

Greening Events in the Greenest City:

Achieving Sustainable Event Waste Management in the City of Vancouver



Annie Merritt, Greenest City Scholar
City of Vancouver
September 9, 2013

Acknowledgements

I would like to express a big thank you to all those greening event experts who shared their time and insights with me over the course of my research. I cannot thank you enough for your generosity in sharing the “tricks of the trade” that you have pioneered in the last few years. Your innovative spirit and dedication to achieving environmental sustainability is very much an inspiration and I hope that many others in event management will learn from your example.

I would also like to thank Jen Richards, for being a great support and sounding board for ideas, and Dan Campbell for helping get everything in place to make the pilot research possible. Many, many thanks for your support.

Contents

Acknowledgements.....	ii
1.0 Introduction	1
2.0 Background	1
3.0 Purpose	2
4.0 Methods.....	2
4.1 Selecting which behaviour to target.....	3
4.2 Identifying the barriers and benefits to proper waste sorting behaviour	3
4.3 Identifying a strategy to reduce barriers and enhance benefits	7
4.4 Piloting the strategy.....	8
5. Results.....	13
5.1 Reference Points and Calculations Used in Interpretation of Results.....	13
5.1.1 Measuring Contamination	13
5.1.2 Variables Affecting Contamination of Recycling and Food Scrap Streams.....	14
5.2 Contamination of Monitored and Unmonitored Bags.....	15
5.2.1 Effect of Event Size on Contamination of Bags.....	19
5.2.2 Effect of Event Enclosure and Communities’ Injunctive Waste Sorting Norms on Contamination of Bags.....	23
5.2.3 Effect of Presence of Food Vendor Trucks on Contamination of Bags	25
6.0 Discussion.....	28
6.1 Summary of Contamination Reduction Strategies	28
6.1.1 Use contamination-reduction strategies tailored according to event size and number of food vendors present	28
6.1.2 Employ best practices in recycle station monitoring.....	28
6.1.3 Employ best practices in back-of-house sorting	30
7.0 Recommendations	33
7.1 Ways in which the City can encourage event organizers to adopt waste reduction strategies.....	33
7.2 Ways in which Sanitation Operations better service events	40
7.2.1 Pre-event setup.....	40
7.2.2 Post-event waste management logistics	41

7.2.3 Provision of equipment.....	46
8.0 Conclusion and Next Steps.....	50
Sources Cited	50
Appendix A: Key Terms	52
Appendix B: Back-of-House Sorting	53
Appendix C: Bin Signage.....	55
Appendix D: Zero Waste Training Guide.....	58
Appendix E: Use of Sustainable Food Packaging among Food Vendors.....	61
Appendix F: Recurring Zero Waste Recommendations—Interview results	62
Appendix G: Key Points from Stakeholder Interviews.....	65
Appendix H: Frequency of Contamination Summary of Results.....	67
Appendix I: Extent of Contamination Summary of Results.....	68

1.0 Introduction

As set out in Vancouver's Greenest City 2020 Action Plan (2011), the CoV has set the ambitious target of reducing solid waste going to landfill or incinerator by 50% from 2008 levels. The City is taking numerous approaches to achieving this goal, including initiatives that target City operations themselves. This approach is based on the recognition that asking residents and businesses to reduce their environmental impact must be accompanied by the implementation of internal greening efforts targeting city operations and facilities directly. One of four high-priority actions targeting City operations is the greening of community events that the City runs, sponsors and permits¹. This action is notable because its effectiveness is dependent upon the efforts of event organizers and event attendees, in addition to the efforts of the City. In fact, it is because of their public profile that the greening of City-permitted and City-serviced events also dovetails with one of the highest priority actions identified within the Greenest City Action Plan under the "zero waste" goal—to develop education and enforcement programs to keep recyclables out of the waste stream².

2.0 Background

Every year, Vancouver's Film and Special Events Office and the Parks Board³ approve approximately 600 and 500 events, respectively. Since March 2013, all event organizers seeking to register their event with FASE or the Parks Board have been required to complete a "Green Events Form"⁴. This form includes a variety of questions pertaining to the operation of the event, including food options, energy sources, and waste and recycling setup. Each response the event organizer inputs into the form is given a certain number of points which correspond to the sustainability of the approach that they are using (i.e. waste bins only would receive zero points, while food scraps and recycling bins would receive 10 points). In this way, the form serves as an educational tool to encourage event organizers to consider the sustainability of their event management choices. For those event organizers who choose to use the City's waste hauling services rather than hiring a private waste hauling company, the green event form may also help the Supervisor of Street Cleaning for Parks and Special Events to engage in a conversation with event organizers about how the waste services provided by the City's Sanitation Operations department could be combined with on the ground efforts made by the event organizer's team to minimize waste.

In addition to the Green Events Form, the City's current pricing structure for waste and recycling bins is also designed to encourage sustainable event management choices. For the 2013 season, mixed paper recycling, container recycling, and food scraps bins were made available to event organizers at a

¹ "Vancouver is becoming the greenest city, inside and out". (Source: <http://vancouver.ca/green-vancouver/how-we-are-greening-city-operations.aspx>)

² Greenest City 2020 Action Plan

³Source?

⁴ Available at www.vancouver.ca/greenyourevent

discounted cost of \$10 apiece as compared to waste bins, which are charged \$15 to service. In spite of these strategies to encourage zero waste events, many barriers to effective recycling and composting persist. According to preliminary reports from Sanitation Operations staff members who are responsible for providing waste hauling services to city-serviced events, one of the principal issues faced is the ongoing contamination of recycling and compost streams with improperly sorted items. This has made recycling and composting a challenge, as highly contaminated recycling and compost streams must be sent to landfill⁵.

3.0 Purpose

The primary purpose of this report is to explore the potential means of addressing the contamination of recycling and food scraps at city-serviced events. Recycle station monitoring, back of house sorting, and effective signage are all explored as approaches to reducing the contamination of these streams with improperly sorted items. Research focused mainly on the first strategy—recycle station monitoring—as preliminary research suggested this strategy would be the most cost-effective⁶ and the most successful at keeping waste contamination to a minimum. The secondary purpose of this report is to explore the means by which the City of Vancouver might encourage the adoption of contamination- and waste-reduction strategies by event organizers. Finally, the report provides recommendations regarding potential ways that the City’s Sanitation Operations could enable the minimization of waste through the logistical and advisory support that are provided to event organizers.

4.0 Methods

In order to explore potential means of addressing the contamination of recycling and food scrap streams with improperly sorted items at city-serviced events, this report uses a community-based social marketing (CBSM) approach. CBSM is based on research which demonstrates that the most effective means of changing behaviours is through initiatives that are introduced at the community-level to remove barriers to a desirable activity, while enhancing the activity’s benefits⁷. Following the CBSM model, research followed five general steps:

- 1) Selecting which behaviour to target—in this case, the proper sorting of waste items at events
- 2) Identifying the barriers and benefits to the selected behaviour
- 3) Developing a strategy that reduce barriers and enhance benefits to the selected behaviour
- 4) Piloting the strategy
- 5) Evaluating the results of pilot implementation and implementing at a broad scale

⁵ Contamination of recycling and food scraps streams was perceived to be such a prevalent issue that Sanitation Operations’ waste and recycling pickup services have come to managed as a single waste stream, whereby all streams are combined into one truck upon pickup at events. This has resulted in nearly 100% of recyclables and food scraps from city-services events being sent to landfill.

⁶ As discussed in section X, this method has the potential to be very cost-effective because it is a job that can be performed by volunteers rather than paid staff.

⁷ Mohr et al., 2012

In order to complete the first two steps—selecting the behaviour and identifying barriers and benefits—interviews were conducted with five “greening event” professionals, which addressed waste sorting behaviour and “best practices” in recycling and waste reduction at events. This was complemented by a literature review examining recycling behaviours and attendance at four events in an observational capacity⁸. Based on the findings of these preliminary steps, recycle station monitoring was identified as the key strategy to addressing waste sorting behaviour—and thereby the contamination of recycling and food scraps—at events. Research focused primarily on the effect of having volunteer “recycling educators” stationed at clusters of recycling, compost, and garbage bins at five pilot events. The effect of clear and effective signage and “back-of-house” waste sorting were also investigated as complementary approaches that could help to address waste contamination. However, due to time constraints, the CBSM model was applied only to the recycle station monitoring component of the research.

4.1 Selecting which behaviour to target

In order to address waste contamination, the *waste sorting behaviour of event attendees⁹ at recycle stations with four streams* was targeted. Bin clusters with fewer than four streams were excluded from the study for strategic and practical reasons. Strategically, the researcher aimed to create the ideal recycle station conditions in which all streams are made available and clustered together for convenience, as these are the conditions that the City of Vancouver is encouraging event organizers to move towards over time¹⁰. Furthermore, the data would not be comparable if the contamination of a three-stream and four-stream cluster were both included in the study because the presence of the additional bin would provide the event attendee with an additional waste sorting option which could affect the waste sorting behaviour, and therefore contamination levels, under study.

4.2 Identifying the barriers and benefits to proper waste sorting behaviour

The academic literature offers several insights into the barriers and benefits of proper waste sorting. First, the Theory of Planned Behaviour, which has been shown to have notable predictive value in various social and behavioural science studies¹¹, posits that behavioural intentions are a function of 1) an individual’s attitude toward a behaviour, 2) the individual’s perception of the ease or difficulty of effectively engaging in the behaviour (“Perceived Behavioural Control”) and 3) the subjective norms surrounding the behaviour¹². These factors are examined below as potential variables that may contribute to the uptake of effective waste sorting behaviour at events. Perceived Behavioural Control

⁸ Two events were attended prior to implementation of the pilot studies: Car Free Day on Main Street (serviced by Recycling Alternatives) and Marpole Community Day Event (serviced by CoV’s Sanitation Operations). An additional two events were attended in an observational capacity following pilot implementation in order to gather information about best practices: EPIC Sustainable Living Festival and Surrey Canada Day Event.

⁹ Note that the study did not examine the waste-sorting practices being used by food vendors at events, although it is likely that much of the food vendor waste was combined into the waste bins provided for event attendees.

¹⁰ According to the literature and on-the-ground observations, these are also the conditions under which event attendees are most likely to sort their waste into recycling and food scrap streams because it is more convenient to be able to dispose of all items at once than to walk to a separate station for each waste item.

¹¹Rebelo et al. 2005

¹²Ajzen (1991)

and subjective norms are examined in particular because they may be influenced directly by the event environment and are therefore within the realm of control of event organizers. This is accompanied by a short summary of additional barriers which are not explained under the theory of planned behaviour but may also be contributing to sub-optimal waste sorting behaviours at events.

Barrier 1: Attendees' perceptions of behavioural control

The level of Perceived Behavioural Control is determined by two factors: self-efficacy and the presence of the facilitating conditions¹³. *Self-efficacy* refers to the question of how difficult the individual perceives the task to be, combined with the individual's confidence in their ability to perform the behaviour¹⁴. In the context of waste sorting at events, the presence of *facilitating conditions* may refer to the conditions at the event grounds that moderate attendees' ability to adopt effective waste sorting behaviour. This could include the distribution of recycling bins (i.e. not so far apart as to be inconvenient) and the onsite presence of bins for all landfill diversion streams (paper, food scraps, and containers). If garbage bins are more convenient than recycling bins because they are greater in number or more evenly distributed, attendees are likely to perceive the difficulty of sorting waste into various waste diversion streams to be higher. Similarly, if the individual has access to a source of information (i.e. a visual sign or a knowledgeable volunteer) regarding which items belong in which stream, they may be more likely to attempt to sort their waste into the proper landfill diversion bin¹⁵. According to the Theory of Planned Behaviour, even if an individual believes that their (waste sorting) behaviour will produce a positively valued outcome (such as diversion of waste from the landfill), they will only be motivated to attempt to perform this behaviour if they are confident in their ability to do so successfully. If the individual is not confident in their ability to select the proper stream for their waste, they may make a lesser effort to select the proper stream at all.

A 2012 survey of event attendees at city-serviced events suggests that while attendees have at least a moderate level of perceived self efficacy in waste sorting, the City could be doing more to assist event organizers to establish facilitating conditions for proper waste sorting behaviour. Among 160 individuals surveyed, 47% did not notice the presence of recycling and food scrap stream bins. Among those who did notice the bins, 48% stated that they felt it was clear what to recycle—indicating a degree of confidence in their ability to effectively sort waste—as compared to 15% who felt that it was not.

Barrier 2: Subjective norms pertaining to waste sorting behaviour

The Theory of Planned Behaviour suggests that subjective norms are one of the key variables mediating behavioural intentions. Indeed, studies show that the perception of social pressure to engage in recycling has a strong influence on recycling behaviour¹⁶. A small sample of intercept surveys of event attendees conducted at the Hastings Kickoff the summer event provided further evidence of the existence of internalized norms surrounding the importance of recycling among residents of Vancouver.

¹³ Taylor & Todd (1995)

¹⁴ Kraft et al. (2005)

¹⁵ Studies have shown increased recycling compliance when recycling prompts are placed closer to bins and when bins are placed closer to users (Duffy & Verges, 2008).

¹⁶ Ewing (2001) found that subjective norms (i.e. the perception of social pressures) surrounding recycling were one of the most important variables explaining variation in recycling behaviour

Among 10 attendees surveyed, the vast majority indicated that they make an effort to sort their waste out of a sense of personal responsibility to protect the environment. Several people stated simply that they considered recycling and composting to be “the right thing to do”. Although this small sample was by no means representative of the entire city, at the majority of pilot events, attendees frequently exhibited a desire to sort their waste into the waste diversion streams, as indicated by the common tendency to pause and read the bin labels prior to disposing of waste. In spite of this evidence suggesting the existence of subjective waste sorting norms, the improper sorting of items continues to be a prevalent issue at events—particularly those at which the conditions facilitating proper sorting of items are not in place.

Greater insight into the discordance between irresponsible recycling behaviour at certain events and responsible recycling norms is offered by the “Focus Theory of Normative Conduct”¹⁷. According to this theory, there are two distinct types of norms: descriptive norms and injunctive norms¹⁸. Descriptive norms (or “is” norms) can be described as those that are based on what is commonly done. When looking to inform personal behaviour, individuals often look to others’ actions to seek evidence of what is likely to be effective. Conversely, injunctive norms (or “ought” norms) are based on informal sanctions, whereby individuals are motivated to act in a manner that is socially encouraged because of the promise of social rewards, or to avoid social punishment for acting in an undesirable manner. According to research conducted by Cialdini et al. (2006), when descriptive and injunctive norms are not aligned, they can be in competition with one another. This is one possible explanation for the lack of recycling behaviour that arises in the absence of facilitating conditions at events.

In the context of recycling at public events, injunctive norms suggest that event attendees do their best to properly sort their waste into recycling and food scrap streams to make diversion of waste from landfills possible. However, if the facilitating conditions are not put into place, descriptive norms are more likely to conflict with these injunctive norms. While event attendees may know that they *ought* to take the time to properly sort their waste to make recycling and composting possible (eliciting injunctive norms), when seeking evidence of others’ behaviour at the event (eliciting descriptive norms), they may find that very few others are actually doing so. What can result under these circumstances is that the undesirable behaviour suggested by the descriptive norm—not properly sorting waste into the correct streams—is encouraged, thereby overruling any injunctive social norms that event attendees may have previously internalized¹⁹. Furthermore, poor sorting of waste into landfill diversion streams likely has a

¹⁷ Developed by Cialdini, Kallgren, & Reno (1990)

¹⁸ The term “subjective norm” refers to *perceived* social pressure to engage in a behaviour. While this term emphasizes the individual’s perception of a norm, it complements the concept of injunctive and descriptive norms (i.e. a norm may be referred to as a “subjective injunctive norm”)

¹⁹ The power of descriptive norms was also recognized by event waste management Maryanne MacDonald, organizer of Waste Free World in London Ontario, who emphasized the importance of maintaining the cleanliness of an event space by having volunteers do occasional clean-ups to ensure that litter is not left to accumulate. She reported that taking measures early on to pick up a small amount of waste acts as a preventative measure to ensure that the waste does not multiply through a snowball effect. She also suggested that the cleanliness of the space communicates to attendees that irresponsible management of waste items is not acceptable at events, thereby setting a descriptive norm which proactively prevents future littering.

high potential to influence descriptive norms because of the high visibility of the behaviour: an improperly sorted item may remain visible to event attendees long after it was thrown in a bin. This is particularly true of bins with open lids or lids that are lifted open in order to dispose of waste²⁰.

Barrier 3: Lack of focus on the task of sorting waste into landfill diversion streams

In addition to putting forward the concept of injunctive and descriptive norms, the Focus Theory of Normative Conduct posits that norms are likely to influence an individual's behaviour only when they are the focus of attention and therefore at the forefront of the individual's consciousness²¹. This may further help to explain the discrepancy between event attendees' stated beliefs regarding the importance of sorting waste to reduce landfill and the improper sorting that is frequently demonstrated at events: the busy, loud, and distracting environment that characterizes many events likely poses an added challenge to effective recycling and waste sorting when compared to undertaking the same activities in a quiet home environment.

Barrier 4: Lack of knowledge about the rules for sorting waste items into landfill diversion streams

Although this barrier falls outside of the range of behaviours explained by the theories outlined above, it has been evidenced through observation of event attendees' waste sorting behaviour at events. In many cases, attendees' internalized injunctive norms emphasize recycling and composting first and therefore, when they are uncertain about the stream to which an item belongs, they place this item in the recycling or composting stream. Paradoxically, this leads to reduced waste diversion, because unless waste is being sorted prior to its shipment to recycling or composting facilities, these streams end up being too contaminated to be diverted from the landfill.

Benefit 1: Social rewards for complying with norms surrounding responsible waste sorting behaviour

According to the model of altruistic behaviour²², behaviour can be explained by the interrelationship among four factors: social norms, personal norms, awareness of consequences, and ascription of responsibility. These can be understood as follows:

- 1) **Personal norms:** Refer to the individual's concept of right and wrong. When upheld, personal norms create a sense of pride, and when violated, create a sense of guilt. *Example:* "I should recycle because it is the right thing to do"
- 2) **Social norms:** Dictated to a certain extent by social groups. *Example:* "I should recycle because my family and friends feel it is the right thing to do."
- 3) **Awareness of consequences:** *Example:* "I should recycle because it leads to environmentally positive outcomes"
- 4) **Ascription of responsibility:** *Example:* "I should recycle because it leads to environmentally positive outcomes for which I am personally responsible."

²⁰ The City of Vancouver's bins had large lids that had to be lifted in order to be used prior to August 2013. However, the City has since created smaller holes in bin lids, meaning the lid does not have to be lifted.

²¹ Cialdini et al., 2006

²² As developed by Schwartz(1977), see Oom Do Valle et al., 2005.

The model suggests that personal and social norms will only be activated when an individual is also aware of the consequences of his or her actions and accept responsibility for these actions. This theory is notable for several reasons; First, a lack of awareness of consequences of improper waste sorting behaviour may reduce the activation of personal and social norms—members of the public are not likely aware of the fact that the improper disposal of items into the waste diversion streams may lead to contamination exceeding acceptable levels and contents being sent to landfill, and may therefore make less of an effort to sort properly. Second, this theory suggests that any measures that can be taken to enhance the social rewards of proper recycling behaviour are likely to contribute to more effective waste sorting behaviour, permitted other enabling factors (i.e. labels to help in sorting etc.) are in place.

4.3 Identifying a strategy to reduce barriers and enhance benefits

It was expected that many of the challenges to effective sorting of waste items at events that are suggested by the academic literature could be addressed by posting well-trained and communicative recycling educators in close proximity to the recycle stations (as highlighted in Table 1, below).

Table 1: Barriers to waste sorting behaviour and the potential effect of recycle station monitoring

Theory	Barriers to the proper sorting of waste items at events	Solutions offered through the use of recycle station monitoring
Theory of Planned Behaviour— Perceived difficulty in performing behaviours	Attendees’ perception of effective waste sorting as being too difficult because of the variety of waste sorting rules in place	Attendees’ specific questions regarding the proper stream can be addressed by Recycling Educators
Focus Theory of Normative Conduct— Competing injunctive and descriptive norms	Descriptive norms create a snowball effect of improper sorting by attendees	Recycling Educators can educate public on proper sorting and sort the occasional improperly sorted item, thereby avoiding runaway contamination
Focus Theory of Normative Conduct— Norms influence behaviour only when focus of attention	Attendees’ lack of focus on the injunctive norm emphasizing proper waste sorting behaviour	The presence of Recycling Educators and their interaction with the public make the act of disposing of a waste item less thoughtless, automatic
Theory	Benefits to the proper sorting of waste items at events	Ways in which the use of recycle station monitoring enhances benefits
Model of Altruistic Behaviour— Rewards for compliance with personal and social norms	When pro-waste diversion personal and social norms are in place, sorting waste into recycling and composting streams results in social rewards and personal satisfaction	The presence of Recycling Educators and their interaction with the public enhance the visibility of attendees’ waste sorting behaviour and create an opportunity for social rewards for positive behaviour (i.e. Recycling Educator saying “thank you” etc.)

In addition to being theoretically sound, the use of recycle station monitors was widely recommended as an effective strategy in many green event guides produced by other municipalities and event greening companies²³. This was further echoed by four zero waste coordinators²⁴ who were interviewed about their methods. These individuals identified the presence of recycling educators as a crucial factor in keeping contamination levels to a minimum.

4.4 Piloting the strategy

In order to quantify contamination of monitored and non-monitored bins, a pilot study was undertaken at five city-serviced events, whereby recycling educators were posted at certain recycle stations while others were left unmonitored. Recycling educators were encouraged to assist event attendees to dispose of their waste in the correct bin, and, if necessary, remove improperly sorted items from bins themselves using long-handled “garbage grabbers”. Events were selected to be variable with regard to target audience, number of attendees, and kinds of waste materials produced. Pilot events included those with and without food vendors, targeting families, youth, and various cultural and neighbourhood communities, both in enclosed and unenclosed spaces. They ranged in size from an attendance of 2,500 people to 100,000 people (see Table 2, below). At all but the last pilot, old labels were used on the bins and the majority of the bins did not have holes. New labels and bin holes were introduced in time for the last pilot event. For a comparison of old and new signage, see Appendix C. For a discussion about the relative advantages of the new labels/bin holes see Section 7.2.3.

Following the first four events, waste audits were performed with the assistance of Sanitation Operations staff 1-2 days after the event, once the waste had been shipped to National Yards. At the fifth pilot, back-of-house sorting was performed onsite, by United We Can staff. This permitted the contamination level of both monitored and unmonitored recycle stations to be assessed. It also permitted for on-the-ground observations regarding effective sorting logistics and required time allocations for sorting to be kept.

This pilot project allowed the following hypotheses to be tested:

Hypothesis 1: Recycle stations at which recycling educators are not present will have contamination levels above the acceptable limit in the majority of cases²⁵. **Hypothesis 2:** Recycle stations at which recycling educators are present will have less contamination than the acceptable limit in the majority of cases. These hypotheses are based on both the green events literature as well as on-the-ground

²³See “North Shore Recycling Program’s Guide to Creating a Zero Waste Event”, “Special Events Waste Diversion Handbook” (City of Toronto), “Zero Waste Community Event Toolkit” (Recycling Council of Ontario), “Festivals and Events—Best Practices to Reduce and Recycle” (Recycling Alternative), “Waste Reduction for Events and Festivals” (Green Calgary), “Guideline for Working Towards Zero Waste Events” (Auckland City Council) and “Zero Waste Guide for Event Planners” (Sunshine Coast Regional District)

²⁴Eyal Lebel of the Vancouver Folk Festival’s Environmental Committee and Maryanne MacDonald of Waste Free World (based in London, ON) and Liliana Segal and Nicki Casley from Green Chair Recycling (based in Vancouver). For a complete summary of interview results, see Appendix F.

²⁵Based on reports from Sanitation Operations suggested that contamination exceeds acceptable levels close to 100% of the time

observations made by Sanitation Operations staff members and zero waste coordinators who were interviewed for this study.

Table 2: Pilot Event Details

Pilot	Event Name	Nature of Event	Location	Time and Date	Total Attendees	Presence of Bottle Collectors	Enclosure	Waste Generating Activities	Recycling Educator Volunteers
1	Telus Walk to Cure Diabetes	Family-oriented fundraising walk which began and ended at an enclosed site within which recycle stations were located	Lumberman's Arch, Stanley Park	June 9 8:30 am-2:30 pm	4,500	Security staff were present and expelled bottle collectors from the grounds on a number of occasions	Access to the event area was controlled through the use of fencing. Entry was intended for walk participants and fundraisers only	Food and food-related packaging were the main source of waste at this event. Food included: packaged fruit bars, yogurt, juice boxes, coffee, and water, hot dogs, veggie dogs, and canned/bottled beverages. Some flyers/freebies present from sponsors	Two volunteers were present, one in AM and one in PM. Both students were Masters level university students with a commitment to the recycling & environment. GCS played a major role in monitoring.
2	Sunrise Summer Kickoff Event	Family-oriented event including children's street hockey tournament, community organization booths and musical and cultural performance	Sunrise Square Parking Lot, 2500 Block Franklin Street	July 6 10:00 am-4:00 pm	2,500	Bottle collectors were present for the entire duration of the day. They collected the vast majority of containers with a deposit value.	Event was not enclosed, permitting the general public to attend the event.	Food and food related packaging, craft supplies, organization booth flyers and miscellaneous freebies. Food included: packaged nuts, pop in cans, beef and veggie burgers, hot dogs, chips	Five JANlink volunteers present from 9:30 am until 2:30 pm. Two high-school aged volunteers present from 2:30-4:00 pm GCS played supervisory role in 1 st shift and monitoring role in

									2 nd shift.
Pilot	Event Name	Nature of Event	Location	Time and Date	Total Number of Attendees	Presence of Bottle Collectors	Enclosure	Waste Generating Activities	Recycling Educator Volunteers
3	Khats-ahlano! Music + Arts Festival	10-block "street party" style event featuring food vendors, free music at various stages, business booths, non-profit booths, and art displays. Family-friendly and youth-oriented.	West 4 th Ave., between Burrard St. and MacDonald St.	July 13 th 11:00 am-9:00 pm	100,000	Many bottle collectors present throughout the day. Volunteers discouraged collectors from removing bottles from monitored bins.	Event was not enclosed, permitting the general public to attend the event.	Food and food related packaging from food vendors, take-out restaurants, organization booth flyers and miscellaneous freebies. Food vendors all using compostable food containers.	26 total volunteers recruited through JANlink, LMGT, EPIC Festival Green Team. Volunteers worked one 3-4 hour shifts either in morning, afternoon, or evening. GCS supervised.
4	SUCCESS Walk with the Dragon Event	Family-oriented fundraising walk organized by and for the Chinese community. Walk began and ended at an enclosed site within which recycle stations were located. Onsite activities were oriented towards activities with product giveaways/prizes	Lumberman's Arch, Stanley Park	July 20 th 9:00 am-3:00 pm	13,000	Many bottle collectors present throughout the day. Volunteers discouraged collectors from removing bottles from monitored bins.	Event was not enclosed, permitting the general public to attend the event.	Food and food related packaging, newspapers, booth flyers and miscellaneous freebies (i.e. water bottles, flashlights, etc.) Food included: tofu snacks, sandwiches, fruit, bottled drinks, noodle dishes, soya drink samples	Three JANlink volunteers present from 9:30 am until 3:00 pm. GCS played supervisory role and monitoring role throughout the day.

Pilot	Event Name	Nature of Event	Location	Time and Date	Total Number of Attendees	Presence of Bottle Collectors	Enclosure	Waste Generating Activities	Recycling Educator Volunteers
5	Celebrate! Stanley Park: "LIVE at Second Beach" event	Youth-oriented free music festival which included food vendors, one large stage, several tents selling clothing and other items, and a large beer garden.	Second beach, Stanley Park	Aug. 24-25 12:00 pm-9:00 pm	Aug. 24: 10,000 Aug. 25: 15,000	Many bottle collectors present. Event organizing team and recycling educators occasionally requested that bottle collectors leave bottles because of arrangement with United we Can—only ltd. success.	No enclosure	<p>Food, drinks, and related packaging were the main source of waste at this event.</p> <p>Food vendors were all using compostable containers, with the exception of some brown plastic-lined boxes.</p> <p>A large source of waste were the #7 plastic beer cups used by Stanley Park Brewery, which sponsored the event and provided beer in the beer garden. While compostable, this plastic is not accepted by the composting facilities at which the City's waste is processed.</p>	<p>Over 25 volunteers present, many volunteering for shifts on Aug 24 and 25. Shifts were approximately 4.5 hours in length. The majority of volunteers were high school-aged students, many of whom were international students with moderate proficiency in English.</p> <p>GCS provided guidance to recycling educators but did not play a major role in monitoring.</p>

5. Results

5.1 Reference Points and Calculations Used in Interpretation of Results

5.1.1 Measuring Contamination

Defining “Contamination Limits”

In order to assess the frequency and extent of contamination at the five pilot events, acceptable limits of recycling and food scrap stream contamination were used as points of comparison with observed contamination levels. Limits used in this report coincide with those delineated in the City’s contract with recycling processor²⁶, Urban Impact, and food scraps processors, Harvest Power and Enviro-Smart Organics. These limits are as follows: 5% contamination for containers, 5% was contamination for mixed paper, and 2.5% contamination for food scraps²⁷.

Consultation with John Kendler (Policy Analyst, Urban Impact) revealed that contamination limits for recycling streams are not precise cutoffs, but rather preferred ranges and largely depend on the kinds of contamination contained in the stream. When the City of Vancouver delivers recycling materials to the processing facility which exceeds the contamination levels defined in the City’s contract but remains below levels that could be handled by the facility it is still accepted²⁸. With the exception of the paper stream, for which contamination limits coincide with the preferred limit used by Urban Impact, the limits used by processing facilities are slightly higher than those included in the City’s contract. Urban Impact can accommodate up to 30% contamination in the container stream, permitted that the majority of contaminants are containers such as paper cups, and #3, 6, and 7 plastics²⁹. Enviro-Smart and Harvest Power have identified 3% as the preferred contamination limit³⁰.

Table 3: Acceptable Contamination Levels Used in Report

Stream	Contamination limit as per the City’s contract with recycling/ food scrap processors³¹	Informal contamination limit according to recycling/food scrap processors
Containers	5%	30%
Mixed Paper	5%	5%
Food Scraps	2.5%	3%

²⁶ Acceptable contamination limits for the recycling and food scrap streams were determined through consultation with John McDermott (CE II, Solid Waste Management, City of Vancouver) and Bob McLennan, (P. Eng, Solid Waste Management, City of Vancouver).

²⁷ The variation in the contamination limits for various streams is determined by the sorting methods used at the recycling and composting facilities which process recyclables and food scraps.

²⁸ Rather than assess every load that is delivered at the Urban Impact transfer site, the company performs occasional audits in order to verify contamination levels. The City of Vancouver is then charged various amounts depending on contamination levels.

²⁹ This was consistently found to be the case.

³⁰ <http://www.metrovancouver.org/services/solidwaste/planning/Documents/RecyclingMarketStudyReport.pdf>

³¹ Referred to below as “City’s contamination limit”

Frequency of Contamination

The frequency of contamination was measured as the number of bags included in the study for a given stream (containers, mixed paper, or food scraps) that had levels above or below the acceptable contamination level. For example, if 4 out of 10 container bags sampled at a given event had contamination below 5% (the formal contamination limit used by the City of Vancouver), then 40% of bags could be deemed uncontaminated.

Extent of Contamination

The extent of contamination was measured as the percentage of waste items in any given stream that do not belong in that stream (i.e. paper items in the container stream or a garbage item in the food scrap stream etc.) The extent of contamination was measured by calculating the average contamination of individual bags for a given stream³².

5.1.2 Variables Affecting Contamination of Recycling and Food Scrap Streams

Interviewees asserted that the volume of waste produced and the contamination of waste diversion streams are most strongly determined by the following factors: 1) enclosure of the event space (i.e. with access restricted to registered or paid participants)³³, 2) the subjective norms of event attendees, 3) the number of food vendors and 4) the size of the event, as determined by the number of people in attendance³⁴ and 5) the presence of Recycling Educators. Although the latter variable is the focus of this study, the results of the research are best understood by examining the cumulative effect of these variables on recycling/food scrap contamination. These variables and their potential affect on contamination of waste diversion streams are described in greater depth below.

Enclosure of Event Space

Among the five pilots conducted, one was physically enclosed by a fence (Pilot 1), while all others were unenclosed and open to the public. Several interviewees suggested that the enclosure of event space may affect waste sorting behaviours, noting that waste diversion bins at enclosed events often have lower contamination levels³⁵. Interviewees posited that enclosed event spaces may tend to create a greater sense of responsibility for maintaining the cleanliness of the space when compared with unenclosed events. This is consistent with the literature on behaviour which suggests that subjective norms affect recycling behaviour. It is possible that by paying or registering to be part of an event, this may create a sense of community among event attendees and therefore a greater sense of social pressure to behave in a manner that is environmentally responsible. However, this behaviour control is unlikely to operate unless a pro-recycling and pro-waste sorting injunctive norm already exists within a community.

³² Measured by dividing the mass of improperly sorted items in a bag by total mass of items in a bag

³³ As reported by Jon McDermott, Eyal Lebel

³⁴ As reported by Eyal Lebel, Liliana Segal, Jon McDermott

³⁵ Jon McDermott, Eyal Lebel

Subjective Norms of Event Attendees

No formal research into the subjective norms of event attendees at the Pilot events was conducted. Therefore, this research cannot provide any conclusive evidence about the effect of subjective norms on contamination levels. However, it is expected that the absence of pro-recycling and pro-waste sorting subjective norms within a social group can lead to high contamination levels. In Section 5.2.2., comparison between two events with a strong sense of community among attendees held at the same site provides some insight into the potential effect of social norms on contamination of waste diversion streams.

Presence of Food Vendors

The five pilot events attended are categorized into two groups: those that had 1-2 food tents (i.e. barbecue tents, food sample distribution tents etc.) and those that had 5 or more food vendor trucks. While food and food-related packaging was the most common waste item at all events, the presence of food vendor trucks led to a greater diversity of waste items, and therefore a larger challenge for attendees and recycling educators to sort the waste properly. It also led to a greater volume of waste, as the main source of waste at events was consistently found to be food-related packaging.

Event Size

For the purposes of this study, events are categorized as small, medium, or large. Small events are defined as those with an event attendance (over the entire duration of the event) of 5,000 people or less, and include Pilot events 1 and 2. Medium events (Pilots 4 and 5) are those with 10,000-15,000 attendees, and large events are those with over 75,000 people (Pilot 3). These categorizations are not precise but allow for a short-hand reference to the different events attended. Further research would be required in order to determine with more precision the exact event size corresponding to different levels of waste generation and contamination of waste diversion streams. Qualitatively, differences in the use of recycle stations differed most significantly between the small/medium events as compared with large events. At both small and medium events, the disposal of waste items was slow but steady, with occasional peaks in activity near food vendors at meal times. At the large event attended, the disposal of waste was fast-paced for prolonged periods of time³⁶, which challenged the ability of the Recycling Educators to interact with each attendee when they were disposing of their waste. Therefore, it was expected that larger events would tend to have higher rates of contamination.

5.2 Contamination of Monitored and Unmonitored Bags

Pilot results showed that the three recycling/food scraps streams were consistently less contaminated when monitored by Recycling Educators than bins that were unmonitored. There was only one instance in which this trend was reversed—in the food scraps stream in Pilot 3—and this is likely attributable to the fact that a greater number of monitored bins were situated in close proximity to the food vendors than unmonitored bins. Average contamination levels for each stream—relative to the contamination limits delineated in the City’s contract with processing facilities—are illustrated below in Figures 1-3.

³⁶ Monitored bins were focused around the food truck area, but pace of waste disposal was slower in areas more distant from food trucks.

Note that the City's contamination limits are indicated by a black dotted line, and the informal processing facilities' limits are indicated by a yellow dotted line.

Figure 1: Average Contamination of Food Scraps Stream Bins

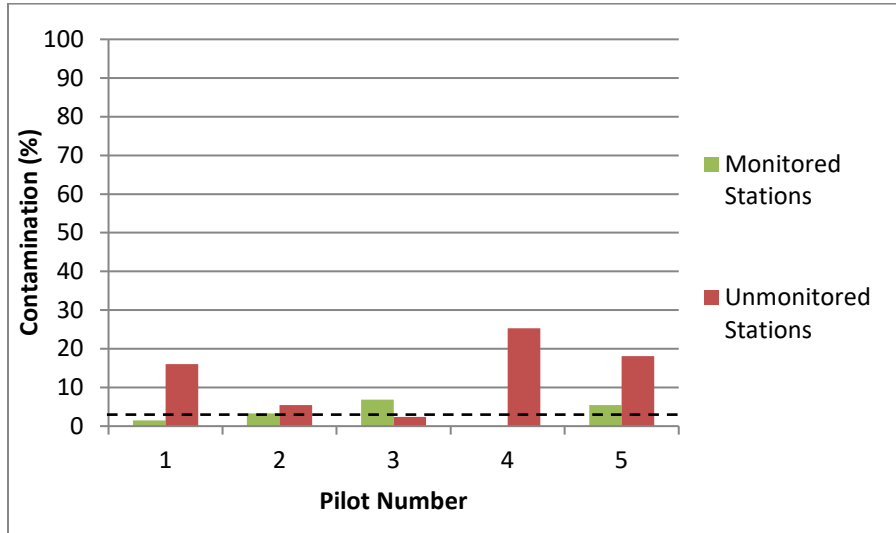


Figure 2: Average Contamination of Paper Stream Bins

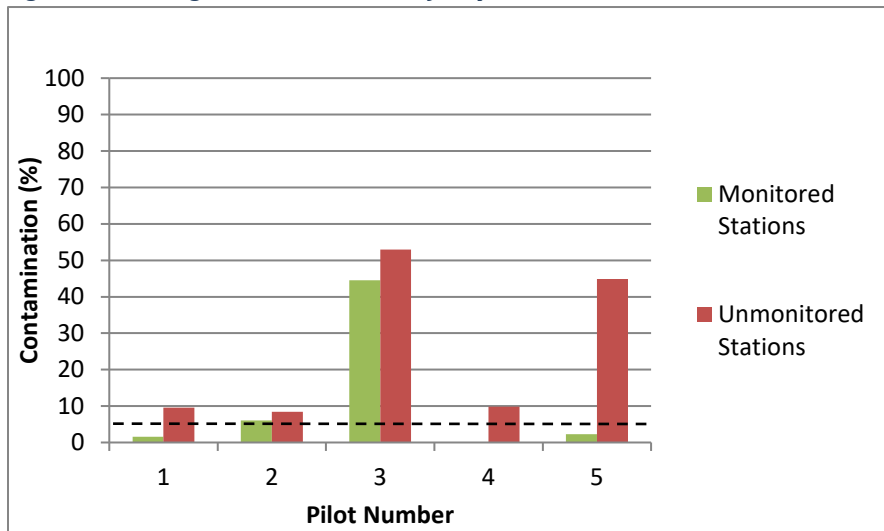
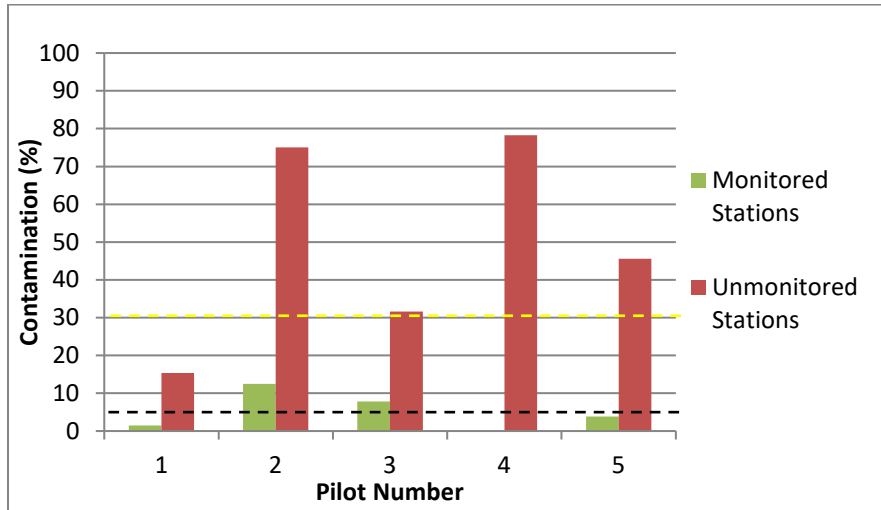
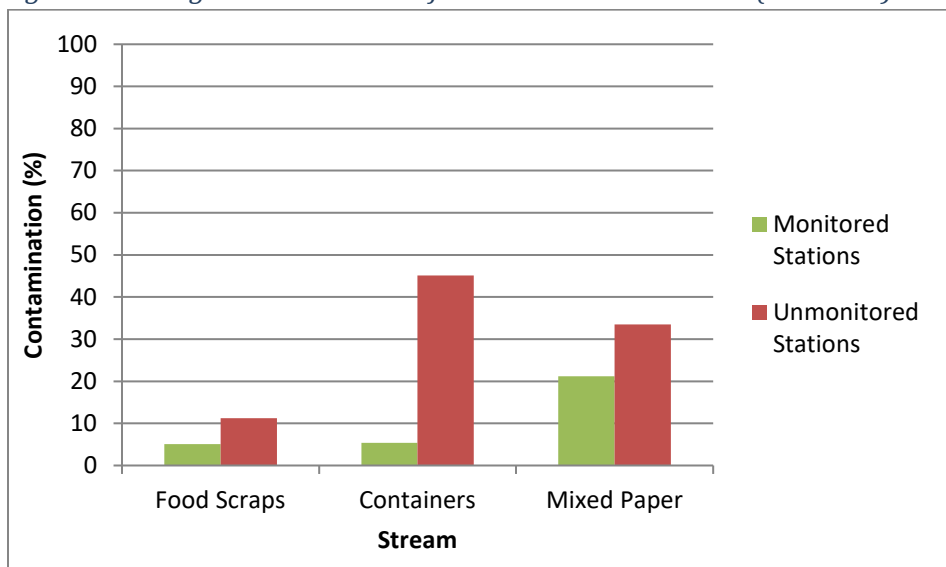


Figure 3: Average Contamination of Container Stream Bins



Monitored food scraps and container streams at the five pilots had similar average contamination levels of 5.1%, and 5.4%, respectively. Average contamination was higher for the paper stream, at 21.2%. While these average contamination levels are all relatively low, none fall below the City’s contamination limits. However, while the contamination of container recycling exceeds this limit by 0.4%, it is nevertheless well below the informal contamination limit of 30%. Furthermore, contamination rates of monitored bags were in general much lower than those that were unmonitored. Average contamination of *unmonitored* bags for each of the three streams was between 1.5 to nearly 9 times the average contamination of monitored bags belonging to the same stream; Average contamination was lowest for food scraps stream, with 11.2% of items being improperly sorted, followed by the paper recycling stream, with 33.5% contamination, and finally the container recycling stream, with 45.1% contamination (see Figure 4, below).

Figure 4: Average Contamination of Waste Diversion Streams (Pilots 1-5)



Audits of the 52 unmonitored bags included in the study showed that only 15% of bags that were unmonitored had contamination levels below the City's contamination limits. In comparison, out of the 61 monitored bags for which data was collected, 48% of bags had contamination levels below these limits. When using the informal contamination limits used by processing facilities, the number of unmonitored bags with acceptable contamination levels doubled, to 30% of the total number of bags included in the study. Similarly, the number of monitored bags below the limit also increased: 66% of all monitored bags had contamination levels under this informal limit. This finding provides moderate support for the Hypothesis 2: that monitored recycle stations would have contamination levels below acceptable limits the majority of the time. The specific conditions under which monitors are most effective in keeping contamination to a minimum are further delineated in Sections 5.2.1 and 5.2.2. These results also provide support for Hypothesis 1: that recycle stations at which recycling educators are not present will have contamination levels above the acceptable limit in the majority of cases. However, with nearly one third of unmonitored bags falling under informal contamination limits, it suggests the need for a more formalized logistical approach to servicing events to accommodate recycling and food scraps, as is further discussed in Section 7.2.2.

The frequency with which bins exceeded acceptable contamination levels varied from one stream to another. Among all unmonitored container stream bags sampled, 0% had contamination levels below the City's contamination limits³⁷, as compared with 59% of monitored container stream bags³⁸. Among unmonitored paper stream bags sampled, 16% of bags had contamination levels below the City's contamination limit, as compared to 44% of monitored paper stream bags. Finally, among unmonitored food scrap stream bags sampled, 33% of bags had acceptable contamination levels³⁹, as compared to 57% of monitored bags from the food scrap stream⁴⁰ (see Figure 5).

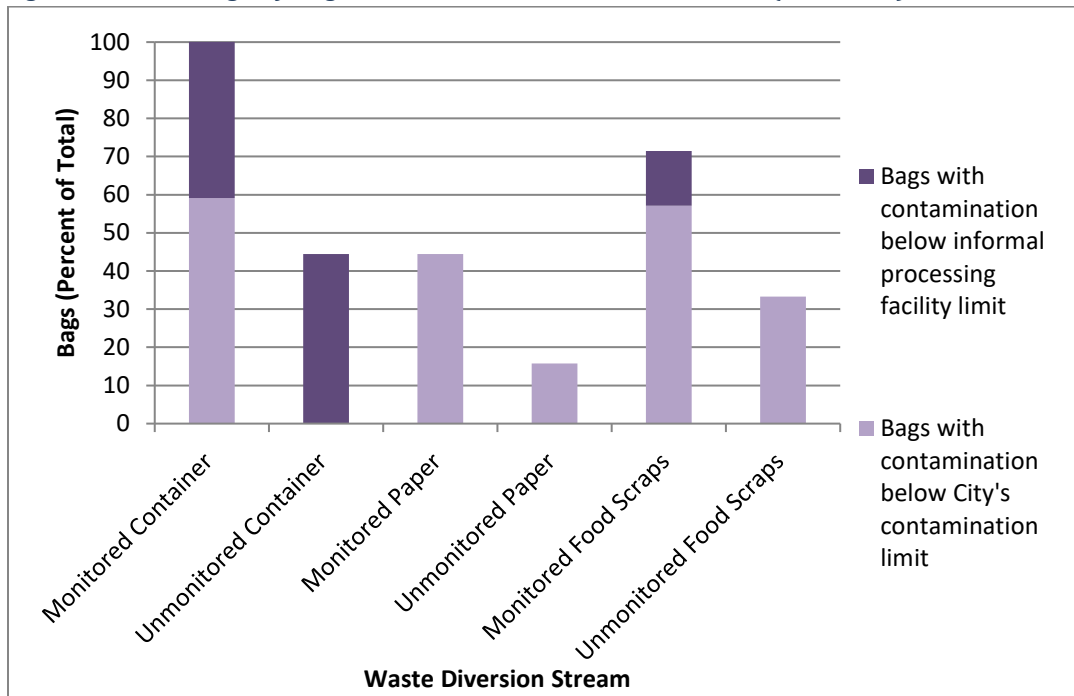
³⁷ Using the informal limits used by recycling processing facilities, 44% of unmonitored container stream bags had acceptable contamination levels.

³⁸ Using the more informal limits used by recycling processing facilities, 100% of monitored container stream bags had acceptable contamination levels.

³⁹ This figure is the same when using the City's contamination limits as well as the processing facilities' contamination limits

⁴⁰ Using the more informal limits used by recycling processing facilities, 71% of monitored food scrap stream bags had acceptable contamination levels.

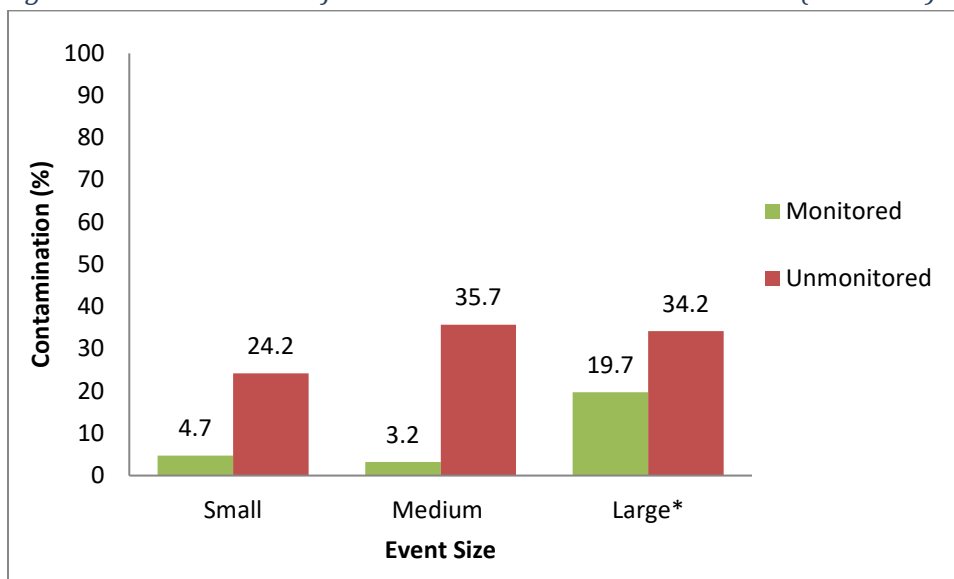
Figure 5: Percentage of Bags with Contamination below Limits (Pilots 1-5)



5.2.1 Effect of Event Size on Contamination of Bags

Although the relationship between event size and contamination rate was not linear, in general monitored bags were more highly contaminated at large events (at 19.7% contamination) as compared with small and medium events (at 4.7% and 3.2% contamination, respectively). Although the difference was found to be less pronounced, unmonitored bags were more highly contaminated at medium and large events (35.7% and 34.2% average contamination, respectively), as compared to small events (24.2% average contamination). See Figure 6 below.

Figure 6: Contamination of Monitored and Unmonitored Streams (Pilots 1-5)



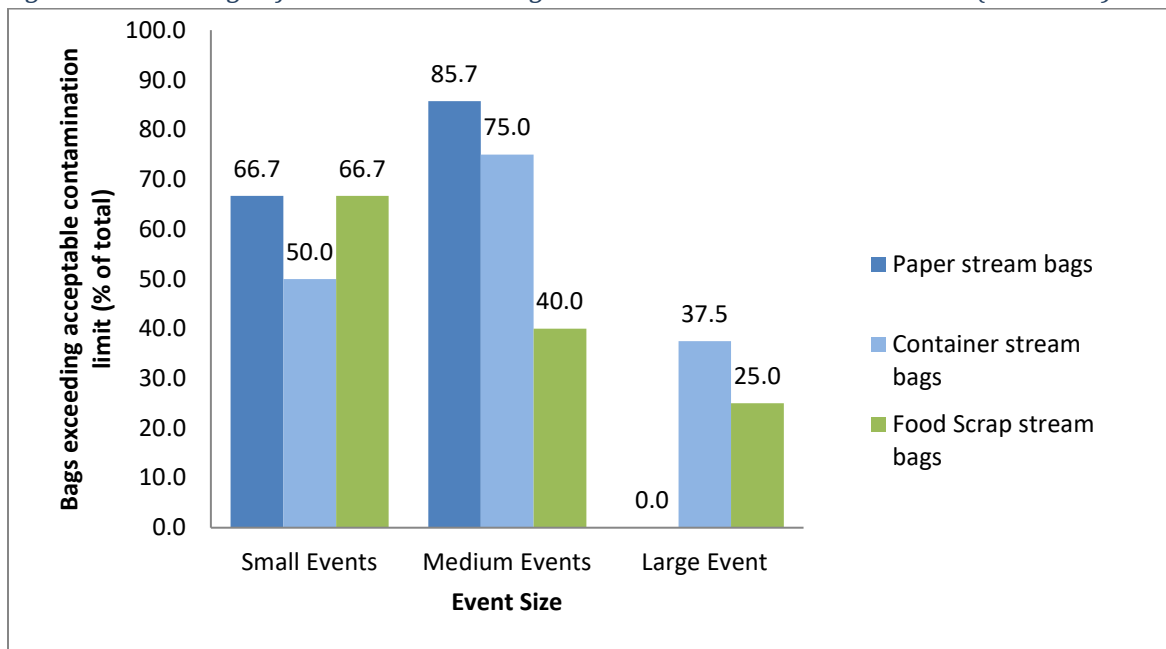
The frequency of contamination exceeding acceptable contamination limits was generally found to be higher at larger events for both monitored and unmonitored bags. The majority of monitored bags at small and medium events were under the City's contamination limit (62.5% and 65.5% respectively), compared with only 21% at large events⁴¹. This suggests that there may be a certain threshold of event attendees, which, once reached may overwhelm the abilities of the Recycling Educators. A similar trend was found among the unmonitored bins at small and medium events: 16.7% and 7.7% of bags at these events were under the City's contamination limit, respectively⁴².

Although the relationship between event size and frequency of contamination does not appear to be linear—monitored bins at small and medium events are contaminated with the approximately the same frequency and to the same extent—monitored bins from large events were contaminated beyond acceptable limits more frequently for all waste diversion streams (see Figure 7, below). For example, 0% of paper stream bags were below the contamination limit at large events, as compared with 85.7% and 66.7% of paper stream bags at medium and small events, respectively. Similarly, only 25% of food scrap stream bags were below the contamination limit at large events, as compared with 40% and 66.7% of food scrap stream bags at medium and small events, respectively. Finally, only 37.5% of container stream bags were below the contamination limit at large events, as compared with 75% and 50% of container stream bags at medium and small events, respectively.

⁴¹ When using the processing facilities' informal contamination limits, 75% and 79% of monitored bags at small and medium events had acceptable contamination levels, as compared with 46% of bags at the large event.

⁴² The trend does not hold when including the data for unmonitored bags from the large event (as 28.6% were found to be below the contamination limit) but this is likely attributable to 1) the fact that unmonitored bins were situated further away from the food vendors and music stages and therefore the conditions for waste sorting would have more closely resembled small or medium events (i.e. lower rate of disposal, fewer distractions etc.), and 2) the impact of bottle collectors on remaining contents of bins—their activities lead to a higher contamination rate of the container stream at small events than large events.

Figure 7: Percentage of Waste Diversion Bags with Contamination below Limits (Pilots 1-5)



The difference in the effectiveness of recycle station monitors at events of different sizes may be explained by the added barriers to proper sorting that exist at larger events as a result of their faster pace and greater number of distractions (i.e. loud music, large crowds, many potential event-related activities etc.). In such an environment, one-on-one interaction between the educator and event attendee is much more difficult and therefore the capacity of the recycling educator to provide sorting guidance or simply to trigger the focus and attention of the attendee to the task of sorting is reduced.

Another factor that may be contributing to the variability in the effectiveness of Recycling Educators at events of different sizes may be the varied levels of experience and waste diversion/sorting knowledge held by Recycling Educators at these events. At the large pilot event (Pilot 3), only two out of more than 20 volunteers had previous waste sorting experience, and only one coordinator was available to answer volunteers' questions regarding the proper sorting of specific items. Although volunteers at the small pilot events (1-2) 2 were also lacking experience, the presence of the coordinator/researcher, who did have recycling knowledge, was likely more impactful at small events at which fewer volunteers were present, as it allowed for a greater opportunity for each volunteer to have their questions resolved.⁴³

Another potential factor, which is under the direct control of event organizers and is very likely to contribute to the reduced effectiveness of recycle station monitors at the large event included in the study is that the recycling educators were posted in some cases at much larger banks of bins. While bins were clustered in groups of 4 (one bin for each stream) at small events, clusters at large events

⁴³ It is likely that with more experience or a greater number of coordinators, contamination may have been maintained to the same level at large events. Indeed, the owner of Green Chair Recycling, a for-profit social enterprise that provides recycling and other greening services to events, has reported consistently being able to achieve a contamination rate of 1% and lower regardless of event size. This success rate can be attributed at least in part to the fact that the company utilizes many knowledgeable repeat volunteers to monitor waste stations.

contained as many as 12 bins each, in order to facilitate the servicing of bins during the event if necessary. This meant a much faster pace of work for the recycle station monitors, and in many cases monitors spent the majority of time re-sorting items rather than aiding event attendees to do so themselves. Furthermore, it meant that bins were less evenly distributed, making it more difficult for event attendees to locate bins. At the large pilot event, where bins were located in clusters one block apart, the distance between bins resulted in litter accumulating around existing street garbage bins that event organizers had sealed shut with garbage bags. In addition to creating descriptive pro-littering norms, the accumulation of waste at these bins represented a missed waste diversion opportunity as this waste was collected by street sweepers and sent to the landfill stream.

There are two notable findings pertaining to the frequency of *unmonitored* bin contamination at events of differing sizes. First, the positive relationship between event size and contamination levels was reversed for the unmonitored container stream bags. Bags taken from unmonitored container recycling bins were below acceptable limits⁴⁴ more frequently at large events (60% of bags) than at medium events (40% of bags) and small events (33% of bags). On-the-ground observations suggest that this difference is likely the result of the onsite activities of bottle collectors, individuals who remove containers with a deposit value from bins. At large events where the rate at which container disposal likely exceeds the rate at which bottle collectors can remove containers, the overall contamination of the bin remains low. At smaller events with lower attendance, the effect of bin collectors has a greater impact on the final composition of the waste stream. By removing the containers with a deposit value and leaving all others, this frequently contributed to overall contamination levels above acceptable cutoffs. In several cases where the contents of the container stream bins was almost entirely deposit containers, the container bins were nearly empty by the end of the event, despite having been well used by event attendees. It should be noted that in spite of the activities of bottle collectors leaving the remaining contents of the container stream more highly contaminated, they nevertheless contributed significantly to waste diversion at all unenclosed events included in the pilot study.

A second notable difference between unmonitored bin contamination at small events as compared to large events was that the contamination of food scrap bags exceeded the acceptable limit more frequently at small events as compared to large events. Contamination was below the acceptable limit in 20%, 0% and 80% of the food scraps bags collected from small, medium and large events respectively. This observation is contrary to expectations, given that large events were expected to have higher contamination levels. However, this is likely attributable to a sampling error⁴⁵: only one large event was attended and at this event, the unmonitored bins were generally further away from the food trucks and music stages than the monitored bins. Consequently, the food scraps bins were used less frequently and under conditions with fewer distractions⁴⁶.

⁴⁴ When using processing facilities' informal limits

⁴⁵ This sampling error was corrected in Pilot 5 by sampling waste from the same bin clusters for both monitored and unmonitored data. Monitors were used at the bins located close to food vendors on day 1 and removed from these bins on day 2.

⁴⁶ It is notable that even at large events, certain areas may have lower attendance or fewer distractions that more closely resembles small events.

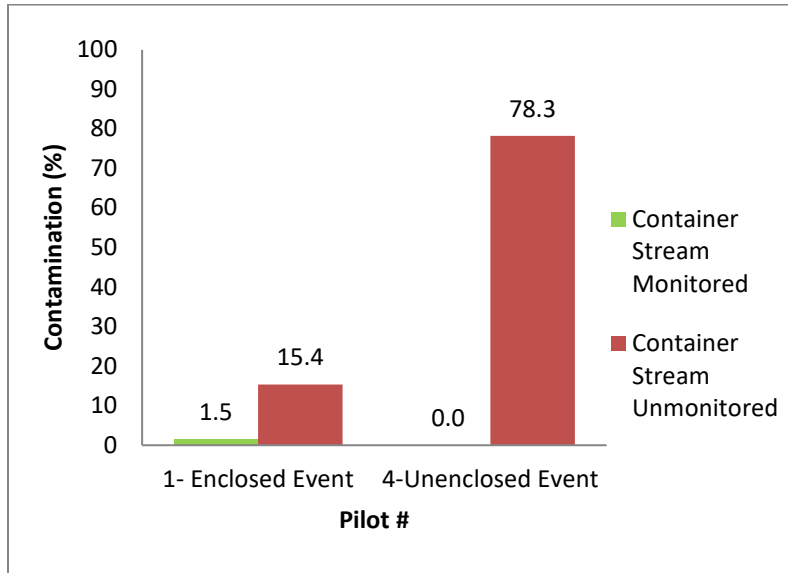
5.2.2 Effect of Event Enclosure and Communities' Injunctive Waste Sorting Norms on Contamination of Bags

Pilot event 1 and 4 were both family-oriented events held at the Stanley Park Lumberman's Arch location. In both instances, this site provided a "home base" for a fundraising walk around Stanley Park. However, Pilot 1 (Telus Walk to Cure Diabetes) was an enclosed event—access was restricted to those who had registered for the walk and the site was surrounded by rental fencing to prevent the general public from entering. Pilot 4 (S.U.C.C.E.S.S. Walk with the Dragon) was an unenclosed event without fencing, thereby permitting passerby to visit and partake in onsite activities, and making it easier for bottle collectors to access the containers with a deposit value in onsite recycling bins. Although only Pilot 1 had a physical enclosure, both events were characterized by a strong sense of community among event attendees—the Walk to Cure Diabetes represented the community of those with Type 1 Diabetes and their supporters, and the Walk with the Dragon represented the community of Chinese Canadians living in the Lower Mainland.

The data collected from these two events provide insight into the impact of bottle collectors on the contamination of the container stream. While the unmonitored container bins at the unenclosed event had an average contamination level of 78.3%, this stream of unmonitored bins at the enclosed event had a comparatively low level of contamination of 15.4%⁴⁷. As expected, at both events, contamination of container stream bins was much lower for monitored streams (See Figure 8, below). Although the bottle collectors did remove items from the monitored bin at the unenclosed event, the Recycling Educators were able to ensure that 100% of items remaining were properly sorted. However, at unmonitored stations, the removal of items with a deposit value (all of which are typically accepted in the container stream), leaves a disproportionately high level of items that are not accepted in the container stream.

⁴⁷ Note that this data is based on a very small sample size of one bag of unmonitored containers from the enclosed event, one bag of monitored containers from the enclosed event, one bag of unmonitored containers from the unenclosed event, and one bag of unmonitored containers from the unenclosed event.

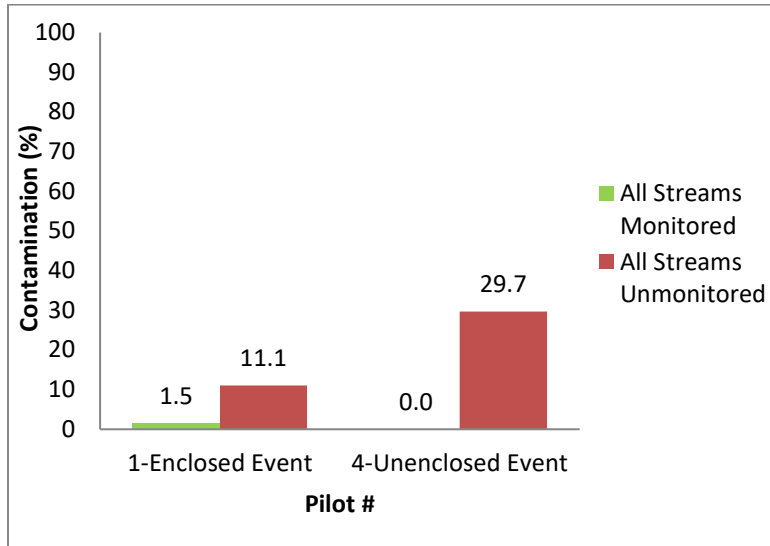
Figure 8: Contamination of Container Stream Bags at Enclosed and Unenclosed Events



Average contamination of unmonitored bins belonging to *all* streams at the two events differed by nearly 20 percentage points; Contamination of unmonitored bags at the Walk to Cure Diabetes event was 11.1%, average contamination of unmonitored bags at the Walk with the Dragon event was 29.7% (see Figure 9, below). These differences are likely attributable in large part to the differing independent variables at Pilot 1 and 4—the size of the events⁴⁸, the communities in attendance, and the enclosure of the event site. It is possible that in addition to the event being open to passerby, a differing set of injunctive norms surrounding waste sorting and recycling practices existed among event attendees at Pilot 4. As discussed in Section 4, the Focus Theory of Normative Conduct posits that perceived social pressure to engage in recycling has a strong influence on recycling behaviour. Therefore, if there is no perception of social pressure to engage in recycling behaviour, individuals will be less likely to make efforts to sort their waste into the waste diversion streams.

⁴⁸ Attendance at Pilot 1 was 4,500 and attendance at Pilot 3 was 13,000

Figure 9: Contamination of Bags from All Streams at Enclosed and Unenclosed Events

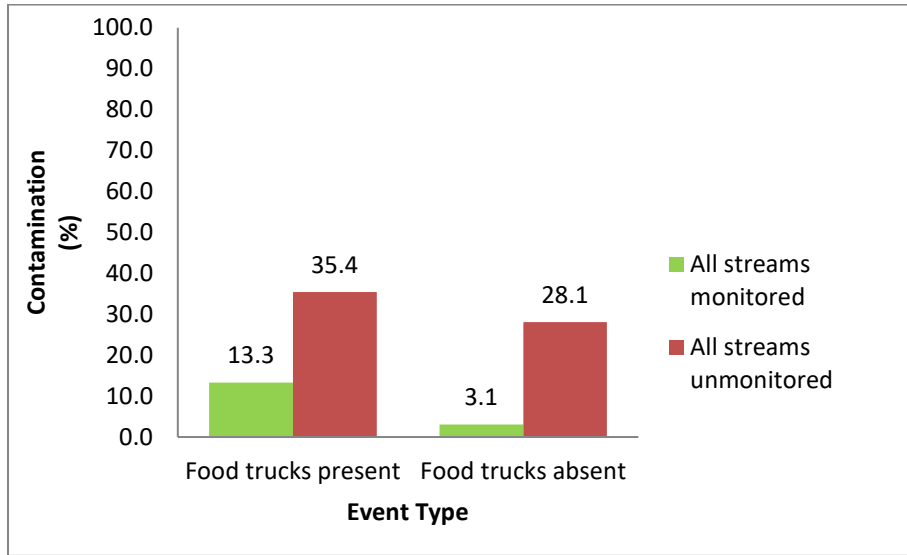


5.2.3 Effect of Presence of Food Vendor Trucks on Contamination of Bags

The extent of contamination was found to be higher for both monitored and unmonitored streams when food trucks were present at events. Monitored streams had an average contamination rate of 13.3% when food trucks were present, as compared with 3.1% when food trucks were not present. While less pronounced, unmonitored bags showed a similar trend: in the presence of food trucks, bags had an average contamination level of 35.4%, compared with an average contamination level of 28.1% when food trucks were absent from events (see Figure 10, below)⁴⁹.

⁴⁹ Note: contamination rate for unmonitored food scrap stream was adjusted for Pilot 3 (one of two events at which food vendor trucks were present) to adjust for the fact that the majority of unmonitored bags were further from food vendor trucks. The average contamination rate for the unmonitored food scrap stream at Pilot 5 (a medium sized event at which food vendor trucks were present) was used as a proxy.

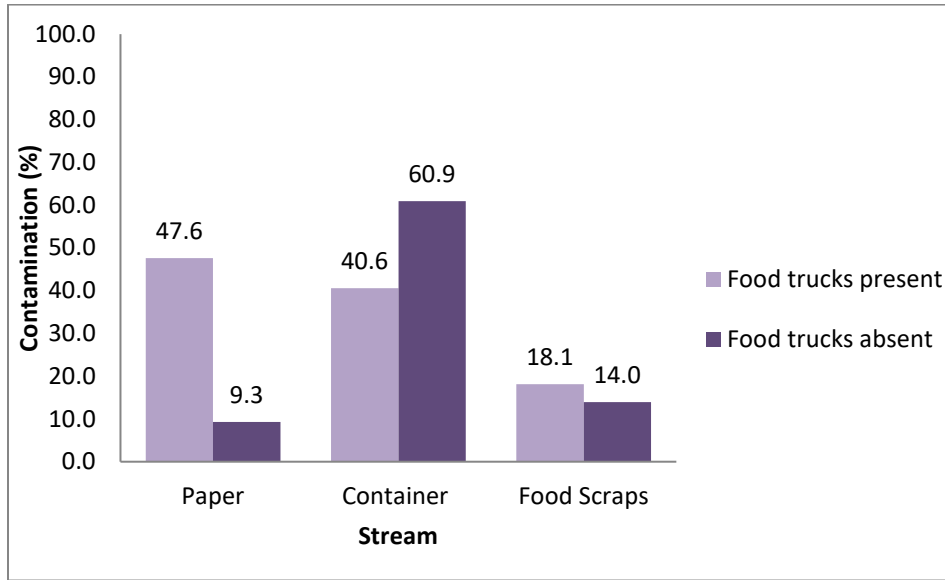
Figure 10: Contamination of Bags from all Streams at Events with and without Food Trucks



When examining each stream individually, unmonitored waste diversion streams generally showed the predicted pattern when comparing events at which food trucks are present with events without food trucks. The unmonitored paper stream has an average contamination rate of 9% when food trucks are absent from events as compared to 48% when food trucks are present at events. Similarly, the unmonitored food scrap stream were found to have, on average, an 18.1% contamination level at events with food trucks as compared to a 14.0% contamination level at events without food trucks⁵⁰. Contrary to the prediction that contamination rates would be higher at events with food vendor trucks, the unmonitored container stream was found to be on average 20% more contaminated at events where food trucks were absent as compared to events where food trucks were present (60.9% contamination as compared to 40.6%). This is likely to be the result of the fact that events with food trucks were on average larger, and the activities of bottle collectors were found to have differing impacts on container stream contamination at events of different sizes (see Section 5.2.1 for discussion). See Figure 11, below, for a summary of contamination levels for unmonitored streams at events with and without food trucks.

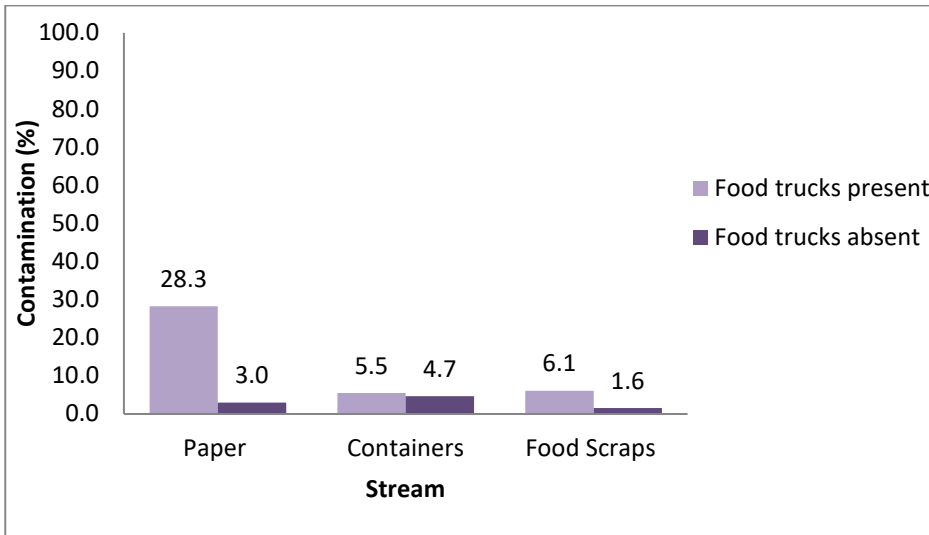
⁵⁰ When using the proxy measurement described in footnote 43.

Figure 11: Contamination of Unmonitored Bags at Events with and without Food Trucks



Among the *monitored* waste diversion streams, bins were found to be consistently more contaminated at events with food trucks as compared to events without food trucks. The monitored food scrap stream was determined to have an average contamination level of 6.1% at events with food trucks, as compared to an average contamination level of 1.6% at events without food trucks. The monitored container stream was found to have an average contamination level of 5.5% at events with food trucks, slightly higher than the average contamination level of 4.7% at events without food trucks. The monitored paper stream had the most notable difference between events with and without food trucks, with an average contamination level of 28.3% and 3.0%, respectively. See Figure 12, below, for a summary of contamination levels for monitored streams at events with and without food trucks.

Figure 12: Contamination of Monitored Bags at Events with and without Food Trucks



6.0 Discussion

The results of the research addressing recycle station contamination confirmed reports by green event coordinators that the monitoring of recycle stations is a very influential factor in reducing the contamination of food scraps and recycling streams. However, the effectiveness of this strategy was found to differ between events of different sizes, and events with and without the presence of food vending trucks. The research also suggests that enclosure of events may also affect contamination levels. Each of these variables are taken into account in the contamination reduction strategies outlined below.

6.1 Summary of Contamination Reduction Strategies

6.1.1 Use contamination-reduction strategies tailored according to event size and number of food vendors present

Given the variability in the effectiveness of recycle station monitoring across small, medium, and large events that is suggested by the pilot research, it is recommended that any approach that event organizers take to addressing recycle station contamination should be tailored according to event size. At smaller events using food scrap and recycling streams with an attendance below 20,000 people per day, the presence of recycling educators alone should be sufficient in maintaining acceptable contamination rates in the food scrap and recycling streams. However, events that have an expected total attendance exceeding 20,000 people and/or are expecting to have numerous food vending trucks present should be encouraged to complement recycle station monitoring with back-of-house sorting, whereby filled bags or bins from monitored stations are collected, and opened to allow for the contaminants to be removed. By using recycle station monitoring in combination with back-of-house sorting at large events and events with a large number of food vendors present, the public education benefits of monitoring are maintained, and contamination reduced significantly, thereby facilitating the task of sorting back-of-house. Unlike the monitoring of recycle stations, which mostly involves interacting with the public, the role of waste sorting is not likely to be easily filled by a volunteer, as it is a messier and generally less desirable task. In a survey⁵¹ of 13 volunteers who participated in the pilot research as Recycling Educators, only 53% stated that they would be willing to work in a waste sorting role in a volunteer capacity, as compared to 85% of volunteers who stated that they would be willing to work as a Recycling Educator again, after their first experience. Although event organizers who are considering this option should expect to pay some staffing costs, they need not be prohibitively high. Sorting can be done either on-site, by staff hired by the event organizer, or after the event is complete by the waste hauling company servicing the event.

6.1.2 Employ best practices in recycle station monitoring

As indicated by the results of the pilot research at large events, as well as the reports of other greening events experts⁵², if volunteers are unmotivated, lacking knowledge, or unable to keep up with the pace

⁵¹ Survey used convenience sampling method and was not necessarily representative of all volunteers who participated in research.

⁵² In a waste management report addressing the CoV's experience with greening events efforts at SummerLive in 2011, it was reported that over 95% of bins were contaminated. Common problems included a lack of knowledge

of waste disposal, the rate of contamination will be likely to increase. The following list of recommendations reflects the researcher's experience in coordinating recycling educators for the duration of the study as well as the practices employed by four of the greening event experts interviewed⁵³. The first two items are identified as priority items that have the greatest effect on contamination of waste diversion streams.

- **Priority 1:** Ensuring the presence of a waste reduction coordinator who can support recycling educators in their role by answering questions, coordinating breaks, ensuring that volunteers remain on task and providing any supplies required (i.e. gloves, tongs, etc.). This coordinator should be an expert on the proper sorting of waste items and should be able to provide early and ongoing support to Recycling Educators at the event to ensure that they are providing the public with accurate sorting information.
- **Priority 2:** Posting a minimum of two monitors per 4-bin recycle station. If more than 4 bins are clustered together or if the station is situated in a highly trafficked area, proportionately more recycle station monitors are needed. The results of the pilot research suggest that no more than 8 bins (i.e. two clusters of 4-stream clusters) should be placed together in any given location as this makes monitoring of bins by Recycling Educators much more difficult, affecting contamination levels.
- Providing monitors with pre-event training, using a waste sorting guide and/or physical examples of common waste items and ongoing check-ins during event whereby coordinator verifies the contents of each stream and corrects any items that have been improperly sorted by Recycling Educators.
- Placing a strong emphasis on the volunteers' contribution to the greening of the event in order to instill a sense of pride in their role and to minimize the stigma associated with jobs pertaining to the management of waste. This can be achieved by referring to these volunteers as "Green Ambassadors", "Recycling Educators", or members of the "Green Team".
- Coordinating recycling shifts to be no longer than 3-4 hours when possible in order to ensure that the volunteers can maintain focus for the entire duration of their shift.
- Equip recycling educators with protective gloves, hand sanitizer, as well as tongs and/or "trash grabbers" (see Figure 13, below) for removing improperly sorted items from streams.
- Rewarding recycling educators with volunteer benefits, such as food vouchers (to be used at the event), a volunteer appreciation party, or a certificate of recognition. In a survey of 13 volunteers who participated in the pilot studies as Recycling Educators, these three options were selected as rewards that would be most appreciated by an even percentage of volunteers (28% each, as compared to 14% who preferred event t-shirts).

among volunteers (which translated into difficulty differentiating between items belonging to different streams), volunteer attendance issues, and language barriers which posed challenges to interacting with the public.

⁵³ Maryanne MacDonald (Waste Free World), Eyal Lebel (independent waste reduction coordinator), and Liliana Segal (Green Chair Events), Ian Williamson (Metro Vancouver)

Figure 13: Recycling Educators using “Garbage Grabbers” at Sunrise Kickoff the Summer Event



6.1.3 Employ best practices in back-of-house sorting

Back-of-house sorting is used by green event coordinators primarily on a casual basis to support front-of-house sorting efforts rather than as the primary contamination control method⁵⁴. Among the green event coordinators interviewed, only one reported utilizing this method exclusively. Therefore, the majority of back-of-house sorting methods shared were not logistically complicated or refined. The following is a summary of the strategies employed by Rod Grant, the City of Surrey’s greening event contractor, who had the most developed strategy for back-of-house sorting among those interviewed. These strategies are combined with the researcher’s experience. Note that the first item is identified as the single most important in order to ensure that back-of-house sorters are effective in removing contamination from streams.

- **Priority:** Schedule one sorting coordinator per back-of-house sorting station who is knowledgeable about the streams in which all waste items belong and who can provide assistance and answer sorting questions as needed.
- Hire staff from local charities or social enterprises to conduct sorting. Provide these staff with hourly wages and provide the organization to which they belong with the profits generated from the refundable containers. Note that this may require adjustments to the unofficial city policy encouraging the activities of bottle collectors, because if the partner organization is counting on making a significant profit from the refundable containers, front-of-house recycling educators

⁵⁴ Reasons cited included: the associated staffing cost for back-of-house sorting due to the undesirability of the role to most volunteers and the lack of public education as compared to using recycling educators.

would need to be trained to discourage bottle collectors from removing items with a deposit value from bins.

- Provide sorting staff with easy access to water for cleaning the sorting area and a custom-made table at waist height with holes under which bags or bins can be placed for each stream.⁵⁵ Table can be designed to drain into portable sink by building in a slight slope to table design (as depicted in Figure 14, below).

Figure 14: Back-of-House Waste Sorting Station Used by City of Surrey at Canada Day Event 2013



⁵⁵ These can be custom made for approximately \$500 by a carpenter that is acquainted with Surrey greening event expert, Rod Grant

Figure 15: Back-of-house Waste Sorting Station Used at Celebrate! Stanley Park Event 2013



- For large events, schedule sorting staff to work for a shift that is slightly offset from the beginning of the event, as it may take a few hours for bags to be filled. For large events at which the bagged waste can be left overnight and for a second shift should be scheduled on the following day after the event is complete. For small events (under approximately 5000 people in attendance), schedule sorting staff to work for 1-2 hours after the completion of the event.
- Provide a waste sorting area that is cordoned off from the public and covered by standard 10x10 tents to protect sorters from rain or sun.
- Consider the appearance of the waste sorting station if it is made visible to the public. Note the differences in the waste sorting station depicted in Figure 14, a site that was visible to the public, and the waste sorting station in Figure 15, a site that was not visible to the public.
 - As demonstrated in Figure 14, providing signage identifying the area as a waste sorting station and identifying the different streams into which waste is being sorted is both visually appealing and can help remind attendees that the event organizers are taking measures to reduce waste and to encourage them to do the same.
 - Although less visually appealing, the simple waste sorting station depicted in Figure 14 was low in cost and very effective. Bags were opened and sorted on the tables and then placed into the small recycling bins according to stream prior to being dumped into the larger bins on the right.

7.0 Recommendations

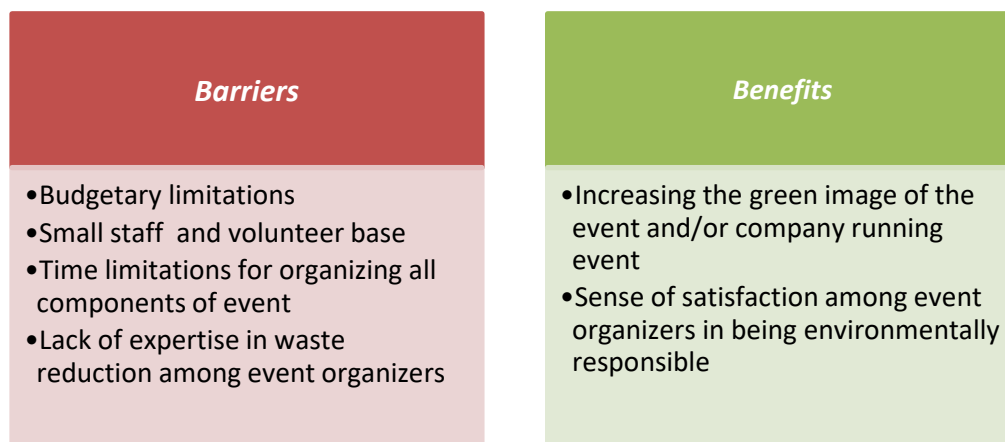
7.1 Ways in which the City can encourage event organizers to adopt waste reduction strategies

Adherence to the recommendations set out above suggest a fundamentally new direction for the management of event waste, whereby event organizers ensure that waste streams are actively managed by volunteers and staff to maximize waste diversion rather than simply providing bins and coordinating their pickup by a waste hauling company. It is notable that at two of the pilot events, event organizers were not going to provide bins for all waste streams, until contacted to participate in the pilot study⁵⁶. One event had planned to provide only bins for container recycling and another had planned to utilize only small 60L household blue bins for single-stream recycling, in order to cut down on waste management costs. Therefore, the premises of the pilot study (availability of bins for all four waste streams) actually exceed the present waste reduction efforts being undertaken by many event organizers. In addition to encouraging event organizers to monitor and actively manage waste onsite at events, the city's efforts will also need to promote the use of four-stream recycle stations.

The means by which event organizers could be encouraged to move from the “out of sight, out of mind” waste management model towards a resource recovery model can be better understood by utilizing the CBSM “barriers and benefits” framework that was introduced in Section 3. The event organizers of the five pilot events included in this study cited four common barriers to the implementation of waste reduction measures. These included: 1) budgetary limitations; 2) a small volunteer base (relative to a large number of event-day tasks), 3) a lack of knowledge about contamination reduction and overall waste reduction measures, and 4) insufficient time to dedicate to coordinating the onsite waste reduction efforts. The event organizers for each of these five events were nevertheless very interested in adopting waste reduction measures, and perceived two main benefits of doing so: 1) increasing the “green” image of their event to funders and event attendees, and 2) being environmentally responsible (i.e. managing the event in a manner that is consistent with injunctive norms surrounding recycling). For a summary of barriers and benefits to the introduction of waste reduction strategies at events, see Figure 16, below.

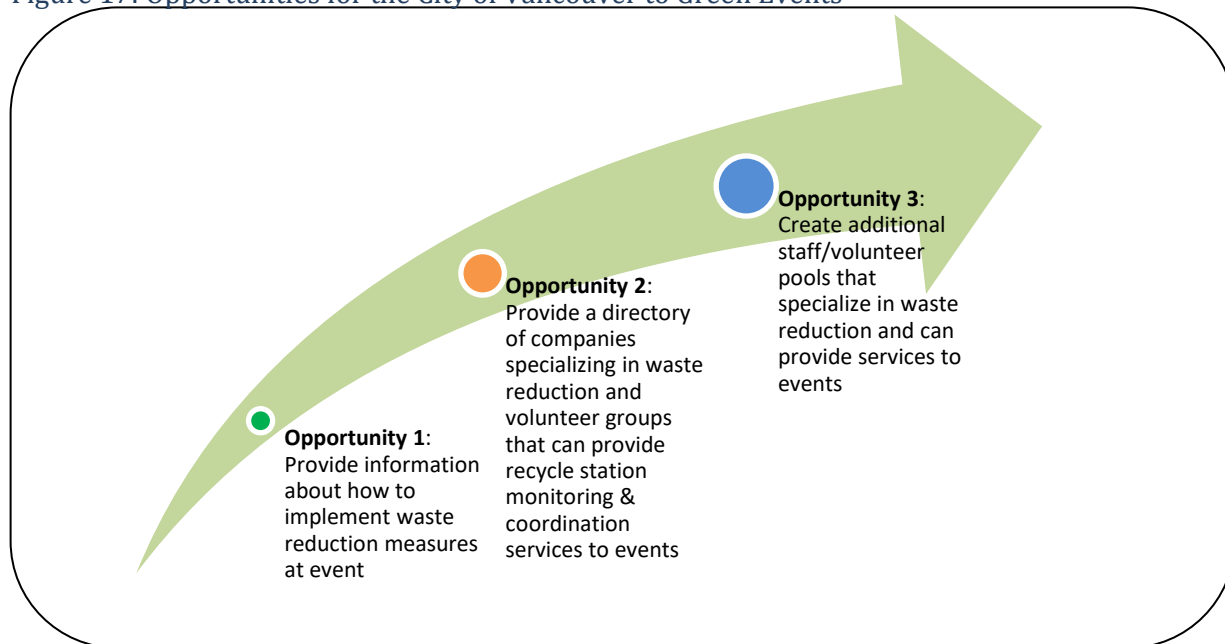
Figure 16: Barriers and Benefits to the Introduction of Waste Reduction Strategies at Events

⁵⁶ This is notable because the design of the pilot study addresses only contamination of bins when all four streams are present. If fewer than four streams are being utilized, waste is likely to be increased because more items will be thrown in the garbage by default.



The City of Vancouver may implement several policies to encourage event organizers to adopt waste reduction measures which address these barriers, as depicted in Figure 17. These options are not mutually exclusive, nor do they preclude the option of taking punitive measures to enforce responsible event waste management practices. However, by providing assistance to event organizers in addressing the barriers to implementing waste reduction efforts by using these three approaches, this may ease the transition from carrot to stick policies in encouraging the greening of events. The policy options in Figure 17 range in their ability to address barriers to implementing waste reduction efforts. Opportunity 1 addresses the barrier posed by event organizers' lack of expertise, while leaving the issues of time, staffing, and financial limitations unaddressed. Opportunity 2 may help event organizers address all but the financial barriers to their waste reduction efforts, as the availability of volunteer pools is presently limited. Finally, Opportunity 3 has the potential to provide a greater range of greening event service and staffing options, thereby minimizing all barriers to implementing waste reduction efforts.

Figure 17: Opportunities for the City of Vancouver to Green Events



The City has already taken steps to introduce the first measure—providing information about how to implement waste reduction measures at events—through the introduction of the Green Event Guide and the Green Event Form. This approach addresses Barrier 4 (lack of expertise), by making the knowledge required to adopt waste reduction measures readily available to event organizers. This approach may also address Barrier 2 (financial limitations)—by providing information that an external consultant might otherwise provide—for event organizers that have the staff and time to put these green event tips into practice at their events. It does not however reduce financial barriers altogether, as additional staffing costs may need to be incurred to effectively manage waste at events if the event organizer cannot recruit volunteers to fulfill these roles.

Additional steps could be taken to refine the information provided in the Green Event Form to reflect the findings of this study. In order to provide a clear message about the value of recycle station monitoring, it is recommended that greater point value is placed on the presence of Recycling Educators in the green event guide. Furthermore, an additional point category should be provided for the presence of a dedicated Coordinator of Recycling Educators. For large events and events with many food vendors, a point category should be added to encourage back-of-house sorting as well. The Green Event Guide could also be updated to include best practices in recycle station monitoring and back-of-house sorting outlined in Section 6.1.2 and 6.1.3 above. Additional recycle station volunteer recruitment letters, posters and training materials could also be provided in the appendix of the green event guide to facilitate volunteer coordination and training. Further multimedia training resources could be provided on the City’s website such as a waste sorting video or a waste sorting quiz/game which event organizers could share with Recycling Educators prior to their event.

The second measure that could be taken by the City—providing a directory of companies specializing in waste reduction—can be easily integrated into the Green Event Guide by adapting the listing of service

providers that is currently included in the guide. This directory should allow event organizers to easily differentiate between the services provided by various companies so that they can easily identify which would best suit their needs. This table should highlight those companies that can be hired to provide a team of recycling educators to monitor recycle stations, and/or to provide back-of-house waste sorting services at a minimum. For a sample table that could be included in the Green Event Guide, see Figure 18, below.

Figure 18: Sample Greening Event Service Directory⁵⁷

Waste Management Service	Green Chair Recycling	Strategin Solutions	Recycling Alternatives	Smithrite	Supersave	Waste Management	Urban Impact
Bin provision and waste pickup	✓	✓	✓	✓	✓	✓	✓
Provision of recycling options for unusual items (i.e. #7 plastics)							
Training for Recycling Educators	✓	✓	✓				✓
Recruitment and supervision of Recycling Educators	✓	✓					
Back of house sorting	✓	✓					
Ecological footprint measurement	✓	✓	✓				✓
Waste diversion measurement	✓			✓	✓	✓	✓

To complement this company directory, the names of additional volunteer organizations that are able to provide volunteers to help monitor recycle stations at events free of charge could be provided. Based on the researcher’s experience, the organizations whose members are most actively seeking volunteer opportunities are placement agencies for overseas students looking to study and gain volunteer experience in Canada. Many organizations with a sustainability focus already have extensive commitments and may not be able to commit to being “on-call” recycling educators for events. Therefore permission should be sought prior to listing any organizations in the green event guide.

The final measure that could be taken by the City would be to take an active role in creating staff or volunteer pools that could service events as green event coordinators and recycling educators. Although several companies do exist that provide waste reduction services, Green Chair Recycling is the only company in Vancouver that provides an all-in-one service that includes green event coordination and staffing of recycle stations. Furthermore, recruitment for the five pilot events confirmed that few volunteer organizations are presently equipped to formally provide recycle station monitoring services and those that are equipped to do so are in very high demand and therefore not often available upon short notice. If the city is going to encourage recycle station monitoring and back-of-house sorting for all events, a greater number of affordable staffing options will need to be made available. One potential

⁵⁷ Note that this table is a sample only and does not reflect actual waste services provided by waste management companies

strategy that the city could take to increase the availability of green event volunteers would be to provide funding to organizations that are looking to offer zero waste services to events, with an emphasis on green event coordinators, staffing for recycle station monitors, and back-of-house sorters. This funding could be provided through existing grants such as Generation Green Grants or Greenest City Community Grants.

A complementary strategy that could be employed by the city is the creation of a team of green event coordinators that could be made available for events that are seeking a green event coordinator to provide expertise on recycle station setup, recycle station volunteer coordination and training and coordination of back-of-house sorting, if necessary. This model has been implemented by the City of Portland, Oregon, which runs a “Master Recycler” program. Participants in this certification program are trained on thoughtful consumption, waste reduction, recycling and composting practices in an eight-week course and commit to volunteer 30 hours of providing community outreach services that provide them with experience utilizing their knowledge. In order to fulfill the volunteer requirement, many of these Master Recyclers work with event organizers to create a waste reduction plan, as well as train and coordinate green event volunteers at events.

While smaller in scope, another measure that could be taken is the creation of a part-time summer student waste reduction coordinator position who would be employed to supervise events that use the City’s waste management services. If paired with pre-and post-event consultation with event organizers, this coordinator could contribute to capacity building in green event practices among event coordinators. Furthermore, the coordinator could provide audits of events in order to verify which greening event measures that were reported to be used in the Green Event Form are actually being practiced on the ground. The presence of a green event coordinator could also help to ensure that city-serviced events are being run in a sustainable manner, which is a priority that has been identified by the City. Additionally, it could also provide value-added to the present portfolio of services provided by the City’s Sanitation Operations⁵⁸. It is recommended that this position is not added to the responsibilities of the City’s Green Event Coordinator because of the nature of the role: this position would require frequent weekend hours, and a set of skills and experience which would be better suited to an entry-level/student position⁵⁹.

A final means by which the City could contribute towards increasing greening event service options is by engaging with businesses that presently provide bin delivery and waste pickup without the additional waste reduction services in order to increase the range of services provided. At the very minimum, these companies should be encouraged to provide waste sorting guides that highlight which items can be sorted into the various garbage, food scrap and recycling streams. This is important, as the waste

⁵⁸In conducting the five pilot events, the researcher assumed the role of ad-hoc green event coordinator. This experience confirmed that there is a demand for these services among event organizers.

⁵⁹ The City of Vancouver has had success utilizing pools of enthusiastic, knowledgeable and skilled students in the past, with the Green Ambassador program. This team was paid \$14/hour to help disseminate information about the Green Bin program to Vancouver residents in the summer of 2013, and was hired through the consulting firm Edelman.

sorting rules vary from one waste hauler (and their partner processing facility) to another. Therefore, if the City were to assemble a training guide or video, it would only apply to the sorting rules used by the processing facilities that are used by the City of Vancouver.

One additional action that the City could take to enhance the *benefits* of event “greening” and introducing waste reduction measures is the introduction of an award system which recognizes events that have taken measures to become more environmentally friendly. Green event and recycling awards have been pioneered by organizations such as the Recycling Council of Ontario⁶⁰ and A Greener Festival⁶¹ (AGF), using different models. That which is used by AGF is based on a system whereby event organizers pay a fee to cover the costs of conducting the greening event audit, and receive a discount on the cost of insurance for the event through an insurance organization that has partnered with AGF. The researcher’s experience working with event organizers over the summer is that event organizing businesses and organizers that rely heavily on sponsorship highly value the positive publicity that results from greening event measures, as it can help in seeking out sponsors and in drawing the public to the event. Therefore, an awards system that formally recognizes organizers for their efforts and enhances publicity opportunities would be likely to be highly valued.

Summary of Recommendations

Recommendation 1: Adapt the Green Event Form rating scheme to strongly emphasize the presence of Recycling Educators and add a point-category for 1) the presence of a Coordinator of Recycling Educators and 2) the use of back of house sorting (for large events and events with a large number of food vendors only). The presence of monitors should be allocated a greater number of points relative to back-of-house sorting in order to reflect the capacity of monitors to contribute to public education.

Barrier addressed: lack of expertise

Recommendation 2: Create a City of Vancouver Recycling Educator package and make it available on Vancouver’s “Green Your Event” website. The package should include a sample recycling educator volunteer recruitment letter and/or poster that can be used by event organizers to advertise the position as well as a training guide and video that the event coordinator can provide to the recycling educator volunteers. This training guide and/or video should highlight which items are accepted and which are not within Vancouver’s municipal recycling and food scraps streams. It should also direct the audience to similar resources that highlight waste sorting rules for other waste hauling companies. It should include many examples of waste items that are commonly generated at events, with a strong focus on the specific food packaging products that are used by food vendors rather than generic images. The guide/video should also be highly visual in order to ensure that it is easily understood by volunteers who are not fluent in English.

Barriers addressed: lack of expertise

⁶⁰ See <https://rcoawards.ca/>

⁶¹ See <http://www.agreenerfestival.com/agf-award/>

Recommendation 3: Update the Green Event Guide to include a more detailed description about the best practices in the coordination of recycling educators at recycle stations and back-of-house sorting, as highlighted in Section 6.1.2 and 6.1.3.

Barriers addressed: lack of expertise

Recommendation 4: Update the Green Event Guide with a business directory indicating what greening events companies exist and the services they provide. This table should allow the user of the guide to easily differentiate between those companies that provide services that are specifically aimed at helping an event to reduce recycling contamination and/or waste generation and those that provide standard pick-up and drop-off of bins and waste. Specifically, this table should highlight those companies that can be hired to provide a team of recycling educators to monitor recycle stations, and/or to provide back-of-house waste sorting services⁶².

Barriers addressed: lack of expertise, limited volunteer workforce, and insufficient time

Recommendation 5: Update the Green Event Guide with a list of organizations that are able to provide volunteers to help monitor recycle stations and/or provide training and recycling educator coordination at events free of charge. Permission should be sought prior to listing the names and contact information for these organizations in the green event guide, as some organizations may already have extensive commitments and may not be able to commit to being “on-call” recycling educators for events.

Barriers addressed: lack of expertise, limited volunteer workforce, financial barriers, and insufficient time

Recommendation 6: Form a regional group of event waste management experts and stakeholders in order to create a shared vision for greening events and work together on emerging issues. Alternatively, include waste management companies that service events in ongoing business engagement efforts in order to improve the range of greening event services they provide. Efforts may include sharing “lessons learned” by the City’s Sanitation Operations, and offering assistance with the development of waste sorting guides and videos that can be provided to event organizers. Like those described in Recommendation 2, these guides should be highly visual and should demonstrate which specific items are recycled or composted by the waste processing facilities that the waste service provider uses, as sorting rules vary from one facility to another.

Barriers addressed: lack of expertise, limited volunteer workforce, and insufficient time

Recommendation 7: Provide funding to organizations that are looking to offer zero waste services to events, with an emphasis on staffing for recycle station monitors or back-of-house sorters. This funding could be provided through existing grants such as those offered through the Vancouver Foundation Greenest City Fund.

⁶² A preliminary scan of local greening event organizations suggest that Green Chair is the only well-established company in Vancouver that offers staff who are free to monitor waste stations, and United We Can is the only organization that formally provides back-of-house sorting services. The latter has only recently begun to explore servicing events in this capacity and should therefore be consulted prior to being referenced in the green event guide. United We Can has also expressed concern with providing waste sorting services in the absence of recycle station monitors.

Barriers addressed: lack of expertise, financial barriers⁶³, limited volunteer workforce, and insufficient time

Recommendation 8: Introduce a recycling coordinator certification program similar to the City of Portland’s Master Recycler program, whereby individuals are trained about best practices in reducing, reusing, and recycling and required to complete 30 hours of volunteer community service applying their recycling skills. In addition to the value of educating community leaders in recycling, this would create a pool of volunteers who would be available to provide waste reduction expertise to event organizers.

Barriers addressed: lack of expertise, limited volunteer workforce, and insufficient time, financial barriers

Recommendation 9: Create part-time summer student position/s for a waste reduction coordinator to assist in the implementation of on-the-ground greening event efforts for events serviced by the city’s Sanitation Operations. Individual(s) working in this role would take responsibility for any combination of the following list of responsibilities: pre-event consultation regarding waste reduction measures and site mapping of recycle station sites, training of volunteer Recycling Educators, onsite coordination of Recycling Educators, onsite assistance with arrangement of bins and coordination of mid-event waste pickup service, and supervision of back of house sorting activities.

Barriers addressed: lack of expertise, limited volunteer workforce, insufficient time, financial barriers

Recommendation 10: Create an awards system recognizing the greening event efforts of event organizers.

Benefits addressed: increasing the green image of the event to funders and event attendees

Additional Recommendation:

- Change wording in the City of Vancouver’s Green Event guide from “Waste Stations” to “Recycle Stations” to maintain consistency with wording used on the flags provided and in order to encourage the shift away from garbage as “waste” to garbage as “resource”

7.2 Ways in which Sanitation Operations better service events

The research findings suggest that the contents of recycling and food scraps bins at city-serviced events are under the contamination level accepted by the city’s processing facilities nearly one third of the time. Therefore, it is recommended that City’s Sanitation Operations services be adapted to ensure that those uncontaminated bins are not being sent to landfill. This would require changes in the logistics of pre-event setup, post-event waste hauling and disposal, as well as additional training of Sanitation Operations staff members who provide services to events.

7.2.1 Pre-event setup

At events where bins for all four streams have been ordered, bins should always be placed in banks of four whenever possible. At present, bin setup falls in the hands of the event organizing team, because Sanitation Operations staff who deliver bins to event grounds often do so the day before an event begins. Under this arrangement, Sanitation Operations staff cannot be held responsible for the

⁶³ Whether or not financial barriers would be addressed by this model would depend on the business model used by the organization (i.e. whether it operated as a non-profit or for-profit organization)

placement of the bins because event-day setup would inevitably lead to their rearrangement. Without converting to the use of clustered bin covers⁶⁴, two measures could be taken to ensure that bins begin to be set up properly. First, the Supervisor of Street Cleaning for Parks and Special Events could ensure that the need for bin clustering was communicated clearly to the event organizer during site mapping meetings (for large events) or phone/email communications (for small events) and the staff who make the pre-event delivery could then re-iterate this message upon their delivery. Second, a City staff member could attend the event and take responsibility for the setup of stations. During the summer of 2013, the Supervisor of Street Cleaning for Parks and Special Events attended several weekend events to move bins into their proper configuration on behalf of event organizers, and provide delivery of special orders such as “Recycle Station” flags and water fountains. In the future, these responsibilities on the day of the event could be shared with the larger group of Sanitation Operations staff members. These staff members could be provided with training and a standard checklist of event set-up procedures in order to properly train and prepare them for this expanded set of responsibilities. Alternatively, if the city begins to explore new staffing or volunteer options, similar to those highlighted in Recommendation 8 & 9, this role could also be fulfilled by a recycling coordinator.

It is recommended that the staff member who assumes responsibility for the setup of bins ensures that bins are placed in clusters of no more than 8 bins in order to ensure that they can be adequately monitored by Recycling Educators, as the waste audit data reveal that events at which bins were placed in clusters exceeding this size had rates of contamination that were consistently higher than the City’s contamination limits. At large events requiring bins to be emptied throughout the event, it is also recommended that the City staff discuss the waste management capacity of the event organizers in order to determine whether or not the City’s waste pickup services will need to be provided during the event. Whenever possible, event organizers should be encouraged to assume full responsibility for servicing waste during the event. Because event organizers use small golf carts to carry the contents of bins to a central pickup location rather than large trucks such as those used by the city, this allows for bins to be more evenly distributed throughout the event, making their use more convenient, and thereby helping to keep litter to a minimum. The researcher noted that in those cases in which events were serviced by the City’s truck prior to the end of the event, bin placement was determined according to where a large truck could easily access bins while large crowds were still present. This meant that bins were located close to the periphery of the event site rather than in the middle, creating large areas in which event attendees would not have convenient access to bins⁶⁵.

7.2.2 Post-event waste management logistics⁶⁶

It is recommended that both a recycling truck and garbage truck be sent to pick up waste from large events. For larger events, a designated recycling truck (identical to those which are used to service households) could be sent to pick up food scraps, mixed paper, and containers. This truck features adjustable internal bulkheads which allow it to hold all three streams in separate compartments, as well

⁶⁴ See Section 7.2.3 for description and advantages of bin covers.

⁶⁵ This also contributed to overflowing onsite street garbage cans, see Figure 21.

⁶⁶ These recommendations have been developed through discussions with Matt Baillie and Dan Campbell, Supervisor of Street Cleaning for Parks and Special Events

as arms which are presently designed to lift 360L waste bins in order to dump their contents into the truck's cargo area. For the purposes of keeping the three waste streams clean and unsoiled, the three waste streams should be stored from cleanest to dirtiest going from front to back: paper nearest to the front, followed by containers, and food scraps, which would be loaded into the back⁶⁷. This would prevent any loose liquids from soiling the paper stream. This recycling truck could be sent out from Manitoba Yards to pick up the recycling and food scraps from an event, deposit the foods scraps at the transfer station at Manitoba yards, and then deposit recyclables at the Urban Impact recycling drop-off site on Kent Street.

By sending a recycling truck to service events rather than only one garbage truck, this would send a clear message to event organizers and attendees that the City is serious about their commitment to greening events. This will become increasingly important as the City increases the demands placed upon event organizers to green their event. Furthermore, it would decrease the risk of negative publicity for the city that results from sending only one garbage truck to all events, including those that may have put considerable effort into the sorting of their food scraps and recyclables.

In order to introduce a recycling truck to provide pickup of waste at events, the City would need to cover the costs of the following:

- Hourly cost of operating the vehicle including driver salary: An additional \$120 per event, permitted the vehicle is only used one time
- Adjusting the arms on the vehicle to be capable of lifting 240L bins (see discussion below)
- Training recycling truck drivers who would be servicing events about acceptable rates of contamination for various streams in order to screen out bins that are too contaminated.
- Securing a contract with Harvest Power and/or EnviroSmart to include food scraps from events in the household stream that is being processed by the companies' composting facilities.⁶⁸

One of two possible logistical changes is recommended to accompany the introduction of a recycling truck. If transitioning away from the use of 240L bins to 360L bins⁶⁹, Sanitation Operations should also supply bin liners for bins of this size. At present, Sanitation Operations only provides bin liners for 240L recycling bins, because the cost of the bags for 360L bins is considered to be too high. A second strategy is to continue using 240L bins, with the less expensive bin liners, and simply adjusting the arms of the recycling truck so that it is able to lift 240L bins, rather than only 360L bins. Regardless of which change is made, it is important that the use of bin liners is preserved because of the increased ease with which lined bins can be emptied.

⁶⁷ It is notable that the cumulative contents of all unmonitored food scraps bins included in each individual pilot exceeded the 1% contamination limit. Therefore, in the short term, unmonitored food scraps bins, may need to be treated as landfill. This approach is also taken by Vancouver's waste hauling company that specializes in recycling.

⁶⁸ At present, the city has received only informal permission from these composting companies to send event food scraps to their processing facilities (See interview notes with Jon McDermott, Appendix F).

⁶⁹ As proposed by Dan Campbell, Supervisor of Street Cleaning for Parks and Special Events. The advantage of the 360L bins is that they can be used at events at which a high volume of waste is expected as the frequency of bin emptying does not need to be as frequent.

At the larger events that the researcher attended, bins were filled and emptied several times over the course of the event. Because bags were used, when bins were full, the crew responsible for the management of the site was able to enter the site and pick up bags with a “gator” or golf cart. Rather than having to be emptied by a Sanitation Operations truck every time a bin is filled, the bag lining the bin can be removed, tied closed, and carried to a central deposit site which can be serviced by a single Sanitation Operations recycling truck at the end of the event. Although this does require some logistical capacity on behalf of the event organizer’s waste management team, the researcher’s experience was that most large events were well prepared to take on this responsibility. At smaller events, bin liners were equally important because in many cases the number of bins provided was insufficient to hold for the volume of waste produced. Having extra bin liners allowed for filled bins to be emptied by the event staff in order to avoid overflowing bins. In the absence of bin liners, bins must be emptied by a Sanitation Operations truck every time a bin is filled—thereby increasing the cost to Sanitation Operations of servicing the event and contributing to the greenhouse gas emissions associated with servicing the event. As described in section 7.2.1, this also leads to the arrangement of bins in locations that are convenient for pickup by a large truck rather than in locations that are convenient for use by event attendees.

It should be noted that the recycling truck that would be used by the City to service events is designed to pick up and empty unlined bins into the open top of the truck’s cargo area. Furthermore, bags are not accepted at either the Urban Impact recycling drop off site or by the food scraps processors. Therefore if bags continue to be used onsite at events, they would need to be emptied into large recycling bins in the back-of-house deposit area in order to be picked up by recycling trucks at the end of the event.

A second logistical detail that should be considered is whether the recycling truck would be used to service both small and large events. Sanitation Operations staff have recommended this “one size fits all” approach because it would be the most straightforward to introduce. If this approach is taken, the underutilization of the cargo space when servicing events with small quantities of recycling could be addressed by coordinating the pickup of recycling from various small events could in one trip. Alternatively, the recycling truck could be used to pickup all waste from a small event, including garbage⁷⁰, thereby eliminating the need for two trucks to be sent. This would however only be possible if an event were using only three waste streams (or if unmonitored food scraps streams were being treated as landfill), as there are only three compartments in the truck. Sanitation Operations may also wish to explore the financial costs and benefits of sending one Jitney to small events, which could carry all recycling and food scraps streams in separate bags, and empty them at Kent St. and/or the transfer station. At these events, clear green bags could be used to easily distinguish food scraps/recycling streams from landfill streams.

At present, the City of Vancouver offers waste sorting services and report-back to event organizers regarding overall waste diversion only under special arrangements for city-sponsored events. If the City

⁷⁰ This would only be possible for very small community events, as the recycling truck does not have the ability to “pack” garbage. Rather, it is carried as a “fluff load”.

is promoting the greening of events, it is further recommended that feedback is provided to all event organizers regarding their waste diversion performance. According to the model of altruistic behaviour highlighted in Section 4, an individual's behaviour can be explained by the interrelationship between various factors including personal norms (i.e. concept of right and wrong) as well as awareness of consequences. Applying this theory, the event organizer's personal norms may only be activated when he or she is also aware of the consequences of his or her actions and accepts responsibility for these actions. At present, the City's waste management model for events upholds the "out of sight, out of mind" management of waste: although the majority of event organizers with whom the researcher worked expressed personal pro-waste diversion norms, they were not be supplied with information regarding the consequences of their waste management efforts—whether good or bad.

The primary barrier to introducing reporting of waste diversion to event organizers is that oftentimes one truck is used to pick up the garbage/recycling for several events prior to returning with a complete load to the transfer station at Manitoba Yards where the scale is located. Under this system it would not be possible to determine the mass of waste that originated from each event. One potential solution to this issue is the estimation of waste based on volume. If each bag from a given event is counted and recorded as it is loaded into the truck, a simple calculation could be made to estimate volume of items for each stream (i.e. 5 x 240L bins landfill, 2 x 240 L bins food scraps, 1 x 240 L bins mixed paper, 2 x 240 L bins containers = 50% waste diversion). Simple adjustments could be made to account for half-full bags and contaminated recycling bags that would need to be sent to landfill.

In order to address financial barriers to waste reduction efforts being used by small events, it is also recommended that a range of service options be made available to event organizers, whereby the event organizer could assume responsibility for bin pickup and/or drop-off, and select whether or not the pickup of waste would be necessary after the completion of the event. If combined with small collapsible garbage bag stands (see Figure 19, below), this would permit a very low cost means for small events to ensure that they provide 4-stream recycling stations. At present, even with the discounted cost of waste diversion bins (at \$10 apiece instead of \$15), ordering several clusters of these bins is too cost-prohibitive, and for very small events, many of the waste diversion bins are underutilized because of the low volume of waste produced. For example, if an event organizer wants to have four recycling stations at their event, this will cost them \$180 (4 garbage bins= \$60 + 12 waste diversion bins= \$120). However, the forecasted volume of waste produced may only require them to have six bins available, meaning that this green option costs double the amount of simply ordering 6 garbage bins (for a total cost of \$90).

Figure 19: Collapsible Garbage Bag Stands



Summary of Recommendations

Recommendation 1: Take measures to ensure strategic placement of bins in four-stream clusters and within convenient walking distance from one another by sending a Sanitation Operations staff member or Waste Reduction Coordinator on the day of the event. Alternatively, the Supervisor of Street Cleaning for Parks and Special Events or Green Event Coordinator could provide detailed advice regarding bin setup using site maps to event organizing team prior to event.

Recommendation 2: Train Sanitation Operations staff who provide bin delivery to events how to set up flags and water fountains. Provide staff with event-servicing checklist which itemizes these extra responsibilities.

Recommendation 3: Send a recycling truck to service all events exceeding 5000 attendees that include recycling bins in their order. For events with fewer than 5000 attendees and no more than 2 food vendors, send one Jitney to pick up all waste and use colour-coded bags to decipher food scraps and recycling from landfill bags.

Recommendation 4: Provide a post-event waste report using volume based assessments to all event organizers regarding the quantity of their waste that was sent to landfill and the quantity that was diverted into the food scraps or recycling stream. Train recycling truck drivers who service events how to identify improperly sorted items and estimate whether a load exceeds acceptable contamination levels in order to determine what waste diversion bags need to be treated as landfill stream.

Recommendation 5: Provide a range of service options that can be adapted to the budget and needs of the organizers of smaller events.

7.2.3 Provision of equipment

Existing equipment

Water fountains and bike racks

During the course of the study, water fountains and bike racks were used at only one of the five events: Pilot 3 and Pilot 5, respectively. Although provided as options on the City of Vancouver website, this equipment had not yet entered routine use. The integration of the provision of equipment into the range of services provided will require staff training and convenient storage of the equipment in areas proximate to the bins that are distributed at events. The researcher’s experience suggested that the roll-out of additional equipment had not yet been integrated into staff’s job responsibilities. For example, Sanitation Operations staff who provide drop-off of bins had not been trained how to set up water fountains—whenever they were used, they were set up by the Supervisor of Street Cleaning for Parks and Special Events. An additional challenge with the water fountains was a concern among event attendees with a tripping hazard posed by the hose attaching the water fountain to the fire hydrant. This issue could be solved with the inclusion of a cord cover to accompany the water fountain. Attendees were also concerned about a slipping hazard posed by the smooth surface of the base of the water fountain, which was often wet from spillage. This problem could be addressed by painting the surface of the water fountain with a grainy anti-slip coating.

Signage and bin holes

In mid-August 2013, all bin labels were replaced with new labels and had holes added. The following observations, in Table 4, below, were made regarding the use of bins before the addition of new labels and holes (Pilots 1-4) and after their addition (Pilot 5). No further changes to bins and signage are recommended at this time.

Table 4: Observations Regarding the Summer 2013 Changes to Signage and Bins at Events

Variable	Observations
Presence of Holes in Lids	<i>Before addition of holes:</i> When bins were placed in clusters in which only one bin had a hole cut out, event attendees would more frequently place improperly sorted items into that bin as a result of not wanting to touch the bin lid. This is likely because they perceived the lid to be dirty. It is therefore recommended that bins are always placed in banks only with other bins containing holes in the lid.
	<i>After addition of holes:</i> it was noted that made the bins more user-friendly, helping event attendees to place their waste into bins when they have their hands full.

	Furthermore, with the addition of the holes, event attendees could read the bin labels as they were disposing of their waste (as the label that is most visible is right next to the hole on the top of the lid).
Presence of Labels on the Back of Bins	<i>Before addition of labels:</i> It was noted that when bins are placed in open areas rather than up against a wall, event attendees often approach bins from behind to dispose of waste items. Items were commonly being sorted improperly in these instances because the bins for different streams were indecipherable from this angle.
	<i>After addition of labels:</i> Many bins were in open areas. Although no quantitative observations were made regarding rate of proper sorting among those approaching bins from the back, it did appear that event attendees were reading the new labels that had been added to the back of the bins—in a few instances in which event attendees were observed approaching bins from behind, they selected the appropriate stream.
Presence of new labels	<i>Before replacement of old labels:</i> Many event attendees looking for direction regarding proper sorting of an unusual waste item were observed to pause to seek direction from the labels but when they were unsuccessful, they appeared to make a “best guess”
	<i>After replacement of old labels:</i> A quick observational study of 13 people disposing of waste at an unmonitored station with new labels showed that only one person did not pause to look at the labels. Four individuals looked at the bin labels and disposed of all of their waste items correctly, three individuals looked at the bin labels and disposed of some of their waste items correctly, and five individuals looked at the bin labels and did not dispose of their waste items correctly. While this is not a representative sample, it does suggest that many people are looking from direction from the labels and that the labels are moderately effective as a standalone tool for providing information regarding proper waste sorting methods.

Potential future equipment

Priority: Garbage bins that can be lined with garbage bags

It is recommended that Sanitation Operations standardize all bins used at events—purchasing recycling bins with a 360L volume or a greater number of garbage bins with a 240L volume—and provide bin liners for all streams. At the majority of pilot events attended, 240L Food Scraps, Mixed Paper, and Container recycling bins, as well as 360L Garbage bins were provided. By providing larger garbage bins than waste diversion bins this sends the message that the garbage bin should be the primary option for disposal of waste items, when, under a resource recovery model, the reverse is true. Additionally, even after the addition of new labels and holes to bins, many garbage bins that were in use at Pilot 5 remained unlabelled and without holes. Most problematically, the 360L bins are consistently unlined, as the City no longer purchases 360L bin liners. As a result, large events that require bins to be emptied on an ongoing basis are dependent on servicing by the trucks used by the City of Vancouver, and cannot empty bins using the golf carts that event organizers frequently have available. In addition to costing more for the City to service these events, this also led to an arrangement of bins that was designed to

easily accommodate pickup by a large truck rather than to ensure convenient use by event attendees (as described in Section 7.2.1).

Bin covers for creating inseparable “clusters” of bins for recycling stations

When bins are not placed in clusters that lack a waste stream, in most cases event attendees will not go out of their way to seek out another row of bins that contains the waste stream they need. For example if the container bin is lacking from the cluster they approach, they will often dispose of their water bottle in the garbage. A challenge that was occasionally encountered was that once bins had been placed in clusters of four, a food vendor would remove a bin from the cluster closer to their own truck or tent for their own use. The City of Vancouver may wish to consider bin covers that physically and visually maintain all bins in a cluster, such as those used by the City of Surrey (see Figure 20, below), or alternatively provide tents for recycle stations that house bins for all streams, as has been used by the City of London (see Figure 21, below).

Figure 20: Bin covers used by the City of Surrey for Recycle Stations



Figure 21: “EcoStation” Tents used by the City of London



Bin covers for existing City of Vancouver garbage cans on streets

One piece of equipment for which several event organizers expressed a need⁷¹ was a cover that could be used to seal off the existing garbage cans in parks and on streets. Standardized bin covers offered by the City would serve several purposes: first, they would allow for events looking to use only bin clusters (whereby garbage bins are accompanied by recycling and food scraps bins) to close all standalone garbage cans. This is considered “best practice” in waste minimization as it discourages the disposal of recycling items in the garbage out of convenience. Second, this would encourage event attendees to use only those bins that the event staff have the capacity to service. What frequently happens at events that are situated on the street is that existing garbage cans, which are relatively small and are not serviced by event staff, become over-filled, leading to garbage spilling out onto the streets. Oftentimes, improvised bin covers such as plastic bags or cardboard affixed with tape are simply ignored or removed by event attendees (See Figure 22, below). This counteracts the efforts of event organizers to keep the event grounds clean and makes it difficult to uphold descriptive anti-littering and responsible waste sorting norms for event attendees to follow. Bin covers provided by the City would ideally be very difficult to remove and would include a message requesting that all waste be disposed of at the Recycle Stations provided.

Figure 22: Overflowing street garbage at the Khatsahlano! Music + Arts Festival 2013



Waste sorting tables

If the City continues to encourage back-of-house sorting, or begins offering this service to event organizers, waste sorting tables would greatly facilitate the process of sorting the contents of bins and bags. A table that could be easily set up on site at an event or at the yards would be the most useful.

⁷¹ Eyal Lebel, Khatsahlano Event Organizers (BrandLIVE), and event organizers who were interviewed during the 2012 summer season expressed a need for such bin covers

8.0 Conclusion and Next Steps

The challenge presently faced by the City of Vancouver is to shift management of waste at events away from an “out of sight, out of mind” model towards a new approach whereby waste is treated as a resource to be recovered and diverted from landfill. In order to realize this shift, the City will need to work with event organizers in order to facilitate the adoption of responsible waste diversion practices including monitoring of recycle stations by Recycling Educators and, at larger events, the use of back-of-house sorting to further reduce contamination of waste diversion streams. Sanitation Operations will also need to take measures to ensure that all uncontaminated recycling and compost items are diverted from the landfill by adjusting logistical operations.

Questions that arose in this research that require further examination are as follows:

- What the costs or penalties incurred by the City for recycling or compost exceeding contamination limits set out in contract with processing facilities (Urban Impact, Enviro-Smart, and Harvest Power)?
- What was the profit generated from the Celebrate Stanley Park event by United we can? Does this organization consider the back-of-house waste sorting model to be sustainable operationally and financially?
- What waste reduction services are provided by the companies presently servicing events? (Collect data for all rows highlighted in Figure 18)
- What is the comparative cost per volume of waste of onsite back-of-house sorting and city-run back-of-house sorting? Is it financially and operationally sustainable for Sanitation Operations to continue providing back-of-house sorting services?

By conducting further research into these areas and pursuing the recommendations contained in this report, the City of Vancouver stands to contribute significantly to the diversion of waste from the thousands of events that occur in the city every year.

Sources Cited

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50:179.
- Cialdini, R., R. Reno & C. Kallgren (1990). A Focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 58: 1015.
- Cialdini, R., L. Demaine, B. Sagarin, D. Barrett, K. Rhoads & P. Winter (2006). Managing social norms for persuasive impact. *Social Influence* 1: 3.
- Duffy, S. & M. Verges (2009). It Matters a Hole Lot: Perceptual Affordances of Waste Containers Influence Recycling Compliance. *Environment and Behaviour* 41: 741.
- Ewing, G. (2001). Altruistic, egoistic and normative effects on curbside recycling. *Environment and Behavior*, 33:733.
- Kraft, P., J. Rise, S. Sutton, E. Roysamb (2005). Perceived difficulty in the theory of planned behaviour: Perceived behavioural control or affective attitude? *British Journal of Social Psychology* 44: 479.
- McKenzie-Mohr, D. (2011). *Fostering sustainable behaviour: An introduction to Community-Based Social Marketing*, 3rd ed., New Society Publishers. Gabriola Island.
- Oom Do Valle, P., E. Rebelo, E. Reis, & R. Menezes, 2005. Combining behavioural theories to predict recycling involvement. *Environment and Behavior* 37: 364.
- Taylor, S. & P. Todd (1995). Understanding information technology usage: A test of competing models. *Information Systems Research* 6:144.

Appendix A: Key Terms

- *City's contamination limits*: the target contamination level, expressed as percentage of total that is delineated in the contract between the City of Vancouver and processing facilities
- *Event organizer*: Used to refer very broadly to those who are involved in decision-making pertaining to the operation of the event. At larger events, there may be multiple organizers who assume different areas of responsibility (i.e. volunteer coordination, logistics, etc.)
- *Recycle stations*: clusters of four bins including one mixed paper recycling, one container recycling, one food scrap, and one garbage bin.
- *Recycling Educators*: volunteer recycle station monitors; this name reflects the emphasis placed on educating and assisting the public to place their items in the correct waste stream
- *Waste Diversion Streams*: used in this report to include recycling, compost, and landfill
- *Waste sorting behaviour*: the act of separating recyclable and compostable waste items from items that must be sent to landfill. In this report, the behaviour mediating waste diversion is described as "waste sorting" rather than "recycling" because it implies that attendees are taking the time to separate all waste items into the proper streams. "Recycling" behaviour itself can actually decrease waste diversion if the proper items are not being placed into the recycling bin.
- *Large events*: For the purposes of this study, large events are those that have 50,000 or more attendees per day
- *Medium events*: For the purposes of this study, medium events are those that have roughly 10,000-25,000 attendees per day
- *Small events*: For the purposes of this study, small events are those that have 5,000 or less attendees per day.

Appendix B: Back-of-House Sorting

Post-event Waste Sorting Shift Duration

Event	Number of attendees	Number of sorters (incl. researcher)	Trained or new (excl. researcher)	Time required (hours)	Mass of waste sorted (lbs)	Number of bags sorted	Setup and supplies used	Total number of man-hours	Speed of sorting (mins/lb)	Cost
Pilot 1	4,500	4	New	2.5	207.5	16	No tables, one scale, tongs, gloves	10	2.89	TBD-calculate based on wages of recycling truck drivers
Pilot 2	2,500	3	New	2	106.5	16	No tables, two scales, tongs, gloves	6	3.38	TBD (see above)
Pilot 3	100,000	9 for 3 hours 6 for 2 hours	2 Trained, 6 New	5	1014	52	Makeshift tables, two scales, tongs, gloves	39	1	TBD (see above)
Pilot 4	13,000	5 for 1 hour, 4 for 30 mins	1 Trained, 3 New	1.5	190.4	15	Make-shift tables, two scales, tongs, gloves	7	2.2	TBD (see above)

Onsite Back-of-House Waste Sorting Shift Duration

Event	Number of attendees	Number of sorters (excl. researcher)	Trained of new (excl. researcher)	Time required (hours)	Mass of waste sorted (lbs)	Setup and supplies used ⁷²	Total number of man-hours	Speed of sorting (mins/lb)	Cost
Surrey Canada Day	100,000	4 sorters & 2 supervisors	Sorters new, supervisors trained	Day One: 14 Day Two (after event): 8	Final numbers not received at time of report submission. Contact: Rod Grant	Custom-made table with holes, standard garbage bins, gloves, tents	88 from staff and 44 from supervisors	TBD (calculate based on mass of waste sorted)	\$10.25/hr for staff = \$1,353.00 total
Pilot 5	10,000-15,000 per day for two day event	3 sorters & 1 supervisor	All staff new to onsite event sorting but supervisor had experience in recycling at UWC warehouse	Day One: 8 Day Two: 8	Final numbers not received at time of report submission. Contact: Dan Campbell (CoV) and Gerry Martin (United we Can)	Four standard 6ft long folding tables, 10 recycling bins used to hold waste for different streams, gloves, 2 tents ⁷³	48 from staff and 16 from supervisor	TBD (calculate based on mass of waste sorted)	\$12.50/hr for sorting staff and \$25 for supervisor = \$1000 total

⁷² See Figures 14 and 15

Appendix C: Bin Signage

Signage introduced August 2013



Signage in use prior to August 2013



Appendix D: Zero Waste Training Guide

Why do we need Recycling Educators?

Diverting recycling and organic materials contributes to the reduction of solid waste from the landfill or incinerator and reduces negative impacts on the environment. The City of Vancouver provides bins at events for four waste streams: paper recycling, container recycling, food scraps, and landfill. Without the help of recycling educators, recycling streams can become contaminated with improperly sorted items, and end up as garbage. Recycling educators help to prevent contamination from happening, thereby keeping landfill waste to a minimum.



Your role as a Recycling Educator:

For the duration of your shift, your role is to ensure that attendees properly sort their waste into the bins provided and keep the recycling and food scraps stream contaminant free. To do this, you can:

-Direct those who bring their waste to the station to use the proper bin for their items.

-If the station becomes too busy to keep up, you may also use the tongs provided to remove improperly sorted items from one bin and place them into another.

During your shift:

- When interacting with the public, maintain a friendly and helpful attitude. Don't worry if someone puts something in the wrong bin, just let them know which bin it belongs in and use the tongs to dispose of the item in the proper bin. Most people will try their best when they know that you are watching them!
- Keep an eye on the recycle station bins at all times. One common problem is "copycat" mistakes, where one person puts an item in the incorrect bin and then all those who come later see that item in the incorrect stream and make the same mistake, assuming that it must be correct. For this reason, runaway contamination is a risk. So, when taking breaks, please ensure that at least one monitor is present at the station. If you aren't working with a partner, inform the recycle station coordinator when you are leaving your station.
- Always use tongs when sorting garbage; never place your hand directly in a bin without watching what you are touching, even if you are wearing gloves. You may risk touching sharp objects such as broken glass or needles.

- If things get slow, you may wish to use your garbage grabbers to pick up litter around your station.

Waste Disposal Tips

- If you are uncertain about the proper waste stream for an item, verify with recycle station supervisor if possible. If the supervisor is unavailable, place that item in the landfill stream. ***“If in doubt, throw it out”!***
- Always collapse cardboard boxes prior to placing them in the recycling bin. If they are too large, collapse and place them next to the bin.
- Certain items may consist of different pieces that should be separated before being sorted into the different waste streams. For example, a coffee cup with a heat sleeve and lid should be separated into three streams: container recycling (lid), cup (landfill), and paper recycling (sleeve).
- Always encourage the public to empty liquid from containers before placing them into recycling bins.
- Always check the bottom of plastic containers to determine if they can be recycled or not. There should be a number imprinted on the container that is framed by a recycling symbol. If it is a 1,2,4, or 5 plastic, it can be recycled. If not, it belongs in the waste stream.
- If a paper container is lined with shiny plastic (i.e. coffee cups or disposable food containers) they belong in the landfill stream. Generally it is safe to assume that all coffee cups go in the landfill stream unless they have a 100% compostable label on them.
- Note that while the compost stream is labelled as “food scraps”, you may find that the majority of the items going in are in fact not food, but food-soiled paper. Always place napkins and tissues (clean or dirty) into this stream along with any food container that doesn’t have a plastic lining.
- Unfortunately all clear plastic containers as well as white plastic cutlery labeled “compostable” must go in the landfill.

Proper Waste Stream for Common Waste Items at Events

Item	Incorrect stream	Correct Stream
Dirty Napkins and food-soiled paper dishware	Paper recycling ✘	Food Scraps ✓
Plastic-lined paper coffee cups or dishware	Paper recycling ✘	Landfill ✓
Coffee cup heat protection sleeve	Landfill ✘	Paper Recycling ✓
Tetra-Pak juice boxes	Paper recycling ✘	Container recycling ✓
Plastic drinking straws	Container Recycling ✘	Landfill ✓
Plastic utensils (including those labeled “compostable”)	Container Recycling ✘	Landfill ✓
Wooden skewers and wooden popsicle sticks	Food Scraps ✘	Landfill ✓
Plastic over-wrap (from flats of soft drinks, napkins, etc.)	Container Recycling ✘	Landfill ✓
Styrofoam cups and plates	Container Recycling ✘	Landfill ✓
Clear plastic takeout food containers (#1,2,4,5)	Landfill ✘	Container Recycling ✓
Plastic cups, plates and bowls (#1,2,4,5)	Landfill ✘	Container Recycling ✓
Plastic-lined paper food containers	Paper recycling ✘	Landfill ✓
Wax paper and waxy paper food sleeves	Landfill ✘	Food Scraps ✓
Plastic condiment packet	Food Scraps ✘	Landfill ✓
Paper ketchup/sample cup (dirty or clean)	Landfill ✘	Food Scraps ✓

Appendix E: Use of Sustainable Food Packaging among Food Vendors

The following notes are based on interviews with food vendor owners and/or managers at the EPIC Sustainable Living Festival. While outside of the scope of this research, many waste reduction experts interviewed strongly recommended taking upstream measures addressing the food packaging at events in order to reduce the quantity of non-compostables and non-recyclables onsite. Indeed, waste monitoring is only effective in increasing waste diversion if items are accepted in the waste diversion stream. The table below is intended to provide some insight into barriers and benefits faced by food vendors in purchasing compostable and recyclable packaging which future research may build upon.

Barriers and Benefits to Providing Recyclable and Compostable Food Packaging

Company Name	Barriers	Benefits
Hot Donuts	<ul style="list-style-type: none"> No recognition for greening efforts among customers (do not usually notice packaging) Additional cost 	<ul style="list-style-type: none"> Satisfaction in running business in accordance with personal environmental ethics
Kaboom Box	<ul style="list-style-type: none"> Additional cost 	<ul style="list-style-type: none"> Maintaining green image consistent with their food products (i.e. sustainable seafood) Recognition for environmentally responsible business practices among customers Satisfaction in running the business in a manner that is environmentally responsible
Beljan's Waffles	<ul style="list-style-type: none"> Additional cost is the primary barrier Appearance of food—food doesn't look as appetizing in compostable containers 	<ul style="list-style-type: none"> None identified
Orange Juice Vendor	<ul style="list-style-type: none"> Additional cost 	<ul style="list-style-type: none"> Satisfaction in being environmentally friendly, living in a safe environment
Beavertails	<ul style="list-style-type: none"> As a franchise, franchisees are limited by what the chain headquarters will provide; impromptu sourcing of recyclable food packaging is not allowed because it does not have the branding on it (exception: cutlery) 	<ul style="list-style-type: none"> Desire to be a sustainable and organic franchise

Appendix F: Recurring Zero Waste Recommendations—Interview results

	Upstream measures: regulating vendor supplies	Recycle stations	Use of signage	Use of back-of-house sorting	Use of Recycling Educators
Ian Williamson, Metro Vancouver	Potential actions that can be taken include 1) the event organizers purchasing all of the recyclable dishware and then selling it to the food vendors as a condition of their involvement and then adding an additional \$0.25 fee to all meals to cover the additional cost of sustainable dishware or 2) Issuing a letter/agreement form that all vendors must read, then monitoring their compliance with the terms of that agreement	Best if no alternatives are available; every garbage bin is accompanied by recycling bins	Signage helpful but not sufficient to prevent high contamination	Strongly recommended against using back-of-house sorting method alone; in his experience it is only effective when combined with signage and waste monitors Recycle station monitors can perform preliminary sorting using garbage grabber tool if event attendees do not properly sort their waste items	Experienced working with volunteer group Tzu-chi who are committed to the cause and knowledgeable about waste sorting rules. Recommends working with these kinds of volunteer groups.
Maryanne MacDonald, Waste Free World, London ON	Strategies used with success: 1) City of London banned Styrofoam (at one large, centrally-located park where the majority of festivals are held); 2) Recycling educators acting as monitors for banned materials, whereby if a banned waste item is brought to the recycle station, they determine the food vendor who distributed it and addressing issue with vendor 3) Pre-purchasing materials for backup if vendors not aware of rules	Has used one waste sorting station per 4 food vendors regardless of event attendance Best if no alternatives are available; every garbage bin is accompanied by recycling bins; bins are flipped over indicating that the station is closed when a monitor is not present	Important to recycle stations easy to locate: used tents and flags above the sorting sites to do so. Signage on bins only, signage minimal ⁷⁴ due to the strong reliance on Recycling Educators	Did not use back-of-house sorting. Preliminary sorting performed by the recycle station monitors using garbage grabbing tool.	Educators are highly effective when: 1) drawing from a pool of committed volunteers 2) adequately trained (in advance if possible) 3) provided with reference materials laminated on site 4) supervised by a volunteer coordinator who rotates around the various stations to answer any questions

⁷⁴ See Figure 21 for photo

	Upstream measures: regulating vendor supplies	Recycle stations	Use of signage	Use of back-of-house sorting	Use of Recycling Educators
Jon McDermott, Solid Waste Mgmt	Limited first-hand experience but cited Folk Fest as a success story	Four-stream stations ideal, but stated that the food scrap stream is not presently sustainable; it has been combined with the food scraps from households in limited instances but the current contract with processing facilities does not actually include food scraps from events and the acceptable contamination limits are very hard to achieve at events	No comment	Strongly discouraged the use of back-of-house sorting as a standalone approach; suggested that this would be very challenging due to the contamination of recycling with food waste If back-of-house sorting used, the waste should be sorted as soon as possible (i.e. onsite by volunteers at the event rather than by the S.O. staff at the yards)	Warned against the limitations of this approach. Results from 2011 SummerLive event and annual Celebration of Light show that recycling educators are not effective when: <ul style="list-style-type: none"> 1) they are not dedicated to the cause 2) they do not have supervision/support from a coordinator 3) there are very high peak attendance levels
Rod Grant, Surrey Greening Event Contractor and owner of ICL services, a special event food management company	Strategy used with success: Mandating vendors to use only uncoated paper service ware and compostable cutlery since 2011 (by vendor coordinator who is contracted by event organizer)	Ideally, all recycle stations are monitored; no recycle stations should have garbage bins without being accompanied by recycling and compost bins	Signage is helpful but not sufficient to prevent contamination Found the signage to be most effective when visual (also helps the volunteer Recycling Educators as many are not fluent in English)	Sorted all waste streams (recycling, compost, garbage) without the use of monitors at the Canada Day event in Surrey using paid sorters, with some success but determined to be more cost-effective to pay the waste management company to sort the waste after the event. Waste sorters equipped with rubber-coated gloves, aprons, and hose for cleaning off station; created a table for sorting (built for only \$500)	Achieved 90% waste diversion (based on cubic feet/volume) when combined with sorting and recycle stations Suggested training recycling educators with a focus on proper sorting of problem items (i.e. dirty tinfoil, coffee cup and lid etc.) Found very high levels of contamination in those instances where recycle stations were not monitored so back-of-house sorting is a bigger job unless recycling educators present.

	Upstream measures: regulating vendor supplies	Recycle stations	Use of signage	Use of back-of-house sorting	Use of Recycling Educators
Liliana Segal and Nicki Casley, Green Chair Recycling	Work several months in advance with event organizers to ensure that rules are put in place so that vendors use only materials that can be composted or recycled	Use of mobile recycle stations on wheels Ensure that all recycle stations are monitored	Due to the important role of recycling educators, signage on bins is minimal ⁷⁵	Back-of-house sorting is used to ensure maximum waste diversion is achieved but emphasis is placed on front-of-house and education of the public	Consistently achieve contamination below 1% with the assistance of R.E.'s, in part because they draw from a pool of repeat volunteers who have become very knowledgeable in waste diversion/sorting rules; has created a feeling of community among R.E.'s, using thank you events etc.
Eyal Sebel, independent greening events coordinator (Portfolio includes: Folk Fest, Make Music Vancouver, EPIC Sustainable Living Festival)	Mandating food vendors to use compostable food containers significantly contributes to keeping waste to a minimum. In order for food packaging rules/restrictions to be effective, vendors need to sign a legally-binding clause that requires them to comply or face fines Event organizers should have compostable food and drink containers readily available to sell to food vendors	All standalone waste bins should be closed so that recycle stations with four streams are the only option available; city should provide bin covers that can cover existing garbage bins and direct public to recycle stations at events When using R.E.'s, can provide only waste diversion bins (paper, containers, food scraps) and have garbage bag to the side to make that stream most difficult to use At enclosed events, stations should be placed at "bottlenecks" (i.e. entrance to event), at unenclosed street events, stations should be placed at every intersection and in the middle of the block in order to ensure that one station is always in sight and convenient to use	Signage is helpful but not sufficient to keep contamination at acceptable levels; the presence of R.E.'s is imperative to prevent excessive levels of contamination	Back-of-house sorting a less desirable job among volunteers than monitoring recycle stations, best if used only as a back-up option at large events Typically takes at least a half day for bins to fill so starting sorting activities a few hours after event begins is best for large events; for small events, sorting can be done after event is over Equipment needed: stands with plastic bags, hose, gloves, tarp to lay waste items out on the ground	Recommends that the City introduce requirement for events to have a minimum number of R.E.'s according to expected number of event attendees Ideal length of shift for R.E.'s working outdoors: 3-4 hrs, or 4-6 for indoors R.E. Coordinator is important to provide training and ongoing support at event Ideally use two R.E.'s per station When recruiting R.E.'s best to recruit for that role specifically because you get more dedicated volunteers Reward volunteers with food, t-shirts, and certificates

⁷⁵ See: <http://www.greenchairrecycling.com/inspiration/photos> for photos of recycling stations used by Green Chair Recycling

	who do not come prepared.				
--	---------------------------	--	--	--	--

Appendix G: Key Points from Stakeholder Interviews

Contact and Organization Name	Key points from interview
Gerry Martin, General Manager, United We Can	<ul style="list-style-type: none"> • For several years, United We Can has been involved in different capacities in assisting events to maximize diversion of recycling from the waste stream. • Currently in transition, may be moving from a model focusing on providing recycling services for items with a deposit value to providing waste sorting services for all streams at events. • Prefer to provide back-of-house sorting services only to events that are using recycling educators to monitor stations as this helps to keep contamination low and maximizes the amount of containers with a deposit value remaining in bins. • United We Can is experimenting with using the value accrued from deposit containers to cover cost of truck so event organizers only have to pay for the wages of back-of-house sorters (\$12.50/hr for sorting staff and \$25/hr for supervisor). • Due to large pool of staff, not likely to be an “upper limit” to the size of events that could be provided with back-of-house sorting services by United We Can. • A model that has been used in the past at the Vasaki Festival has been organizers paying for recycling truck and driver only. Rather than pay bottle collectors an hourly wage, they were provided with portable carts called “Urban Binning Units” provided by United We Can to collect bottles and were allowed to keep 100% of the profit.
J Lauren Norris, Coordinator, Portland Master Recycler Program, (Portland, Oregon)	<ul style="list-style-type: none"> • Master Recycler program is offered to adults (18 and over) with an interest in reducing waste in their own lives and personal/professional networks and consists of an 8-week night class and mandatory volunteer hours. • Since 1991, 1230 Master Recyclers have completed the program, which is run three times per year and is in very high demand. • In order to receive a certificate for completing the course, participants must complete 30 hours of volunteer work applying their recycling skills and knowledge; serving as a green event coordinator is a very popular option. • The project coordinator has established relationships with companies and organizations that are in need of waste reduction and recycling experts and helps to put Master Recyclers in touch with these organizations in order to complete their volunteer hours
Bryan Tasaka, Coordinator of Special	<ul style="list-style-type: none"> • City of Surrey has aimed to minimize waste at four major annual events: Canada Day and Fusion Festival (larger events) as well as Party for the Planet and the Tree Lighting Festival

Events, City of Surrey	<ul style="list-style-type: none"> • Have 12 three-stream recycle stations with built-in signage and removable covers which are used in addition to the bins provided by larger waste haulers at large events • Combine mixed paper and container recycling into one recycling stream in order to keep costs of bins down • Have experimented with providing their own back-of-house sorting station, but are making the transition away from this model for future events because it was determined to be just as cost-effective to pay the waste hauling company (SuperSave) to do sorting at a recycling centre that is equipped to sort single-stream recycling • Challenges with using the back-of-house sorting method: need to coordinate to find staff from a charity, City of Surrey had experience with staff not showing up; also need to have the space and time available to do post-event sorting, as there is a delay between the event's beginning and the production of waste • At City of Surrey Canada Day event, back-of-house sorters sorted through all bags, including garbage bags, in order to remove recyclable items. At Fusion Festival, when SuperSave Paid to sort, both garbage and recycling bin waste items were sent to the recycling facility for sorting.
-------------------------------	--

Appendix H: Frequency of Contamination Summary of Results

Percentage of Monitored Bags with Acceptable Contamination levels

Event Type	Stream	Bags with contamination under limit in City contract (% of total)	Bags with contamination under processing facility limit (% of total)
All (Pilots 1-5)	Mixed Paper	44.44	44.44
	Containers	59.09	100.00
	Food Scraps	57.14	71.43
Large (Pilot 3)	All	20.83	45.83
	Mixed Paper	0.00	0.00
	Containers	37.50	100.00
	Food Scraps	25.00	37.50
Medium (Pilots 4-5)	All	65.52	79.31
	Mixed Paper	85.71	85.71
	Containers	75.00	100.00
	Food Scraps	40.00	50.00
Small (Pilots 1-2)	All	62.50	75.00
	Mixed Paper	66.67	66.67
	Containers	50.00	100.00
	Food Scraps	66.67	66.67

Percentage of Unmonitored Bags with Acceptable Contamination levels

Event Type	Stream	Bags with contamination under limit in City contract (% of total)	Bags with contamination under processing facility limit (% of total)
All (Pilots 1-5)	Mixed Paper	15.79	15.79
	Containers	0.00	44.44
	Food Scraps	33.33	33.33
Large (Pilot 3)	All	28.57	50.00
	Mixed Paper	0.00	0.00
	Containers	0.00	60.00
	Food Scraps	80.00	80.00
Medium (Pilots 4-5)	All	7.69	23.08
	Mixed Paper	20.00	20.00
	Containers	0.00	40.00
	Food Scraps	0.00	0.00
Small (Pilots 1-2)	All	16.67	25.00
	Mixed Paper	20.00	20.00
	Containers	0.00	33.33

	Food Scraps	25.00	25.00
--	-------------	-------	-------

Appendix I: Extent of Contamination Summary of Results

Pilot 1 Contamination Levels of Monitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
2	Paper	6.50	0.10	1.54%
3	Containers	17.00	0.25	1.47%
6	Food Scraps	17.00	0.25	1.47%
1	Landfill	12.50	1.00	8.00%
7	Landfill	10.00	2.00	20.00%
12	Landfill	11.50	3.00	26.09%

Pilot 1 Contamination Levels of Unmonitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
8	Paper	16.00	0.50	3.13%
9	Paper	10.00	2.00	20.00%
15	Paper	17.50	1.00	5.71%
10	Containers	6.50	1.00	15.38%
14	Food Scraps	11.00	1.00	9.09%
16	Food Scraps	34.50	4.50	13.04%
4	Landfill	12.00	1.00	8.33%
5	Landfill	12.50	2.00	16.00%
13	Landfill	13.00	5.50	42.31%

Pilot 2 Contamination Levels of Monitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
2	Paper	5.00	0.50	10.00%
4	Paper	12.00	0.25	2.08%
7	Containers	4.00	0.50	12.50%
12	Food Scraps	6.50	0.10	1.54%
15	Food Scraps	4.00	0.20	5.00%
10	Landfill	9.50	1.50	15.79%
11	Landfill	10.00	0.30	3.00%

Pilot 2 Contamination Levels of Unmonitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
1	Paper	10.50	0.60	5.71%
3	Paper	9.00	1.00	11.11%
5	Containers	3.00	1.50	50.00%
6	Containers	3.00	3.00	100.00%
13	Food Scraps	5.50	0.10	1.82%
14	Food Scraps	5.50	0.50	9.09%
8	Landfill	8.00	2.50	31.25%
9	Landfill	11.00	3.00	27.27%

Pilot 3 Contamination Levels of Monitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
32	Paper	1.50	0.50	33.33%
33	Paper	4.50	1.00	22.22%
34	Paper	0.65	0.40	61.54%
35	Paper	2.50	1.50	60.00%
36	Paper	6.50	1.00	15.38%
37	Paper	3.25	2.50	76.92%
38	Paper	2.50	1.20	48.00%
39	Paper	3.25	1.25	38.46%
16	Container	2.50	0.00	0.00%
17	Container	9.20	0.07	0.76%
18	Container	7.50	1.00	13.33%
19	Container	10.00	0.50	5.00%
20	Container	11.20	1.20	10.71%
21	Container	1.75	0.25	14.29%
22	Container	12.00	1.00	8.33%
23	Container	10.00	1.00	10.00%
24	Food Scraps	13.50	2.50	18.52%
25	Food Scraps	10.85	0.86	7.93%
26	Food Scraps	6.25	0.25	4.00%
27	Food Scraps	12.90	0.40	3.10%
28	Food Scraps	15.10	0.60	3.97%
29	Food Scraps	19.00	0.20	1.05%
30	Food Scraps	12.20	1.70	13.93%
31	Food Scraps	8.17	0.17	2.08%

Pilot 3 Contamination Levels of Unmonitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
6	Paper	5.50	3.50	63.64%
7	Paper	2.70	1.32	48.89%
8	Paper	4.76	1.40	29.41%
9	Paper	5.00	3.50	70.00%
10	Container	6.00	1.50	25.00%
11	Container	2.34	0.34	14.53%
12	Container	7.50	4.00	53.33%
13	Container	10.00	4.00	40.00%
14	Container	4.00	1.00	25.00%
1	Food Scraps	12.10	0.60	4.96%
2	Food Scraps	1.60	0.04	2.50%
3	Food Scraps	16.76	0.26	1.55%
4	Food Scraps	12.08	0.08	0.66%
5	Food Scraps	36.30	0.80	2.20%

Pilot 4 Contamination Levels of Monitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
3	Paper	3.00	0.00	0.00%
4	Paper	15.00	0.00	0.00%
5	Containers	21.00	0.00	0.00%
1	Food Scraps	6.50	0.00	0.00%
2	Food Scraps	2.50	0.00	0.00%
6	Landfill	16.00	0.50	3.13%
7	Landfill	17.00	0.00	0.00%
8	Landfill	12.00	0.50	4.17%

Pilot 4 Contamination Levels of Unmonitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
4	Paper	18.60	1.20	6.45%
5	Paper	19.00	2.50	13.16%
3	Containers	4.60	3.60	78.26%
1	Food Scraps	14.50	4.00	27.59%
2	Food Scraps	19.50	4.50	23.08%
6	Landfill	8.50	3.00	35.29%
7	Landfill	12.70	9.80	77.17%

Pilot 5 Contamination Levels of Monitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
1	Paper	3.09	0.22	7.12%
2	Paper	7.11	0.11	1.55%
3	Paper	5.53	0.03	0.54%
27	Paper	2.13	0.00	0.00%
28	Paper	7.10	0.16	2.25%
5	Containers	4.80	0.05	1.04%
6	Containers	10.73	0.48	4.47%
7	Containers	10.65	0.15	1.41%
8	Containers	3.70	0.34	9.19%
9	Containers	5.18	0.80	15.44%
10	Containers	5.12	0.49	9.57%
11	Containers	5.19	0.00	0.00%
12	Containers	4.00	0.00	0.00%
13	Containers	6.60	0.10	1.52%
37	Containers	2.17	0.00	0.00%
38	Containers	5.78	0.00	0.00%
14	Food Scraps	8.03	0.10	1.25%
15	Food Scraps	16.94	0.19	1.12%
16	Food Scraps	16.01	0.51	3.19%
17	Food Scraps	14.18	0.68	4.80%
42	Food Scraps	4.30	0.61	14.19%
43	Food Scraps	13.36	0.36	2.69%
44	Food Scraps	14.69	1.69	11.50%
45	Food Scraps	0.85	0.04	4.71%

Pilot 5 Contamination Levels of Unmonitored Bags

Bag #	Waste Stream	Bag weight (lbs)	Contamination by weight (lbs)	Percent Contamination (weight)
4	Paper	2.70	2.36	87.41%
20	Paper	4.94	0.06	1.21%
21	Paper	2.90	2.54	87.59%
22	Paper	4.69	1.06	22.60%
23	Paper	0.26	0.05	19.23%
24	Paper	2.93	1.42	48.46%
25	Paper	1.12	0.03	2.68%
26	Paper	1.29	1.16	89.92%
18	Containers	4.00	0.50	12.50%
29	Containers	3.88	2.08	53.61%
30	Containers	5.17	4.54	87.81%
31	Containers	6.00	0.86	14.33%
32	Containers	6.57	2.69	40.94%
33	Containers	11.50	2.00	17.39%
34	Containers	2.64	2.44	92.42%
35	Containers	2.20	1.58	71.82%
36	Containers	8.82	1.69	19.16%
19	Food Scraps	11.44	0.94	8.22%
39	Food Scraps	7.76	0.76	9.79%
40	Food Scraps	1.76	0.26	14.77%
41	Food Scraps	14.10	5.60	39.72%