the corridor.

Methodology

The methodology of this research was developed from a pilot project conducted by this researcher in 2017. In the study, two interventions were staged over the course of three days to determine first, how important signage was to disposal choices, and second, whether university students accustomed to source-separation tended to look inside a waste bin to make a disposal choice in the absence of signage. Some current media exists describing the potential of transparent waste bins to improve correct disposal, though no conclusive impacts of such a change on contamination have been stated (Keramitsoglou & Tsagarakis, 2018). Further investigation along this route is also promising to determine in which contexts certain types of signage and other infrastructure, such as open-top waste bins, may be appropriate to reduce contamination.

This study is replicable in part or full at any institution or group of institutions where customers dispose of their own waste at a public disposal station. Though developed for and suited to a North American multi-stream recycling system, the modelling and analysis is applicable in any institution or region that uses a source-separation waste management strategy. However, an institution which requires any level of waste sorting, whether into two streams or seven, can apply this methodology to assess customer engagement with their waste management system. Food service institutions are especially suited for this type of analysis because a variety of waste items are generated and disposed in a single vicinity. In addition, well-populated urban areas likely contain many food service institutions to fulfill a variety of niches which, like the current study, presents a natural experimental design. Moreover, improving food service industry waste management is critical to any region attempting to prevent organic material from entering landfills, because a substantial proportion of the items disposed are compostable food or food-soiled paper products.

Additional areas to apply this methodology include, large, open-space events such as fairs, festivals, community markets, or amusement parks. These events likely have food vendors and a waste management system. The researcher could identify a few key waste stations and peak times and observe and record over a few days as appropriate for any interventions. Similarly, a cafeteria in a mall, airport, or corporate building would provide reliable food services where any interventions could be timed appropriately for the number of customers regularly using the institution. A similar statistical analysis to this study could be executed within these institutions to assess similarities or differences by

location of the bins, and assess the spatial distribution of disposal patterns using GIS software to identify high-user or high-contamination areas (Felder, Petrell, & Duff, 2001, p. 364). On the other hand, larger regional assessments of food service institutions in general could randomly select any number of locations based on identified key characteristics, to obtain either a regional baseline set of values or target specific system designs or interventions. Some follow-up studies specific to Squamish could be to select high-volume, high-contamination institutions and implement different sign strategies, then to follow up later and see if contamination levels or other identifiable aspects of human behaviour have changed around the modified system.

In this analysis, only grouped disposals were assessed to understand disposal behaviours and institutional characteristics. However, future research could group all customer disposals together and evaluate "Customer Success" to approximate both customer interaction with the waste system as well as account for any qualities for or against waste sorting the customer may have in their own context. For example, at Tim Hortons a single customer was observed to read all signs very carefully and make a series of disposals one by one, taking care to get each item in the correct stream. In contrast, other customers would simply group all items together in a handful or by stuffing them inside a coffee cup and make a group disposal. This type of customer-centric analysis is likely more suited at an institutional level instead of the regional level assessed in this study. For example, summarizing all data to investigate individual customer disposal interactions with the waste system, would be skewed by the series of disposals common at a coffee shop drink station. Customers there commonly disposed a series of sugar packages and stir sticks without appearing to intentionally interact with the waste system at all. However, their disposal style would look similar in summary to a person who has carefully chosen where to place each item.

Finally, a major benefit of this methodology is that it is less time-consuming and costly than completing a comprehensive waste audit. Waste audits are the current business standard for developing institutional waste reduction work plans (WRWP) (Appendix F) and are incredibly useful for complex institutions with many intersecting waste management systems (Felder et al., 2001; Ontario Ministry of the Environment, 2008). In fact, the Province of Ontario requires all institutions with over 800 regular attendants to conduct annual waste audits to report in their WRWPs (Ontario Ministry of the Environment, 2008; Province of Ontario, 2014). However, comprehensive auditing is less feasible for small businesses like, but not limited to, food service institutions. Previous studies have evaluated recycling behaviour around an intervention, such as placing recycling bins at different distances from participants (Zhang et al., 2016), altering the form of the recyclable item (Trudel & Argo, 2013), and activating social norms in a variety of ways to encourage correct waste disposal (Geislar, 2017; C. J. Li et al., 2017; Nomura et al., 2011). However, no previous research has sought to extensively assess disposal behaviours as they occur in source-separation waste management systems. In fact, one study states that "it is very costly to evaluate every sign this way when there are many possible signs to choose from"(Meis & Kashima, 2017, p. 12). Contrary to this statement, this study demonstrates that at an institutional or regional level, observing enough customer disposal behaviours to understand their interactions with a waste system is very efficient and revealing. Moreover, this methodology is meaningful to assess a variety of interventions, including sign design, bin placement, and stream/item availability. Thus, as a model for data collection and WRWP development, the methodology used in this study is widely applicable and simple enough to include in the profile of a managerial staff member.

Conclusion

A total of 29 food service institutions in Squamish, BC were observed to investigate relationships between institution and waste management system characteristics, and customer disposal choices and contamination. “Service Type” and “Sign Quality” were found to be the key characteristics that predict disposals and behaviours that contaminate waste systems. Thus, food service institutions should prioritize adding signs to their waste disposal systems and developing their services to limit the type and quantity of items available for customers. Follow-up assessments of waste systems would inform institution managers of other changes to make to their food and waste disposal services to further reduce waste and stream contamination.

Waste management solutions are contextual and require a clear understanding of the needs and limitations of existing systems at many institutional, individual, and regional levels. Food service institutions are a key source for compostable waste disposal, which often leads to organic content entering landfills. As addressing this problem is a goal at the BC provincial level, it is necessary to improve waste management systems at food service institutions both front- and back-of-house to decrease stream, especially Landfill, contamination. At the food service institution level, providing waste streams that suit customer disposal needs based on items provided by the institution, as well as providing clear signage and intuitive bin locations that fit the service needs of the institution, are important for decreasing waste contamination. In Squamish, decreasing Landfill contamination with compostable material is a key goal; however, this methodology can be adapted to other waste streams, such as investigating contamination of mixed recycling streams.

A thorough statistical analysis of waste streams is not essential for this methodology to be conducted at an institutional level. Rather, an employee could be tasked to observe customers disposing waste for a few hours over a week. Then, the employee or manager would compile and summarize those data to understand what their contamination levels likely are, and which items and disposal behaviours cause this contamination. From there, online resources would be accessed to create appropriate signage and make other changes limited only by the creativity of the manager. Importantly, the cost of conducting this research is much less than conducting complete waste audits, which is the traditional method for understanding waste stream composition and contamination. Therefore, this methodology is suited to the institution level, especially if the institution has fewer resources to conduct comprehensive audits. Moreover, the insights provided to the researcher by observing unique behaviours and interactions with the waste system provide key insight to where different challenges may be addressed.

Future waste management research should further develop this methodology to assess how certain waste system interventions, such as to signage content, bin placement, and stream availability, affect customer disposal behaviours and the resulting contamination. Some potential avenues include modifying sign content to vary the text-image ratio or alter the types of images shown, to change the order that bins appear in from a customer perspective, and to expand or limit the types of streams available appropriate to the types of items provided at an institution. This methodology can be applied around an intervention or, as described in this study, across many institutions to investigate regional patterns. In addition, the criteria for selecting a waste station to observe require only that users dispose of their own waste, thus making this methodology adaptable to a variety of locations such as public

parks, festivals, or cafeterias. By conducting research, innovating, and improving communication, waste management systems can dramatically divert waste to create a more sustainable future.

Conflicts of Interest

The author declares no conflicts of interest regarding intent or funding behind this research.

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Appendices

Appendix A: Sample Data Sheets

Table 14: Data were collected by hand using the following datasheet. Items were colour-coded to identify whether they were disposed by the same customer, and then assigned a unique customer ID when input to a spreadsheet. Interesting behaviours as well as the components of grouped disposals were recorded in the Comments section, with any distinct stream or institution observations recorded in the Notes section at the top of the sheet.

Disposal choice behaviour assessment Samantha.Leigh@questu.ca

Location:

Date:

Time:

Notes:

Obs. #	Customer ID	Item	Stream	Choice (1,0)	Comments/ Disposal Components
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Table 15: Data Summary formulas used after all items and streams were standardized, and all observations from a single institution were collected on the same sheet. Text in parentheses represents the data columns selected in the formula.

Summary Value	**Formula**
# Items Disposed	=COUNTA(“Items”)
# Customers	=SUMPRODUCT(1/COUNTIF(“Customer ID”:”Customer ID”))
# Types of Items	=SUMPRODUCT(1/COUNTIF(“Item,”Item”))
# Streams Used	=SUMPRODUCT(1/COUNTIF(“Stream”,”Stream”))
Total Correct Choices	=COUNTIF(“Choice”,"1")
Total NA	=COUNTIF(“Item”,"NA")
*Any NA values under “Stream” were copied to the “Items” column for ease of analysis.	

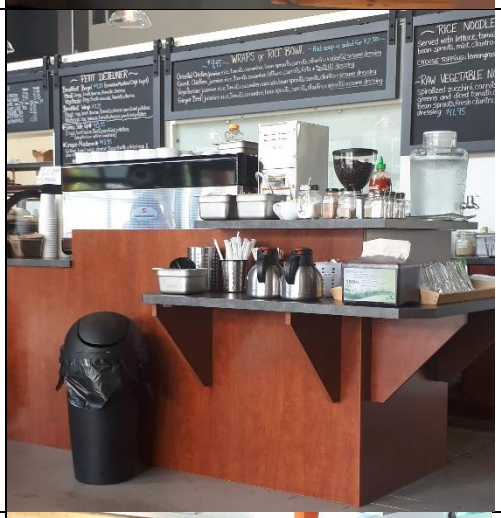
Appendix B: Food Service Waste Items and Appropriate Streams

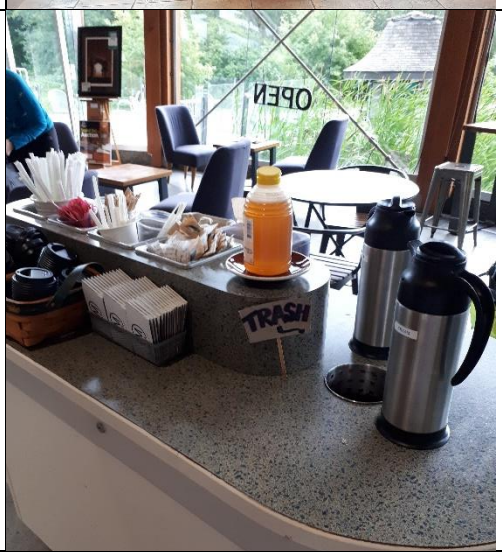
Table 16: Waste items available at Squamish food service institutions organized by generally by accepted stream. Note that all paper products are compostable, and all refundable containers are also recyclable.

Stream	Compost	Paper**	Recyclable Containers	Refundable****	Landfill*****
Item	Compostable straw Compostable hot drink cup Compostable plastic clamshell Compostable plastic cold drink cup Compostable plastic hot/cold drink lid Compostable plastic meal tray Compostable plastic ramekin (with lid) Compostable plastic utensil Compostable soup bowl Food waste Liquid Waste Muffin cup* Napkin* Wooden chopstick / stir stick***	Boxboard wrapper Cardboard clamshell*** Paper clamshell Paper condiment packaging Paper fibre coffee tray Paper fibre dish Paper fibre hot drink sleeve Paper plate Paper ramekin Paper tray mat Paper wrapper Pizza box*** Receipt	Paper hot/cold drink cup Plastic clamshell / container Plastic cold drink cup Plastic dish Plastic hot/cold drink cup lid Plastic ramekin (with lid)	Aluminium can Drink box Glass bottle Plastic bottle Tetra-pak	Chip bag Condiment container Foil-paper wrapper Plastic bag Plastic cling wrap Plastic stir stick Plastic straw Plastic utensil Seal or zip packaging Soft plastic wrapper Styrofoam

*napkins and muffin cups are not able to be recycled as paper (Recycle BC, 2017).
**all paper products are compostable, especially when contaminated with food products.
*** Cardboard and wood products are not accepted in paper recycling and should be composted.
****all refundable containers are recyclable, except glass which must be collected separately.
*****some landfill items are now recyclable through a Recycle BC Flexible Plastic Packaging recycling pilot project (Recycle BC, 2018).

Appendix C: Waste Station Photos

Institution	Image	Description
1914 Coffee Company		Single black unlabeled bin next to coffee station. Bin assumed to be Landfill.
a Table!		Single black unlabeled bin next to coffee station. Bin assumed to be Landfill.
A&W		Two unlabeled holes in waste station: rectangular hole on top, circular hole on side. Both go into separate bins with clear bags. No signs indicate whether stream is recycled, so assumed to be Landfill.

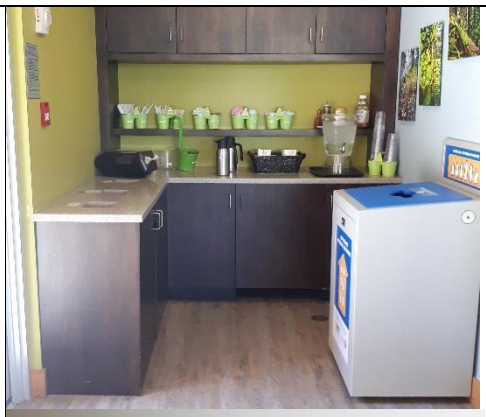
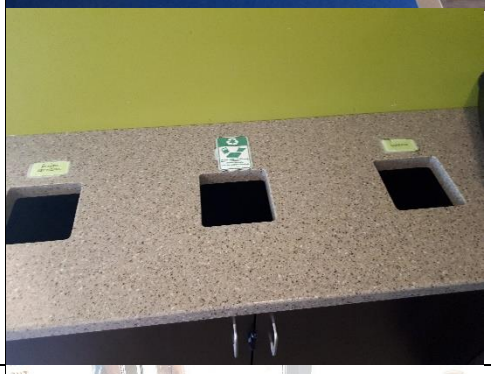
Bean Around the World Coffees		Single black unlabeled bin next to coffee station. Bin assumed to be Landfill.
Booster Juice		Signs read (left to right): “Paper”, “Cups / Lids Only”, “Straws Garbage Only”, and “Garbage Only”. Signs are black text on white backgrounds with no images. Straws are stored on the right side of the counter.
Burger King		Two unlabeled bins with tip-in lids and icon of person throwing out waste. Bins assumed to be Landfill.
Caffe Garibaldi		Single hole in coffee station counter labeled “Trash”.

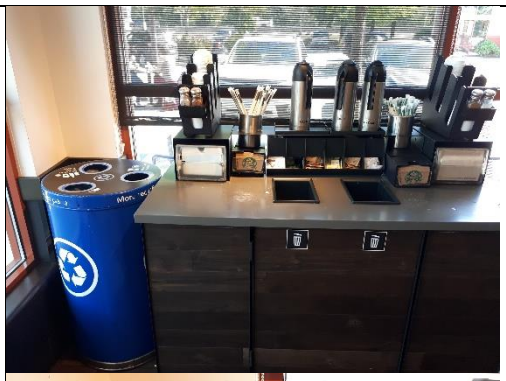
Cloudburst Café			Single unlabeled black bin and two unlabeled blue recycling bins under coffee station counter. Bin assumed to be Landfill, and unlabeled recycling bins assumed to be Recyclable Containers.
Counterpart Coffee			Three small waste bins labeled “Compost”, “Paper”, and “Garbage” underneath coffee station counter.

Freshii		Three bins labeled (left to right): “Waste Only”, “Compostable”, and “Clean Recyclables”, colour-coded and accompanied by photographs of each item sold at Freshii in the correct stream. Additional text underneath describes environmental mission and additional instructions to customers, such as bringing any unclean recyclables to the counter for staff to wash.
Fuel & Forest Café		Small hole in coffee station labeled: “Hey! We recycle! Cans, bottles, even cups + paper! → Put them in the dish bins to your RIGHT 😊.” Bin assumed to be Landfill.

Green Moustache		Two bins next to dish bins labeled (left to right): “Compost: Food waste + to-go containers, including straws”, and “Garbage: Please place garbage here (straws go in the compost).”
Green Olive Market + Café		Single black unlabeled bin under coffee station next to dish bins. Bin assumed to be Landfill.
Mag's 99		Unlabeled bin with tip-in lid and dish bin on top, and blue recycling bin, with black bag, next to it. Bin assumed to be Landfill, recycling bin assumed to be Refundables.

McDonald's		Two unlabeled bins in counter underneath tray holder. Clear bags visible inside. Assumed to be Landfill.
Pizzalicious		Single unlabeled bin with tip-in lid and words “Thank You”, and tub with primarily Refundable containers on top. Bin assumed to be Landfill, tub assumed to be Refundables.
Quiznos		Single unlabeled hole in bin with space for trays and baskets on top and small blue recycling bin on floor beside. Text reads “Please do not throw away baskets”. Bin assumed to be Landfill.

Sea to Sky Gondola Basecamp Café	  	Waste station with counter on right side with holes labeled (left to right): “Plastic Recycling” “Paper”, and “Garbage”. “Paper” sign has recycling icon, other signs are small black text on white backgrounds. On left, bin labeled “Refundable Beverage Containers”, with logos from the Return-It Bottle Depot.
Starbucks (Garibaldi)		Two unlabeled holes in coffee station counter. Assumed to be Landfill.

Starbucks (Squamish)	 	Two unlabeled holes in coffee station counter, with blue “Happier Planet” bin with three holes labeled (clockwise from top): “Aluminium, Glass, Plastic”, “Paper Cups + Lids”, and “Paper”. Labels are companied by icons and there are three separate bins inside for collection. “Aluminium, Glass, Plastic” is assumed to be the Refundables stream, and “Paper Cups + Lids” is assumed to be Recyclable Containers.
Subway (Garibaldi)		Single unlabeled hole in waste bin next to single labeled hole in drink station. Assumed to be Landfill.

Subway (Squamish)		Two unlabeled holes in waste station with room for basket collection on top. Bins assumed to be Landfill.
Sunflower Bakery Café	 	Three bins under coffee station labeled (clockwise from top left): “Paper”, “Compost”, and “Garbage”. Second image shows third observation day, where “Compost” and “Garbage” bins have switch places, so compost bin is in front.

The Ledge Community Coffee House		Single unlabeled hole in coffee station counter. Assumed to be Landfill.
The Locavore Food Truck		Two black bins with circular holes in lids labeled (left to right): “Glass Bottles”, and “Plastic Bottles and Cans”. Signs are high up on fence, with black text on white background. Bear-safe outdoor bin on far left is labeled “Garbage Only.”
The Waiting Room Café	  	Single unlabeled coffee station bin and a labeled black “Recycling” bin. Inside the recycling bin, there are two compartments but no labels. Any recyclable item was marked ‘correct’ if placed in either compartment.

Tim Hortons (Dentville)		Three waste streams labeled (left to right): “Waste”, “Recyclables”, “Paper”, and “Waste” again. Neither waste stream has images, but the “Recyclables” and “Paper” streams have images of items sold at Tim Hortons, as well as round holes with a small rectangular slot to indicate a different stream. The “Recyclables” sign has a note saying “No Cups, No Liquids” in small text at the bottom. As a result, the recycling stream was assumed to be Refundables only. Distinct from Tim Hortons (Garibaldi), this station has additional recycling images around the waste station.
Tim Hortons (Garibaldi)		Three waste streams labeled (left to right): “Waste”, “Recyclables”, “Paper”, and “Waste” again. Neither waste stream has images, but the “Recyclables” and “Paper” streams have images of items sold at Tim Hortons, as well as round holes with a small rectangular slot to indicate a different stream. The “Recyclables” sign has a note saying “No Cups, No Liquids” in small text at the bottom. As a result, the recycling stream was assumed to be Refundables only.
Wendy's		Three tip-in lid waste bins with the standard icon of a person throwing out waste. The left-most bin has a “Compost” sign with Wendy’s-specific images of food waste low on the side and has a certified compostable bag in the bin. The other two bins were assumed to be Landfill.

Appendix D: R Code for GLM Analysis

Code used for simple correlation analyses and general linear model creation (glm). Key assumptions and sources included in code lines.

```
>(data.summ<-read.table("Key_Variables.txt",header=T,sep="\t"))

##Protects the Location column
>I(data.summ$Location)
>(colnames(data.summ)<-c("Location","No.Customers","No.Types.Items","No.Streams",
                         "Service","Sign.Qual","Perc.Cor.Items",
                         "Perc.Group.Disposals","Avg.No.Items.per.Disposal",
                         "Avg.Cor.Items.per.Disposal","Avg.Items.Disposed.per.Cust",
                         "Avg.Disposals.per.Cust"))
>str(data.summ)


#Help page: https://stats.stackexchange.com/questions/88606/multiple-regression-with-categorical-and-numeric-predictors
#glm(response/dependent ~ predictor+predictor+predictor...)


##For each DV (n=6, numeric), I need to model IVs (n=5, integer).
#So, I will have 6 models to compare and see which IVs are most significantly related.


#First: Analyze the variables for relationships.


#### IV: INTEGER RELATIONSHIPS
#Chi-Square is used to compare two independent categorial variables. Since there are only 29 observations per variable, these relationships are not representative of all waste systems, rather indicative of waste systems in Squamish.

##See if No.Customers relates significantly to any other variable.
>chisq.test(data.summ$No.Customers, data.summ$No.Types.Items)  #p=0.4868
>chisq.test(data.summ$No.Customers, data.summ$No.Streams) #p=0.4055
>chisq.test(data.summ$No.Customers, data.summ$Service) #p=0.406
>chisq.test(data.summ$No.Customers, data.summ$Sign.Qual) #p=0.1564

## Does No.Types.Items?
>chisq.test(data.summ$No.Types.Items,data.summ$No.Streams) #p=0.396
>chisq.test(data.summ$No.Types.Items,data.summ$Service) #p=0.4776
>chisq.test(data.summ$No.Types.Items,data.summ$Sign.Qual) #p=0.2894

## Does No.Streams?
>chisq.test(data.summ$No.Streams,data.summ$Sign.Qual) #p=2.253e-05 significant.
>chisq.test(data.summ$No.Streams,data.summ$Service) #p=0.167
```

```
##Does Sign.Qual?
>chisq.test(data.summ$Sign.Qual,data.summ$Service) #p=0.296



### DV: NUMERIC CORRELATIONS

>dv<-as.matrix(cbind(data.summ$Perc.Cor.Items,data.summ$Perc.Group.Disposals,
      data.summ$Avg.No.Items.per.Disposal,data.summ$Avg.Cor.Items.per.Disposal,
      data.summ$Avg.Items.Disposed.per.Cust,data.summ$Avg.Disposals.per.Cust))

>plot(dv[,1],dv[,2]) #continue to plot all DV
#Data are not obviously normally distributed, and those that are skewed are all the same direction.
#So, compare between Pearson's r and Spearman's (since both measure strength of association)
# Help from: https://statistics.laerd.com/statistical-guides/spearmans-rank-order-correlation-
statistical-guide.php and https://stats.stackexchange.com/questions/8071/how-to-choose-between-
pearson-and-spearman-correlation

>dv.pears<-(cor(dv,method=c("pearson")))
>dv.spear<-(cor(dv,method=c("spearman")))

>cor.test(dv.pears,dv.spear)
#Since Pearson and Spearman values are significantly correlated (cor=0.9767, p<2.2e-16), and
#Spearman tests are not accurate ("Warning Message: […] Cannot compute exact p-value with ties"),
#Pearson's values will be used in the following analysis.


# Test the lowest value in this correlation matrix for significance.
# If the lowest value is significant, the others are too.
# If not, find the next-lowest reasonable value

#Lowest values, not significant
>cor.test(dv[,1],dv[,6]) #cor=-0.0226 ; p=0.907
>cor.test(dv[,4],dv[,5]) #cor=0.0223 ; p=0.9082

#Mid-value, not significant
>cor.test(dv[,6],dv[,5]) #cor=0.189 ; p=0.3254

#Highest values, all significant
>cor.test(dv[,1],dv[,4]) #cor=0.986 ; p<2.2e-16, significant
>cor.test(dv[,2],dv[,3]) #cor=0.839 ; p=1.282e-08 significant
>cor.test(dv[,2],dv[,5]) #cor=0.847 ; p=6.782e-09 significant
>cor.test(dv[,3],dv[,5]) #cor=0.944 ; p=1.404e-14 significant

#Compare the rest of the values for a summary table
```

```
### RUN GLM FOR EACH DV USING ALL IVs.

#DV1
>Perc.Cor.glm<-glm(data.summ$Perc.Cor.Items~data.summ$No.Customers+
    data.summ$No.Types.Items+data.summ$No.Streams+data.summ$Service+data.summ$Sign.Qual)
>summary(Perc.Cor.glm) #'Service' and 'Sign.Qual' are slightly significant

# DV2
>Perc.Group.glm<-glm(data.summ$Perc.Group.Disposals~data.summ$No.Customers+
    data.summ$No.Types.Items+data.summ$No.Streams+data.summ$Service+data.summ$Sign.Qual)
>summary(Perc.Group.glm) # 'Service' is highly significant

#DV3
>Avg.No.Items.Disp.glm<-glm(data.summ$Avg.No.Items.per.Disposal~data.summ$No.Customers+
    data.summ$No.Types.Items+data.summ$No.Streams+data.summ$Service+data.summ$Sign.Qual)
>summary(Avg.No.Items.Disp.glm) #'Service' moderately significant

#DV4
>Avg.Cor.Items.glm<-glm(data.summ$Avg.Cor.Items.per.Disposal~data.summ$No.Customers+
    data.summ$No.Types.Items+data.summ$No.Streams+data.summ$Service+data.summ$Sign.Qual)
>summary(Avg.Cor.Items.glm) # 'Service' and 'Sign.Qual' slightly significant

#DV5
>Avg.Items.Disp.Cust.glm<-glm(data.summ$Avg.Items.Disposed.per.Cust~data.summ$No.Customers
   +data.summ$No.Types.Items+data.summ$No.Streams+data.summ$Service+data.summ$Sign.Qual)
>summary(Avg.Items.Disp.Cust.glm) #'Service' highly significant significant

#DV6
>Avg.Disposals.glm<-glm(data.summ$Avg.Disposals.per.Cust~data.summ$No.Customers+
    data.summ$No.Types.Items+data.summ$No.Streams+data.summ$Service+data.summ$Sign.Qual)
>summary(Avg.Disposals.glm) # nothing is significant
```

Appendix E: Observation Calendar and Times

Table 17: Observation schedule with times for each observation, including entire research calendar.

2018 May				
MON	**TUES**	**WED**	**THURS**	**FRI**
30	01	02	03	04
07	08	09	10	11
Reconnaissance Day 1	Reconnaissance Day 2	Skype Eric 9am; Finalize Schedule, Plan budget	Practice Observations	Practice Observations
14	15	16	17	18
ROUND 1: Caffe G 11am-12pm, Mag's 99 12:30-1:30pm, Green Moustache 1:45-2:45pm	1914 Coffee 10am-11pm, Sea to Sky Gondola 12pm-1pm	McD's 12pm-1pm, Pizzalicious 1:15-2:15pm, Green Olive 3pm-4pm	Summer Fellows Lunch	Sunflower11am-12pm, Ledge 12:30-1:30pm, Waiting Room 1:45pm-2:45pm
21	22	23	24	25
VICTORIA DAY	Starbucks (S) 11am-12pm, A&W 12:30pm-1:30pm, Quiznos 1:45-2:45pm	Timmy's (D) 9-10am, Subway (S) 11:30-12:30am, Counterpart 1-2pm	Timmy's (G) 9-10am, a Table 11:30am-12:30pm, Wendy's 12:45-1:45pm	Starbucks (G) 10am-11am, Booster Juice 11:30am-12:30pm, Locavore 1pm-2pm
28	29	30	31	01
Cloudburst 8:30-9:30am, F&F Café 10-11am, Burger King 12-1pm	Bean Around 9-10am, Subway (G) 11:30am-12:30pm, Freshii 12:40-1:40pm			

2018 June				
MONDAY	**TUESDAY**	**WEDNESDAY**	**THURSDAY**	**FRIDAY**
28	29	30	31	01
		ROUND 2: *1914 Coffee 9:30-10:30am*, Mag's 99 12-1pm, *Green Olive 2-3pm*	*Caffe Garibaldi 9:40-10:40am*, Gondola 11:30am-12:30pm	*Sunflower 10:30-11:30am*, *Ledge 12-1pm*, Starbucks (S) 1:45-2:45pm
04	05	06	07	08

McD's 10:45-11:45am, *Pizzalicious 12-1pm*, Waiting Room 1:25-2:25pm	A&W 10:45-11:45am, *Quiznos 12-1pm*, *Green Moustache 1:15-2:15pm*	*Timmy's (D) 8am-9am*, Subway (S) 10:40-11:40am, *Counterpart 12-1pm*	Timmy's (G) 9-10am, a Table 11:45am-12:45pm, Wendy's 1pm-2pm	Starbucks (G) 10-11am, Booster Juice 11:30am-12:30pm, Burger King 12:45-1:45pm
11	12	13	14	15
Cloudburst 8:30-9:30am, *F&F Café 10:30am-11:30am*, Freshii 12:30-1:30pm	Bean Around 8:45-9:45am, Subway (G) 11:45am-12:45pm	ROUND 3: Timmy's (G) 10:30-11:30am, a Table 12:15-1:15pm, Wendy's 1:20-2:20pm	Starbucks (S) 10:45-11:45am, Green Olive 12-1pm, Quiznos 1:10-2:10pm	A&W 10:45-11:45am, Gondola 12:30-1:30pm
18	19	20	21	22
1914 Coffee 10:45-11:45am, Green Moustache 12-1pm, Mag's 99 1:30-2:30pm	Starbucks (G) 10:10-11:10am, Booster Juice 11:30am-12:30pm, Burger King 12:45-1:45pm	McD's 10:45-11:45am, *Pizzalicious 12:00-1:00pm*, Subway (S) 1:10-2:10pm	Carney's Visit	Cloudburst 10:30-11:30am, *F&F Café 11:45am-12:45pm*, Locavore 1:10-2:10pm
25	26	27	28	29
Timmy's (D) 8:30-9:30am, Caffe Garibaldi 9:45-10:45am, *Counterpart 12:15-1:15pm*	*Bean Around 9:45-10:45am*, Subway (G) 11am-12pm, *Freshii 12:30-1:30pm*	*Sunflower 9:20-10:20am*, *Ledge 10:40-11:40am*, *Waiting Room 12-1pm*	Analyze Data	**Locavore 12-1pm** -- Analyze Data

2018 July

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
02	03	04	05	06
Analyze Data	SUMMER SEMINAR PRESENTATION -- Analyze Data	Analyze Data	Analyze Data	Analyze Data
09	10	11	12	13
Analyze Data	Analyze Data	Analyze Data	Prepare Reports	Prepare Reports
16	17	18	19	20
Prepare Reports	Prepare Reports	Prepare Reports	Prepare Reports	Prepare Reports
23	24	25	26	27
Prepare Reports	Prepare Reports	FLIGHT HOME!!	HOME!!	

Appendix F – Waste Reduction Work Plan Template

Guidelines for this work plan are obtained from the Ontario Ministry of the Environment guide for waste audits and waste reduction work plans (2008). This is only a partial version of the template, but the full document (12 pages) can be provided on request.

MINISTRY OF THE ENVIRONMENT WASTE FORM REPORT OF A WASTE AUDIT INDUSTRIAL, COMMERCIAL AND INSTITUTIONAL ESTABLISHMENTS

As required by O. Reg. 102/94

- ***This report must be prepared 6 months after becoming subject to O. Reg. 102/94 and a copy retained on file for at least five years after it is prepared, and be made available to the ministry upon request.***
- ***For large construction and demolition projects, please refer to the forms included with "A Guide to Waste Audits and Waste Reduction Work Plans for Construction and Demolition Projects as Required Under Ontario Regulation 102/94" (Revised July 2008)***

I. GENERAL INFORMATION

Name of Owner and/or Operator of Entity(ies) and Company Name: Quest University Canada			
Name of Contact Person:	**Telephone #:**	**Email address:**	
Street Address(es) of Entity(ies): **3200 University Boulevard**			
Municipality: **Squamish, BC**			
Type of Entity (check one)			
Retail Shopping Establishments		Hotels and Motels	
Retail Shopping Complexes		Hospitals	
Office Buildings		Educational Institutions	X
Restaurants		Large Manufacturing Establishments	

Note: O. Reg. 102/94 does not apply to multi-unit residential buildings.

II. DESCRIPTION OF ENTITY

Provide a brief overview of the entity(ties):

III. HOW WASTE IS PRODUCED AND DECISIONS AFFECTING THE PRODUCTION OF WASTE

For each category of waste that is produced at the entity(ies), explain how the waste will be produced and how management decisions and policies will affect the production of waste.

Categories of Waste	How Is the Waste Produced and What Management Decisions/Policies Affect Its Production?
Example: Disposable Food Packaging	***Generated by customers eating inside restaurant. Food packaging is used for health reasons. Reusable mugs for customers consuming coffee/tea inside restaurant is being reviewed.***

Note: When completing this form, write "n/a" in the columns where the entity will not produce any waste for a category of waste.

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IV. MANAGEMENT OF WASTE

For each category of waste listed below, indicate which waste items will be disposed or reused/recycled and how each item will be managed at the entity(ies).

Category	Waste to be Disposed	Reused or Recycled Waste
Example: Beverage cans	***Staff/clients may place in garbage bins***	***Staff/clients place cans in recycling receptacles. Collection staff later collect cans. Those in garbage are disposed; those in recycling receptacles are recycled.***

Note: When completing this form, write "n/a" in the columns where the entity will not produce any waste for a category of waste.

Appendix G: References

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