IMPROVING WASTE MANAGEMENT IN NON-MARKET HOUSING:
Challenges, strategies, and recommendations to get to zero waste

Prepared by Andrew R. Martin
Greenest City Scholar, City of Vancouver
MCRP Candidate, SCARP, UBC
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Image: The Vancouver Landfill, in Delta.

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EXECUTIVE SUMMARY

PROJECT BACKGROUND

The goal of this study is to support the long term vision of zero waste. Advancements are guided by policies from the City of Vancouver's *Greenest City Action Plan*, including a directive to reduce solid waste going to landfill or incinerator by 50% from 2008 levels by 2020. Due to generally low participation rates in zero waste programs, waste management systems in the non-market housing sector were identified as needing closer study to understand prevailing needs, challenges, and opportunities for support.

Waste management streams explored in this study include programs for organics, recycling, garbage, and bulky waste. Housing types studied include shelters, SROs, supportive housing, and non-market rental housing, which together total 634 sites or approximately 13% of Vancouver's multi-unit residential building sites.

A set of strategies was compiled through a literature review and extensive discussions with key stakeholders including building managers, housing operators, waste haulers, and municipal & regional government staff. Input was sought primarily from organizations in the Vancouver region, and additional case studies were obtained from Toronto, Seattle, San Francisco and Copenhagen.

Finally, a set of 25 recommendations was developed for the City of Vancouver. Given the multi-jurisdictional nature of waste management in the region, many of these recommendations will require extensive collaboration with other levels of government, as well as local businesses and non-profit organizations, in order to be implemented. Many recommendations apply to all multi-unit residential buildings.

The approach taken in this research emphasizes the complexity and prevailing inequities present in waste management systems. By the nature of focusing on buildings that house individuals with barriers, it is to be expected that customized approaches and extra support are required in order to see program improvements. Up to this point, there are no programs in place at the City that specifically address the needs of this sector. Numerous stakeholders made clear their readiness to collaborate with the City on improving waste management in their buildings.

Many cities and housing providers globally are struggling with the same issues. This report is a first step, but further study on this topic is sorely needed in Vancouver and internationally.

KEY FINDINGS

Listed below are the prevailing challenges facing waste management programs in non-market housing. In the full report, findings are organized according to challenge type, including a discussion of each challenge with cases and stakeholder inputs, and suggested recommendations specific to the City of Vancouver. The 19 challenge areas are sorted into eight thematic groupings, and are numbered in the full report as they are below.

I. RESIDENT ENGAGEMENT AND MOTIVATIONS FOR WASTE SORTING

Numerous hurdles can exist that prevent residents from participating in waste management systems. Insight into the personal barriers facing residents is essential to develop an understanding of their needs and preferences, so that systems are designed to meet residents "where they are at". The development of positive role models and use of feedbacks on user behaviour can be effective here.

Key challenges:

1. For residents in "survival mode" waste sorting may not be feasible, and housing operators must meet residents where they are at.

2. In all MURBs, waste disposal is anonymous and thus sorting is optional.

3. Waste management program education for residents must be delivered strategically.

4. Residents do not maintain long-term commitment to sorting waste.

II. WASTE MANAGEMENT SYSTEM USER INTERFACE

In many buildings, key infrastructural elements are missing or insufficient. Best practices are often not employed in developing new systems, and overlooked system maintenance is common due to other more pressing priorities and a lack of funding. Systems should be designed to be intuitive and user-friendly, complemented by informative instruction and regular prompts.

Key challenges:

5. Waste sorting is not convenient.

6. Access may be difficult for residents with physical barriers.

III. WASTE STREAM CONTAMINATION

When there is contamination in waste, building operators end up paying more for waste services. Haulers will typically charge customers directly or absorb the cost upfront and recoup it later when service pricing is renegotiated. Many building staff feel ill-prepared to implement new waste streams, with concerns that they will not be cost effective. Hazardous waste in garbage, especially syringes, can be improved through better disposal bin placement, but buildings that produce this contaminated garbage need regulation relaxations and support.

Key challenges:

7. Some buildings have no organics or recycling service at all.

8. Hazardous waste in garbage creates issues at multiple stages.

9. Contamination ruins the value of organics and recycling.

IV. WASTE STORAGE

Numerous problems arise when waste is stored in outdoor public areas, including bin infiltration, messes, and damage. Some buildings have no space for adequate waste storage facilities, even in public areas. In some alleys, substantial concentrations of dumpsters can cause missed pickups and inefficiencies. New models for waste storage, including front-door waste removal, shared waste bins, underground bins, and shared in-vessel composting systems may help to address these challenges for some buildings. Including social and environmental procurement preferences in waste hauler RPFs can bring value-added community benefits.

Key challenges:

10. Waste storage in outdoor public areas creates issues.

11. On-site organics management depends on champions.

Image: A typical alley with many dumpsters and bins in the Downtown Eastside.

V. BULKY WASTE MANAGEMENT & ILLEGAL DUMPING

Disposing of bulky waste according to regulations is often prohibitively difficult and costly for residents and building operators. Prevalence of illegal dumping has increased significantly in Vancouver in recent years, and has become a commonplace way of dealing with bulky waste. Non-market housing sites are a primary target, substantially increasing their waste management costs. New bulky waste management services offered by the City could halt this trend.

Key challenges:

12. Law-abiding bulky waste management comes with significant barriers.

13. Illegal dumping has become commonplace.

VI. SUPPORTING & BUILDING RELATIONSHIPS WITH BUILDING STAFF

Waste management is often not a priority for building staff, due to more pressing issues and lack of motivation. This, compounded by high staff turnover, means building staff need more dedicated support and training. There is potential for new extensions of City waste hauling services to meet unmet needs.

Key challenges:

14. Building staff need more training and support.

15. Building trust and improving city services.

VII. HAULER-RELATED ISSUES

There are mixed reviews of haulers: some operators praise their hauler for extra supportive services provided, while others lambaste their hauler for unfair binding contracts, mischarges, and providing inaccurate data. Haulers face their own challenges, including health hazards and inaccessibility of bins. There is good potential to grow social-purpose haulers, and improve waste data collection efforts.

Key challenges:

16. Issues with pick-ups.

17. Addressing sense of distrust and frustration with haulers.

VIII. BUDGET LIMITATIONS FOR BUILDING OPERATORS

There is an inappropriate distribution of costs: buildings with high contamination rates, prevalence of hoarding, and illegal dumping tend also to be the most challenged to pay for additional waste hauling costs and fines. Many housing organizations that offer meal programs are forced to accept unwanted food donations, which increases their operational costs, disposal costs, and the overall volume of food waste.

Key challenges:

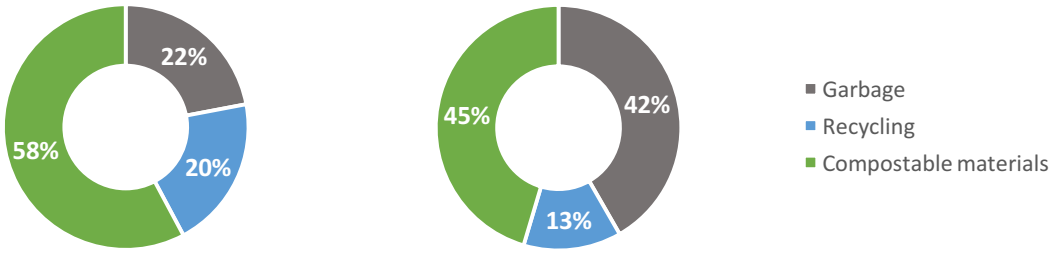
18. Some non-market building operators face additional systemic and situational challenges that put them at a disadvantage relative to other buildings.

19. An inefficient practice of "food donations" puts meal providers in a difficult situation.

WASTE AUDITS

The garbage from four City-serviced SROs and one seniors housing complex together was audited, and was found to contain 78% contamination (material that could have been diverted from the garbage). A similar audit was conducted with garbage from Metro Vancouver Housing Corporation sites located in the City of Vancouver, which contained 58% contamination. The relatively high contamination rate from the SROs and seniors housing suggests a lack of waste diversion programs. Contamination rates for both groups indicate there is significant room for improvement in diversion programs across the non-market sector.

Composition of audited garbage by material type:



Five City-serviced housing sites

Metro Vancouver Housing Corporation sites

RECOMMENDATIONS

The following are recommendations for the City of Vancouver, however many of them require collaboration with external organizations for implementation. In order to reach zero waste, many of these recommendations will have to be implemented at some point in the future. Recommendations are ranked in order of feasibility starting with the easiest to implement at the top, however it is the more challenging policy and systems changes further along in the list that stand to have the largest impact on waste diversion.

SHORT TERM (BY 2020)

1. Update the City of Vancouver Garbage and Recycling Storage Facility Design Guidelines to include examples of waste management best practices (*see Challenge 5*).
2. Revise waste bin volume allocation guides, for both City of Vancouver and Metro Vancouver (*see Assessing Sector Waste Volumes section*).

3. Encourage social and environmental procurement preferences to be incorporated in hauler RFPs (*see Challenge 17*).
4. Encourage public syringe disposal boxes to be emptied and maintained more frequently (*see Challenge 8*).
5. Create a dedicated *Zero Waste Community Engagement Team* within the Solid Waste Management Division solely focused on engaging building staff and residents.
6. Create a program that proactively provides free waste management system consultation to MURB building staff, administered by the *Zero Waste Community Engagement Team.*
7. Create a program that provides free training for MURB building staff, administered by the *Zero Waste Community Engagement Team* (*see Challenge 14*).
8. Create initiatives that build momentum around zero waste ideals, administered by the *Zero Waste Community Engagement Team.*
9. Create a Recycling Ambassadors program with volunteer residents, administered by the *Zero Waste Community Engagement Team.*
10. Encourage BC Housing to specifically fund bulky waste diversion efforts for shelters (*see Challenge 7*).
11. Aggressively target and reduce illegal dumping (*see Challenge 13*).
12. Initiate a pilot of shared waste bins, implemented by a third party (*see Challenge 10*).
13. Implement a pilot of community preferred service agreements for organics and recycling collection from non-market buildings and kitchens with small outputs (*see Challenges 10 & 19*).
14. Expand the selection of waste hauling services offered by the City (*see Challenge 15*).
15. Implement a City-operated bulky waste collection program (*see Challenge 12*).
16. Encourage Metro Vancouver to remove syringes from the banned materials list (*see Challenges 8 & 18*).

LONG TERM (BEYOND 2020)

17. Encourage Metro Vancouver to require waste haulers to collect and disclose data (*see Challenge 17*).
18. Encourage all waste bags to be clear (*see Challenges 2 & 16*).

19. Introduce requirements for new buildings and major redevelopments to follow waste management best practices as part of the development permit application process (*see Challenge 5*).
20. To improve occupational health and safety standards for hauler workers, work towards avoiding direct contact with bagged garbage waste.
21. Encourage Metro Vancouver to standardize recycling practices in the region (*see Challenge 3*).
22. Collaborate with government partners to create a fund for waste management infrastructure and service improvements for non-market buildings (*see Challenges 5 & 7*).
23. Encourage Metro Vancouver to implement policies that permit contamination surcharge exemptions for specific non-market buildings (*see Challenge 1*).
24. Support the establishment of a low-cost food terminal (*see Challenge 19*).
25. Open a small scale resident-only transfer station near areas of high population density (*see Challenge 12, and image below*).

Image: Plans for a new residential transfer station in the urban neighbourhood of Sydhavn, Copenhagen (photo credit: Bjarke Ingels Group).

ACRONYMS & DEFINITIONS

- BIA: Business Improvement Association - an area designated by municipal council in which businesses can collaborate to promote their district.
- CBSM: Community Based Social Marketing - a behaviour change strategy that promotes initiatives delivered at the community level with focus on removing barriers to an activity while simultaneously enhancing the benefits.
- The City: refers to the City of Vancouver, unless otherwise indicated.
- DTES: The Downtown Eastside - a historic neighbourhood in Vancouver, bounded by the neighbourhoods of Gastown, Chinatown and Strathcona.
- EPR: Extended Producer Responsibility – a strategy that makes the manufacturer or distributor of a product responsible for managing and paying for its take-back, recycling and disposal at the end of its life cycle.
- GCAP: Greenest City Action Plan - a strategic policy of the City of Vancouver.
- Hauler: a company, municipal department, or nonprofit organization that is contracted to remove waste from a building and transport it to a waste transfer station.
- MURB: Multi-Unit Residential Building - a residential building with five or more units, commonly referred to as an “apartment building”.
- MVHC: Metro Vancouver Housing Corporation - the public housing agency operated by the regional government of Metro Vancouver.
- Non-market: a residential building where the units are not sold or rented on the general real estate market, and have controls on eligibility for tenancy.
- Operator: a company or nonprofit organization that manages and coordinates the operations of a residential building, sometimes on contract with a public housing agency.
- Organics: food scraps, yard waste, and compostable materials that can be decomposed through an industrial composting process.
- Public housing: a residential building that is funded primarily by government agencies.
- RFP: Request for Proposals - a solicitation, often made through a bidding process, by an agency or company interested in procurement of a commodity, service or valuable asset, to potential suppliers to submit business proposals.
- SHA: The Seattle Housing Authority - the largest public housing agency in King County, Washington.
- SRO: Single Room Accommodation *or* Single Room Occupancy Hotel - a type of low-cost residential building where residents have a simple private bedroom with access to shared bathrooms and sometimes a shared kitchen.
- Waste diversion: diverting eligible waste from garbage for reuse, recycling or composting.
- Waste streams: the available disposal programs for different types of waste, including garbage, organics, cardboard recycling, glass recycling, mixed recycling, etc.

INTRODUCTION

PROJECT BACKGROUND

Zero waste is a philosophy, a means to an end that encourages us to stop and think about how and why waste is generated. Zero waste is also a systems goal, to close the linear process of harvest-production-consumption-disposal so that all waste is reused. This goal is easily defined, yet the path to reach it is affected by numerous uncertainties including human behaviour and political trends. The goal of this report is to support the long term vision of zero waste, by identifying challenges, sharing strategies, and proposing interventions that recognize the complexity and prevailing inequities in present waste management systems.

Part of developing an *equitable* strategy for zero waste means recognizing the diversity of needs and abilities of participants in the system. Where the term *equality* suggests that all participants should be treated equally, *equity* suggests that some participants experience systemic impacts that negatively affect their ability to participate, and thus compensatory measures must be employed in order for them to have an equal shot at participating in the system. In the terms of this project, this means that individuals with barriers need more support and consideration in order to facilitate their effective participation in zero waste programs. This is a foundational principle on which this report is based.

The goal for Metro Vancouver and its 21 municipalities should be: to achieve zero waste through the implementation and operation of equitable and efficient waste management programs. This means that programs must be adapted to meet the needs and abilities of their participants; to "meet people where they're at". The impetus behind this report recognizes that few specialized programs exist that are tailored to the needs of marginalized participants.

Understanding the needs and abilities of people who are the most challenged to participate in waste management programs requires a great deal of insight, access, and study. In conducting the literature review and speaking to professionals who grapple with these challenges, it became evident that this focused field has a profound lack of research. What is presented here is a compilation of learnings from others who work in the field. Most of the ideas shared here are not the author's own, but rather a collection of the diverse perspectives shared through interviews with building managers, waste haulers, municipal and regional waste program planners, non-market housing operators, environmental educators, waste system inspectors, waste management consultants, and behaviour change specialists.

Through this research, it has become evident that numerous cities, housing agencies and buildings are struggling with similar issues. Some have developed unique strategies, which may inspire new programs and success elsewhere. Many of the issues discussed here are not unique to non-market housing facilities, but affect other Multi-Unit Residential Buildings (MURBs) and housing types too. Within non-market housing facilities there is a wide range of capacities and

needs, and the issues discussed here represent the spectrum of challenges across different building types.

An effective waste management plan requires the deployment of many multi-faceted strategies over time: from systems changes at the source, such as California's ban on plastic bags, to paradigm-shifting educational outreach and user-friendly system design. If deployed in the right way, zero waste strategies can do more than eliminate garbage and resulting pollution; they can also have positive societal externalities, including building community partnerships, supporting innovation, reducing operational costs, and creating more green jobs.[1]

Guiding this research are four overarching questions:

1. What are the prevailing challenges facing different types of non-market multi-unit residential buildings in implementing zero waste programs?
2. What are the prevailing challenges faced by specific demographics with barriers that may inhibit their participation in zero waste programs?
3. What strategies can be used to improve zero waste program goals in non-market multi-unit residential buildings and for demographics with barriers?
4. How much waste is generated from non-market MURBs in Vancouver?

SCOPE

BUILDING TYPES

This research examines waste management practices in non-market MURBs. "Non-market" indicates units in buildings that are not part of the wider rental housing market because they have policies that restrict tenancy; this includes shelters, supportive housing units, and rental apartments that are owned by nonprofit organizations and government agencies that reserve units for tenants who have disabilities, special needs, and/or incomes below a specified threshold. This study also includes Single Resident Occupancy hotels (SROs), some of which are privately owned and apart of the wider rental housing market, but are included because they typically house individuals who are receiving government funded shelter allowances. It may be easier to term all of these building types as "low-income", but such terminology is discouraged due to prevailing stigmatization and ambiguity of the term. For the sake of this study, "non-market" is the terminology used, because it more accurately identifies the fact that these buildings are not in the standard rental market, but rather are in a category of housing that receives specialized support due to the needs of individuals who live there.

[1] City of Vancouver (2016): http://vancouver.ca/news-calendar/vancouver-takes-next-step-to-becoming-a-zero-waste-community-by-2040.aspx

Figure: Housing Continuum from the City of Vancouver Housing and Homelessness Strategy 2012-2021.

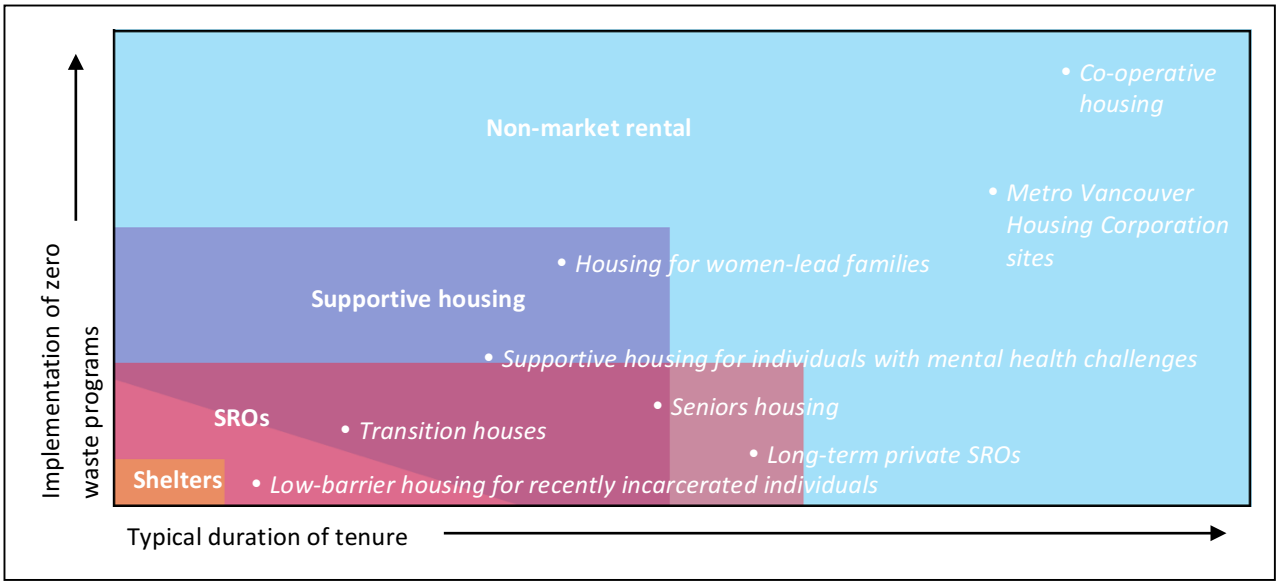
More expansive definitions of the four primary housing categories included in this study are as follows:

- **Shelters** provide temporary accommodations for homeless individuals and those at-risk of homelessness. Some shelters also offer meal programs.
- **Single Resident Occupancy Hotels (SROs)** provide short-term or long-term accommodation in single rooms, typically without private bathrooms or kitchens[2]. These are typically the lowest-cost accommodations available for rent in the City of Vancouver. SROs can be both privately and publicly owned.
- **Supportive housing** can include multiple types of specialized accommodation for:
    - Adults at risk of homelessness
    - Women fleeing violence
    - Seniors
    - Individuals with physical disabilities
    - Individuals with mental health challenges
    - Individuals in addictions recovery programs
- **Non-market rental housing** can include multiple types of accommodation:
    - Subsidized housing with rent geared to income, for individuals and families who are low-income, disabled, over 55, or have Aboriginal ancestry.
    - MURBs owned by governments, nonprofit organizations and cooperatives, which may have a mix of subsidized and unsubsidized units, and which have restrictions for tenant eligibility.

While these categories capture the key characteristics of building types, there are many other variables that affect the capacity of buildings to engage in waste management programming, including: the natures of individual tenants, the inclinations of building staff, building location, funding mechanisms, association with a housing organization and the support mechanisms provided, age and nature of the building structures, waste storage areas available, years of operation of the building, and more. It can be helpful to think of non-market housing as a continuum, where each area of the continuum requires different approaches to achieve successful program implementation. The figure below shows the relative positioning of some examples of housing facilities examined during this study; in general, buildings that are oriented for longer-term tenures tend to have more developed zero waste programs.

[2] BC Housing (2016): *Single Room Occupancy Hotels*

A comparison of examples of housing types by waste program and duration of tenure:



WASTE STREAMS

This research examines waste management programs for multiple waste streams including:

- Organics: including food scraps, food soiled paper, yard waste, and compostable packaging.
- Recycling: including paper & newsprint, cardboard, glass, metal and plastic containers.
- Garbage
- Bulky waste: including furniture, mattresses, appliances, and other large items that do not fit in typical waste bins or which require special recycling.

METHODS

The research for this report included inputs from several sources including:

- A literature review of relevant research and published articles from the past 20 years.
- Reports, studies, policy documents, general literature and websites produced by municipalities, regional governments, nonprofit agencies, waste haulers, previous student researchers, building operators and waste management consultants.
- Direct input from local municipalities and Metro Vancouver through meetings, phone interviews and emails. Through these channels, 23 municipalities in Metro Vancouver were contacted, of which five provided input for this research.
- Three municipalities and housing agencies outside of the Vancouver region provided input through phone interviews, emails, and shared literature. They included: The Cities of Toronto and Copenhagen, as well as the Seattle Housing Authority.

- Direct input obtained through in-person interviews and phone interviews with eight City of Vancouver staff, six building managers and operations managers, two haulers, and three third party consultants.
- A waste audit conducted in collaboration with Metro Vancouver and TetraTech Consulting, according to waste audit methodologies employed by those two partners.
- Note: building residents were not directly engaged in this research. This was due to the sensitivity and ethics requirements required for such research, and because sufficient studies already exist that have engaged residents and adequately convey their needs and perspective. The focus of this study is to gain insights from key decision makers and power-holders in waste management systems, so interviews with these stakeholders were prioritized. However, future research on this topic should work to include direct input from this essential stakeholder group.

LIMITATIONS

The primary limitations in conducting this research were:

- Finding and communicating with professionals in other cities and housing agencies outside of metro Vancouver. This was due to the nature of cold-calling staff during the summer months when people are prone to take holidays, and the difficulty in finding relevant contacts.
- Getting truthful insights and the full picture from interviewees. As the author was working for the City of Vancouver, respondents may have been hesitant to fully disclose some of the issues or practices taking place in the buildings they are associated with, because these actions are not in compliance with regulations.
- Finding academic literature and articles on the topic that have been published in the past 20 years. There has been surprisingly little academic research done in recent decades on strategies for improved waste management, especially with a focus on non-market housing. Numerous studies exist that examine waste management in the developing world, and measure the efficacy of recycling initiatives in housing in the 1990s, but few relevant recent studies could be found.
- The metro Vancouver-centric focus of the research, which makes the findings less applicable to other regions. The deliverables of this report are for the City of Vancouver, and thus the focus is naturally Vancouver-centric.

CONTEXT

POLICY DIRECTIVES FROM THE CITY OF VANCOUVER

This research endeavours to support progressive directives developed by the City of Vancouver that actively shape the trajectory of solid waste management programs in the city. The following are the two most relevant policy directives.

GREENEST CITY ACTION PLAN

The Greenest City Action Plan (GCAP) seeks to "reduce solid waste going to the landfill or incinerator by 50% from 2008 levels by 2020". The priority actions for 2015-2020 are:

- Action 4.1: increase overall diversion of organics by continuing to support the expansion of food scraps recycling to all sectors and support Metro Vancouver's 2015 disposal ban of organic materials to landfill and incinerator through education and enforcement.
- Action 4.4: support Metro Vancouver's Zero Waste Challenge through the development of education and enforcement strategies for all sectors, with a focus on waste prevention and material reuse.

ZERO WASTE 2040

In recognizing that current GCAP targets only extend to 2020, on June 1st 2016, Vancouver City Council approved a motion regarding the development of a Zero Waste Strategy, referred to as Zero Waste 2040, that emphasizes the long term goal of 100% material recovery, or zero waste. The zero waste 2040 strategy is currently in development.

RATIONALE FOR THIS STUDY

EXISTING ZERO WASTE PROGRAMS

Since 2010, Vancouver has reduced the amount of solid waste sent to landfill or incinerator by 23%, almost half way to the 2020 goal.[3] This has been achieved through an expansion of zero waste programs, including an expansion of accepted materials in curbside recycling and the roll-out of organics pickup services. As of spring 2016, all sites in the City of Vancouver are now required by by-law to have organics and recycling disposal programs. This change complements existing regional directives from Metro Vancouver that ban organics and recyclable materials from the garbage stream.

[3] City of Vancouver (2016): http://vancouver.ca/news-calendar/vancouver-takes-next-step-to-becoming-a-zero-waste-community-by-2040.aspx

Figure: progress in Vancouver towards the zero waste goal (source: City zero waste website).

At the regions' transfer stations, contamination surcharges for garbage are set at 50% of the total weight-based tipping fee, and $50 per item for Banned Hazardous and Operational Impact Materials (hazardous wastes) and Banned Product Stewardship Materials (refundable beverage containers). In the City of Vancouver, inspectors can levy fines for not following required waste management procedures, including infractions such as:

- Residential: garbage cart cannot close, cart overflow, no recycling program, non-compliant recycling plan, no organics plan, non-organics in green cart, and prohibited materials in garbage.
- Commercial: container leak, container in poor condition, failure to keep container clean, failure to display address, failure to provide a secure lock, collection vehicle leaking.
- Other: unlicensed container on the street, putting garbage in a public receptacle, failure to obey a previous order.

Presently, fines are rarely levied against site operators because of the lengthy process involved in issuing tickets, and because the City is taking a gentler approach by issuing warnings and providing support instead of applying penalties for noncompliance. However, this may soon change. New bylaws introduced in 2016 will allow street use inspectors to issues tickets swiftly using the Municipal Ticketing Information system (MTI). Inspectors are being trained in this process now, and the system is expected to be active in the fall of 2016. The extent to which new fines will be applied under this system, however, is still yet to be decided.

LOOKING AT NON-MARKET BUILDINGS

The City of Vancouver has over 5000 MURBs, of which 13% (634 buildings) are non-market MURBs. Many of these non-market MURBs have large numbers of units and high densities, so the proportion of units in the City that are in non-market MURBs is likely higher than 13%. As the city continues to grow in population, MURBs will increase as a share of housing stock, and thus strategies to improve waste management programs in MURBs are essential. Non-market

housing sectors are not exempted from disposal bans, and many buildings are struggling to implement zero waste programs to comply with regulations. Developing a set of recommended approaches will enable the City to reach out and assist these buildings with their zero waste needs.

Improving waste management programs in non-market housing not only decreases garbage volumes and helps meet regional directives, but also has a myriad of other benefits including[4]:

- Creating savings in long term building utility costs
- Creating healthy communities by providing high quality and secure living environments
- Strengthening communities by engaging tenants in environmental initiatives
- Leading the way for sustainability initiatives in the social housing and residential development community
- Reducing individuals' environmental footprints

BACKGROUND ON THE ISSUE

UNDERSTANDING BARRIERS

All people have personal barriers to varying extents. However, residents in non-market housing tend to have more numerous and more challenging barriers than residents in market housing. This is because individuals with significant barriers are more likely to face personal hardship, have low- or no-income, and experience unpredictable life circumstances which makes securing tenancy in market rental housing more difficult. The purpose of non-market housing, in theory, is to provide specialized residential facilities and supports that meet the needs of individuals with barriers, so they have homes where they can thrive. Some housing providers and buildings specialize in supporting residents with specific types of barriers; common barrier types encountered in this study include:

- Mental health challenges, including depression and anxiety
- Substance addiction
- Physical disabilities
- Previous incarceration
- Old age, dementia, and limited mobility
- Limited ability to comprehend English language
- Limited knowledge of local cultural norms
- Having young children
- Dependence on external organizations for sustenance and income, over which individuals have no control
- Stigma and prejudice due to an individual's gender, race, occupation, culture, language, sexual orientation, physical ability, personal habits, appearance and social status
- Loneliness, and a lack of personal connections and support networks

[4] BC Housing (2015): *Tenant Engagement on Sustainability Guide*.

Developing barriers is not a choice; they are often a product of systemic injustice and inequality, in a societal system that perpetuates marginalization and violence against those who live with barriers and in poverty. Many of these barriers have developed powerful stigmas in Vancouver society. These barriers put individuals at a disadvantage in reaching their potential and participating in all aspects of society, including in their responsibilities as tenants to sort their waste. Developing an understanding of the implications of specific barriers on individuals' behaviour and needs is essential in order to develop programs that can support these individuals effectively. Up to this point, no comprehensive waste management strategies have been developed by the City of Vancouver to work with the specific needs of individuals with barriers and the non-market buildings they live in.

PREVAILING PARADIGMS AND BEHAVIOUR CHANGE

Waste management is one system within a larger societal system that is shaped by prevailing paradigms. There are numerous key paradigms that strongly influence the way waste management systems have evolved, especially in the non-market housing sector, for example:

- *People who do not sort their waste are lazy and incompetent.*
- *Poor people don't care about the environment.*
- *People who illegally dump bulky waste are immoral.*

These paradigms antagonize and assign fault to the individual. Assumptions are made that individuals living in some non-market housing do not care about managing their waste. However, these people are just doing their best given their limited resources, personal barriers, life pressures, and the system they have to work within. **Rather, we should ask: what is it about the context of their living situation, their personal barriers, and the systems they operate in that shape their behaviour?**

Individuals with barriers are just as passionate and capable as anyone else. However, these individuals are more often negatively affected and drained by the system, which can sap their energy for extra waste management efforts. This reality extends to all people: cognitive energy is a resource, which is limited, and thus spent selectively. For this reason, any waste management system must be designed to be cognitively lightweight so that desired behaviour is as effortless as flicking a light switch. Here, we shift the focus of blame for malfunctions from the user to the system: "**if there's a problem, it's because your system is wrong**"[5].

> *"The starting assumption in behavioral psychology should be that: consciousness doesn't play a role in human behaviour."*
>
> - Dr. Robert Provine, Professor of Psychology, University of Maryland in Baltimore

[5] Quote from interview with Ruben Anderson.

Ideal systems are those that are so cognitively lightweight that they are intuitive: the user can properly use the system without prior instruction. These are called *compassionate systems*, because they work with and not against the existing behaviours of users. In theory, by studying users well enough, they tell you how the system should be designed. While this may seem a daunting challenge, it explains why so many awareness-based behavior change campaigns have proven futile; in many instances it is actually the infrastructure or system design that is the primary issue, which is more difficult to address, but doing so may prove significantly more effective in increasing waste diversion.

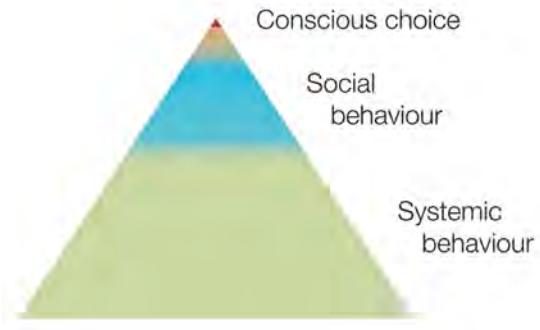


Figure: "99.99% of our behaviour is shaped by our context, and the systems in place there" -Ruben Anderson.

Supporting residents to achieve housing with dignity is a core objective of non-market housing, and waste management programs must be customized to create dignified living environments.

> *"It should be easy to do the right thing. Waste disposal and separation should be accessible regardless of type of housing or particular needs. Households should have good facilities for depositing bulky waste available to them. Bulky waste rooms in apartment blocks help residents to deposit bulky waste easily even if they do not have a car."*
>
> - City of Stockholm Waste Plan, 2013-2016

KEY FINDINGS

Below, the key findings of this study identify the prevailing challenges to waste management programs in non-market housing. Findings are organized according to challenge type, including a discussion of each challenge with cases and stakeholder inputs, and suggested recommendations specific to Vancouver. The 19 challenge areas are sorted into eight thematic groupings, as follows:

I. Resident engagement & motivations for waste sorting
    1. For residents in "survival mode" waste sorting may not be feasible, and operators must meet residents where they are at.
    2. In all MURBs, waste disposal is anonymous and thus sorting is optional.
    3. Waste management program education for residents must be delivered strategically.
    4. Residents do not maintain long-term commitment to sorting waste.

II. Waste management system user interface
    5. Waste sorting is not convenient.
    6. Access may be difficult for residents with physical barriers.

III. Waste stream contamination
    7. Some buildings have no organics or recycling service at all.
    8. Hazardous waste in garbage creates issues at multiple stages.
    9. Contamination ruins the value of organics and recycling.

IV. Waste storage
    10. Waste storage in outdoor public areas creates issues.
    11. On-site organics management depends on champions.

V. Bulky waste management & illegal dumping
    12. Law-abiding bulky waste management comes with significant barriers.
    13. Illegal dumping has become commonplace.

VI. Supporting & building relationships with building staff
    14. Building staff need more training and support.
    15. Building trust and improving city services

VII. Hauler-related issues
    16. Issues with pick-ups.
    17. Addressing sense of distrust and frustration with haulers.

VIII. Budget limitations for building operators
    18. Some non-market building operators face additional systemic and situational challenges that put them at a disadvantage relative to other buildings.
    19. An inefficient practice of "food donations" puts meal providers in a difficult situation.

I. RESIDENT ENGAGEMENT AND MOTIVATIONS FOR WASTE SORTING

When designing resident engagement programs, material must be delivered in a way that matches the nature of the participants, and that takes into consideration the internal social

dynamics and networks of the participants themselves.[6] Resident engagement programs typically have two goals:

1. **Building buy-in** by demonstrating to participants *why* it is important that they participate in waste management programs. This includes showing participants where their waste goes after they throw it away, and highlighting environmental issues.
2. **Instructing** participants on how to correctly use their waste management system, including how to sort, the locations of bins, common mistakes, etc. While some instruction is always necessary to introduce participants to a new program, a well-designed system requires minimal instruction and should be self-explanatory.

Success depends on participants feeling that the system they are being asked to participate in has been designed with their needs and preferences in mind. A system that antagonizes participants and makes them feel resentful will not get far. This is why an *equitable* and *compassionate systems* approach is important, so that waste management programs are designed based on the natures of users.

It is also essential to have positive behavioral role models in every social network (or building). It starts with the building staff, and extends to early adopters. It can also include *group influencers*: the people who are well-connected in the building and influence the behaviour of others. Getting these groups of people on board can make or break a new system.

1. FOR RESIDENTS IN "SURVIVAL MODE" WASTE SORTING MAY NOT BE FEASIBLE, AND OPERATORS MUST MEET RESIDENTS WHERE THEY ARE AT.

Challenges:

Waste management is not a priority for residents, especially when in "survival mode". Some residents are challenged to remove waste from their rooms, let alone sort their waste. In every building there is a spectrum of barriers and capacities of residents.

Discussion:

For individuals with significant barriers who are in a "survival-based lifestyle", adhering to waste management guidelines is the least of their concerns. Just getting tenants to remove waste from their rooms, and in extreme cases to stop tossing waste out of their windows, are primary

[6] Alex Pentland's research team at MIT studies the subtle, subconscious communication between people, and how this influences their behaviour and decision making. This field of *network science* "tries to understand people in the context of their social networks rather than viewing them as isolated individuals". In their book *Honest Signals* (2008), they discuss the power of direct human interaction, and explain that any attempt to influence the behaviours and decision making of a group must consider the social dynamics of that group, the key influencers, and subconscious communication habits.

concerns for building staff. For this reason, many buildings that house individuals with significant barriers have only single stream waste service. There will always be some people who will not change, or who change very slowly, due to personal barriers. The needs and realities of these individuals must be respected and accommodated, and efforts made to meet people where they are at. This means altering regulations and providing specialized supports to buildings where these individuals live, so that building staff can better support their residents.

"Some people do want to make changes in their lives, once they're out of survivor mode. We meet people where they're at."

- George Simpson, RainCity Housing

In every building there is a spectrum of tenants with varying barriers and capacities, many of whom *do* want to participate in waste sorting. Efforts should focus on these people and the vast middle ground of people who are open-minded to adopting new habits. Building good relationships between residents and building staff is the most essential component of creating environments where residents feel supported to engage and change their habits. This means not putting staff in a situation where they have to police residents' waste management habits. In many cases, building staff cannot use fines or threats to change tenant behaviour, due to low-barrier and housing first policies which protect tenancies and prohibit eviction except in cases of violence.

A high turnover of tenants means one tenant may move through multiple buildings at different times. This is a common feature of many non-market buildings, and adds an additional layer of complexity in establishing effective waste management programs, as each building may have different programs in place. Encouraging system standardization across the region is an important step, which is discussed further under Challenge 3.

Recommendations:

- Encourage Metro Vancouver to create allowances in disposal ban regulations for non-market buildings that house individuals with significant barriers. Building operators could apply directly to Metro Vancouver for exemption, with special bag stickers or printed bags issued by Metro Vancouver directly to the approved buildings for use to identify their waste in the stream. This would allow haulers to reduce service costs for these buildings because of reduced contamination surcharges.

2. IN ALL MURBS, WASTE DISPOSAL IS ANONYMOUS AND THUS SORTING IS OPTIONAL.

Challenges:

Residents dispose of waste anonymously, there is no feedback or repercussions for their actions, and it is difficult to identify who is causing contamination.

Residents are not financially motivated to sort waste, it is much easier to just throw it all in the garbage.

Discussion:

For residents in detached houses with individual waste bins, improper waste management results in direct feedback in the form of a missed pickup and informational tag attached to the bin. In MURBs this is not so due to the use of shared waste receptacles. Providing feedback on contamination and waste volumes is important in order to encourage behaviour changes.

Feedback loops are needed, so that residents can see the impacts of their actions and feel they are working towards a recognizable goal. There are several ways this can be achieved:

- Building Managers can request detailed waste volume information from their hauler and/or waste levels can be tracked internally.
- Building Managers can display this information publicly, such as on a board in the waste room or lobby displaying "contamination incidents this month in this bin" or "garbage volumes this month compared to the last four months", etc.
- When there is contamination or problems in the trash room, take a picture. Send out monthly letters or emails to tenants explaining the issue in a constructive way, and post the image with reminders in the waste room.
- Provide an incentive challenge to building residents, for example: "our building is saving up for a foosball table by reducing our waste charges. Please do your part to avoid contamination when you throw out your waste, and savings from reduced waste costs will go towards this new amenity for the whole building."
- Make it known in the waste room how much the building is charged for different types of contamination, and every time the building is charged by the hauler for contamination, make it known: "extra charges last month due to contamination: $_.__".

CASE: The BC Cooperative Housing Federation provides waste management support to co-ops, including presentations on how to improve programs, and coordinating group hauler contacts. All co-ops have an internal recycling committee, and CBSM is used effectively with educational campaigns among residents. Co-op members see direct financial benefits of managing their waste effectively because waste diversion and reduced contamination results in lower monthly

fees. There is a strong incentive to correctly sort waste, and extensive resources within each co-op to support residents in doing so.

CASE: In Copenhagen, all waste streams are only accepted in clear bags to discourage contamination.

Recommendations:

- In trainings with building staff, encourage them to implement resident feedback loops (see above list).
- Require all waste bags to be clear, for subtle anti-contamination pressure.
- Create a city- or region-wide competition for buildings to reduce their garbage volumes and contamination levels, based on data provided by haulers. See "The Mayor's Towering Challenge" in the City of Toronto, as an example.

Image: Eye-catching promotional imagery used by the City of Copenhagen.

3. WASTE MANAGEMENT PROGRAM EDUCATION FOR RESIDENTS MUST BE DELIVERED STRATEGICALLY.

Challenges:

There is high tenant turnover, and new residents are not given necessary information and materials to make new sorting systems easy for them right at the beginning.

There is a lack of region-wide consistency in waste management systems, so each MURB has different waste management procedures, which residents are expected to re-learn when they move, including for bulky waste.

Residents with barriers don't show up to events.

Discussion:

Starting off right

Setting community expectations and positive behaviours right from the start, when residents first move in is essential. Residents should be given an orientation to the building's waste management systems, along with a package of materials that clearly explain the system in their own language, so that expectations are clearly set and any questions can be answered.

CASE: At the Budzey, a supportive housing facility operated by RainCity Housing, residents sign a program agreement when they move in, which is a soft document that sets ground rules on how to be a good neighbour. Here, residents agree to "*put your garbage in the bins as provided - please do not throw anything from your windows. Recycle your containers and paper products. Green waste must be separated from your regular garbage. Bins and receptacles are provided in the garbage room in the basement. If you need a container for your green waste please ask staff*."

Standardization and visuals

The visual language of the system must be intuitive and complete, using standardized colours, icons, and signage in all languages spoken by residents.

Image: The Budzey, a supportive housing facility operated by RainCity Housing.

Image: Standardized icons and colours set by Metro Vancouver.

CASE: Metro Vancouver Housing Corporation (MVHC) recently changed to three stream weekly pickup service provided by a single hauler across all of their properties. This standardization of service helps ease the transition for tenants who move between MVHC properties.

Unique approaches for different demographics

Numerous studies, including those conducted by both City of Vancouver staff[7] and Emily Carr students[8], all confirm the importance of face-to-face contact with the community and liaising through building champions as the most effective methods for delivering information. Waste management programs are highly influenced by acculturation, and understanding how different cultural groups view waste can be key to engaging residents effectively. It is also important to identify who are the groups who do not show up to events and meetings, and how they prefer to be reached. In cases where there are residents with mental health challenges, workshop leaders should have sensitivity training to appropriately engage with these groups. BC Housing has developed a toolkit which includes guides for resident engagement.

Image: A MVHC flyer in Chinese explaining how to use the new organics recycling program.

> "In some countries, there is a tradition of caring for areas around and between dwellings, whilst, in others, this is not the case. Such general attitudes affect the willingness to participate locally."
>
> - Report: UN Habitat (1989): *Community Participation - Solid Waste Management in Low-Income Housing Projects*.

[7] City of Vancouver (2009): *West End Illegal Dumping Project.*
[8] Compost Collective (2012): *Final Report.*

CASE: At the Seattle Housing Authority, resident education initiatives in MURBs start with a community meeting with food, an interactive game, and language interpreters for all languages needed in that building. Flyers are given out in English and languages spoken by residents. The turnout varies, as each building is quite different, and depends on the social dynamic in each building as some people don't feel welcome in community meetings.

Recommendations:

- Trainings for residents must be offered continuously, especially in buildings with high tenant turnover. This is already required under the current solid waste bylaw, where buildings are required to provide education to new tenants about recycling and organics diversion, and must remind tenants annually about waste management systems in the building (clauses 5.15 and 6.7A.4 in the bylaw). Remind building staff of this, and provide support through new "account managers".
- Encourage buildings to have a comprehensive recycling education process for new residents. Include guidelines for recycling in the tenant program agreement. Provide an optional kit for all new tenants that is offered by the building manager when they move in, which includes comprehensive standardized instructions in multiple languages on how to use the waste system correctly, as well as in-unit waste sorting containers.
- Encourage MURBs to provide waste-related feedback information to inform residents of the progress of their diversion efforts, and related environmental impacts. Such information could be provided at the entrance to common waste rooms. Waste-related feedback information could also be provided where other building news is communicated, such as in lobbies and elevators.
- Extensive signage (including hand-outs, posters and bin stickers) should be provided for free to buildings to encourage people to correctly separate organics and recycling. This is already available from the City when requested, but Account Managers could proactively hand out this material where needed.
- Encourage Metro Vancouver to continue to engage and collaborate with municipalities to standardize recycling practices across the region.

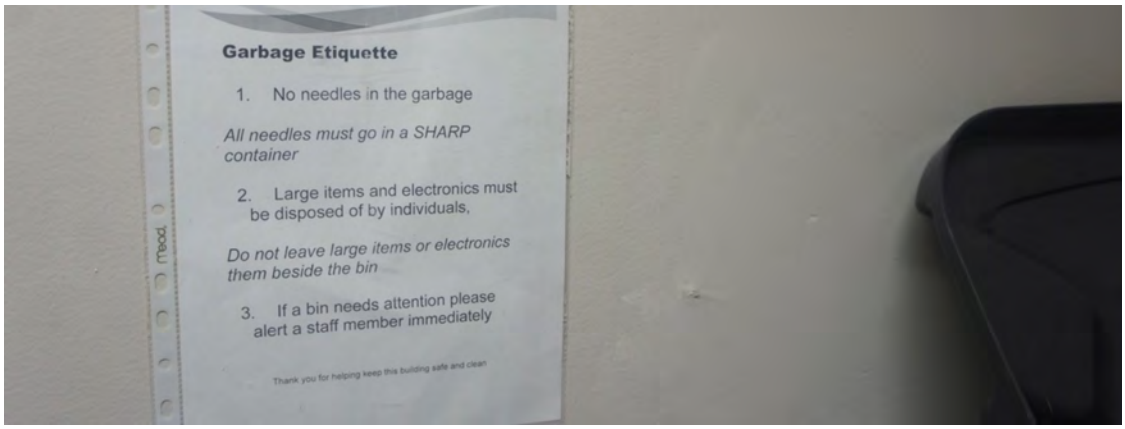


Image: Ineffective informational signage beside a garbage bin in a supportive housing facility for residents with multiple barriers.

4. RESIDENTS DO NOT MAINTAIN LONG-TERM COMMITEMENT TO SORTING WASTE

Challenges:

Residents do not feel a sense of ownership over waste management initiatives.

After a period of community engagement, contamination levels go back up.

A sense of duty towards waste sorting behaviours is not culturally ingrained.

Discussion:

Empowering individuals with barriers

The creation of programs that perpetuate peer-to-peer role modeling can be highly effective in engraining positive waste sorting behaviors. Low income buildings are not exempt from this: everyone has role models and relationships with their neighbours. In many non-market buildings there is a wide spectrum of different people living in one building, with very different levels of personal agency and barrier types. By empower residents and giving them the opportunity to be champions in their buildings, people who are more inclined to participate in waste sorting programs may become role models for others.

CASE: In most buildings run by the nonprofit operator Community Builders, tenants are empowered to fulfill much of the buildings' internal needs, including janitorial and waste

management services, using this “bottom up” approach to engage tenants and build a sense of responsibility for their living environments.

Ambassador programs

There are numerous examples of programs that give residents the opportunity to be role models for their neighbours. These programs empower residents, build neighbour relationships, and deliver educational materials in formats appropriate for the residents’ demographic. They also build momentum to help waste diversion programming continue beyond the end of specific resident educational initiatives.

CASE: At the Seattle Housing Authority (SHA), before rolling out a new program to all, focus is given to building participation and reducing contamination in a small, willing groups first, who become role models when programs are fully rolled out.

CASE: The City of Toronto’s 3Rs Ambassadors program offers free six-hour training and free materials in 17 languages for anyone interested in becoming an ambassador for their MURB. Trainings are offered monthly, where typically 10-15 volunteers attend, and the program now includes over 300 volunteer Ambassadors. The long term goal is for every MURB in the City of Toronto to have at least one Ambassador.

CASE: There are 28 MVHC sites with tenant associations (out of a total 49 sites) who are invited to an annual tenant association conference. Tenants make pitches to their fellow resident representatives for $30,000 worth of grants for recycling projects at their buildings, and also celebrate resident recycling champions.

Images: The Vancouver South Transfer Station and the Vancouver Landfill. Informing residents of where their waste ends up is an important part of building awareness around the importance of zero waste.

Recommendations:

- Recruit and train volunteers to join an official citizen-powered movement supporting zero waste programs. This program could be branded as an extension of the *Keep Vancouver Spectacular* program. Such a program could include:
    - Free training workshops for MURB residents.
    - Allocate funding to provide small grants to Recycling Ambassador teams, which can be delivered through the existing Greenest City Neighbourhood Small Grants program. These grants can cover costs such as printing, translation, workshop organization, etc.
    - Provide supportive materials to volunteers to run resident engagement programming in their own MURBs.

II. WASTE MANAGEMENT SYSTEM USER INTERFACE

5. WASTE SORTING IS NOT CONVENIENT.

Challenges:

Residents do not have bins in their units to sort their waste into; sometimes bins are supplied when buildings are opened but then no replacements are provided.

Garbage receptacles are much easier to access than organics and recycling receptacles.

Waste rooms are not user friendly, and have missing elements including bins, signage, and languages.

Many residents report never receiving information on organics or recycling programs.

Discussion:

An effective waste management system requires convenience when sorting waste in-unit and when depositing waste in common receptacles. The user interface of the system must be intuitive and user-friendly. In some buildings visited for this study, organics and recycling bins were missing completely, and many bins had no signage at all.

The City formerly provided free blue tote bags with recycling instructions for MURBs. Sometimes these materials are provided by building funders when a building opens, but replacement supplies are not provided. Residents with barriers are often unable to provide their own bins; purchasing four-liter ice cream pails, for example, is unlikely due to lack of funds, freezer space, and health issues.

Image: The City of Toronto's free in-unit recycling bags, complete with standardized informational icons (photo credit: Toronto Community Housing).

CASE: In Toronto, in-unit blue recycling bags and kitchen catchers for organics have been available for free for all residents since 2009. Toronto Community Housing (TCH) Superintendents can request up to 10% replacement of bins and bags per year, which they stock on-site. In new TCH site redevelopments, specific space in each kitchen has been created for multi-bin waste sorting.

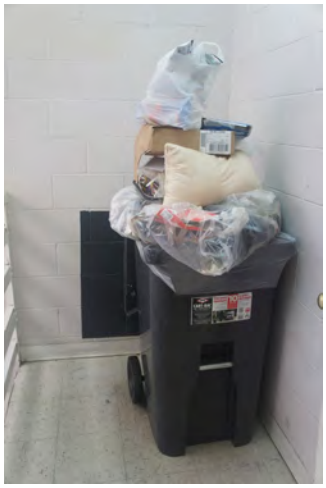


Image: Garbage piles up becoming difficult to manage in an SRO.

Creating a pleasant and intuitive experience in waste rooms is also important. In the pilot study currently in progress at TCH, user interface improvements at each site included improved signage with waste diversion-specific bulletin boards, better stickers for in-unit bins and large metal-backed posters for common waste receptacles. Two newly built TCH buildings have incorporated a 3-stream waste chute systems on each floor to make waste disposal more convenient for residents.

CASE: In Toronto, new mid- and high-density residential buildings are required to follow Toronto Green Standard Tier 1 guidelines, which include: requirements for 3-stream sorting that is as convenient as garbage disposal, waste room accessibility standards, and a minimum 10 m^2 storage area for bulky waste and additional diversion programs. Voluntary Tier 2 guidelines suggest provision of separated cabinet space in all kitchen suites for 3-stream segregated collection, as well as a dedicated collection area or room for household hazardous waste and/or electronic waste. Buildings that implement Tier 2 suggestions can qualify for reduced development fees. Several

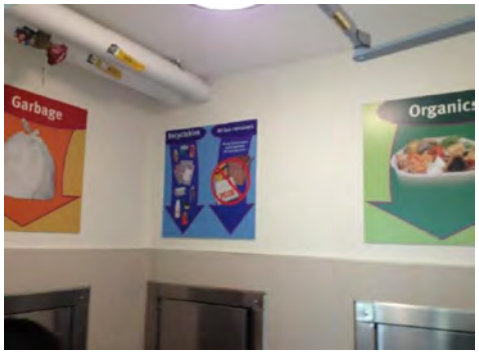


Image: Toronto's version of a "recycling lounge", with hatches that transport waste to another room out of sight (photo credit: Toronto Community Housing).

new buildings in Toronto have included a version of the "recycling lounge", which includes one room with three hatches in the wall where residents go to deposit their waste, with chutes that transfer the waste into a separate adjacent room out of sight.

CASE: In Copenhagen, all MURBs are required to have waste management plans and receptacles or spaces for: garbage, cardboard, paper, hard plastic, batteries, metal, small electronic equipment, bulky waste, large electronic equipment, (sometimes) bottles and glass, and (sometimes) a free item exchange area. Hazardous waste is given to the building manager which is then picked up once per month.

Images: In Copenhagen, multiple well-labelled colour-coded bins are provided to MURBs to make recycling easier for residents (photo credit: City of Copenhagen).

Garbage bins should always be placed to be more convenient to access than organics and recycling bins, however the relative convenience of each bin type must be considered depending on the users' tendencies.

Recommendations:

- Collaborate with the Provincial Government, Metro Vancouver and MMBC to provide free organics kitchen-catchers and blue recycling tote bags to all MURBS respectively, and allow building staff to order up to 10% replacement per year for free. Encourage these in-unit bins for organics and recycling to become standard required items in all living spaces as part of standard lease agreements, as smoke detectors currently are, so that replacements become unnecessary over time.
- Continue to provide free standardized stickers and posters to building staff for distribution to tenants and for posting in common waste rooms.

- Add language and visual examples to the City of Vancouver Garbage and Recycling Storage Facility Design guidelines that encourage waste room best practices, including:
    - Standardized colour-coded wall sections with corresponding bins.
    - Garbage receptacles placed to be slightly more convenient than receptacles for other streams.
    - Designated space for bulky items, electronics, batteries, and hazardous waste.
    - Creating exchange centres in buildings to facilitate re-use of goods that are still in good condition.
    - Separation of user-accessible common space from room where waste is stored, by connecting chutes ("recycling lounge").
- Create clear design guidelines for renovations and new construction that present best practices for waste management, including specific space for in-unit waste sorting bins.
- Encourage, and eventually require, all MURBs to have comprehensive waste management plans, including designated spaces on-site to manage: garbage, organics, cardboard, paper, mixed recyclable containers, glass, EPR programs (i.e. batteries, small electronics), bulky waste, and hazardous waste.

6. ACCESS MAY BE DIFFICULT FOR RESIDENTS WITH PHYSICAL BARRIERS.

Challenge:

Dumpsters are difficult to use for some residents with physical barriers.

When bins are stored in alleys or distant waste rooms, accessing bins can be difficult for some users due to distance, physical impediments, and personal fears.

Discussion:

Dumpsters are notoriously not user friendly, especially for residents with physical barriers including: seniors, kids, and people with physical disabilities. Lids can be too heavy or difficult to open, bin edges can be too tall to get waste into, and waste can be heavy and cumbersome to lift. While some organizations have replaced metal dumpster lids with plastic lids, sometimes these are still too heavy or are not permitted due to fire hazard regulations.

Images: A recycling bin at a Seattle Housing Authority site which has been modified to make it more accessible to residents who are challenged to use a dumpster.

CASE: In SHA townhomes, disabled residents can put their bins behind their back door for pick-up. In MURBs, dumpsters and bins have been modified to be handicap-accessible.

CASE: Three TCH buildings for seniors are considering implementing a door-to-door organics collection service for residents with severe mobility issues who are unable to leave their units. This service has the added benefit of allowing waste collection staff to check bins for contamination and provide targeted education.

Recommendations:

- When dumpsters are included in new building designs, ensure there are mechanisms to make them more accessible, including ramps, or hatches in the side of dumpsters. Alternatively, encourage buildings to build design "recycling lounges" with hatches in the wall that carry waste to dumpsters in another room, or underground waste units with low receptacles.

III. WASTE STREAM CONTAMINATION

When there is contamination in waste, building operators end up paying more for waste services. Some haulers charge customers directly when there is contamination, adding the instance as a line item in their invoice. Other haulers absorb the cost upfront and recoup it later, as contamination levels are taken into account when service pricing is renegotiated at the start of a new service term.

Images: Contamination is highly visible inside this clear garbage bag from a supportive housing facility, which contains syringes, refundable beverage containers, electronics, and numerous types of recyclables.

7. SOME BUILDINGS HAVE NO ORGANICS OR RECYCLING SERVICE AT ALL.

Challenges:

Some buildings have meal programs with an on-site kitchen, but no compost service. Many buildings do not have sufficient incentive or support to set up waste diversion programs.

For seasonal shelters, residual wastes are improperly disposed of as garbage at the end of the season due to limited resources.

Discussion:

As many housing organizations and shelters in the DTES offer meal programs, understanding waste challenges associated with meal preparation is essential to managing their organics waste programs[9]. Building Operator RainCity has successfully implemented organics collection for all kitchen waste from meal programs in their buildings.

Many operators complain that implementing organics and recycling programs in their buildings is not cost effective, especially when there are no incentives or resources to support them. In Toronto and Copenhagen, service fees for organics and recycling pick-up are imbedded in city waste fees, so no additional fees are charged for these services. This approach could not be implemented in Vancouver without a regional waste-containment by-law.

Images: A shared kitchen in an SRO lacks compost and recycling receptacles, and a garbage bag from another SRO is completely full of recyclables. When buildings have only single-stream waste service, residents have no option but to put everything in the garbage.

[9] For more information on the needs of meal service organizations in the DTES, see reports from the DTES Kitchen Tables Project.

Refundable beverage containers are also commonly found in garbage, as most buildings have no receptacles in which to deposit these items.

Some buildings appear to have recycling and organics pickup services, but these bins actually belong to other buildings and have been moved by residents. Building staff are then tasked with returning these bins to their rightful owners, though many bins lack identification. Bicycle parts are a common bulky item left in common spaces, which are typically collected by bulky waste haulers with other waste and put into garbage.

Image: While this SRO has recycling bins in the waste room that are used by residents, there is no recycling pickup service, so all recycling is collected with the garbage.

Image: A collection of recycling bins that have been taken from other sites and deposited in the common space of a nonprofit supportive housing facility.

In shelters, individuals bring a lot of scavenged materials in with them. When seasonal shelters close in the spring there are large volumes of waste concentrated there. This waste all goes to the garbage, as shelter staff do not have the resources needed to separate this waste.

Images: A pile of bicycles in the common space of a supportive housing facility, and unhelpful signage in an SRO. Bike parts are a common bulky waste item that typically lack an effective waste management plan.

Recommendations:

- Many non-market buildings need specialized support to introduce organics and recycling programs. A jointly-funded program should be created between Metro Vancouver, the City of Vancouver, and MMBC to offer free customized waste management consulting to building staff, to help them set-up programs in buildings that currently have no service.
- Collaborate with the Provincial Government, MMBC, and Metro Vancouver to create a fund to support waste management program improvements in non-market housing facilities. Building operators could apply for grants for specific projects, with monitoring and reporting requirements.
- Seasonal shelters funded by BC Housing should be required to budget for waste sorting at the time of shelter closures to improve diversion rates.
- Encourage haulers to partner with local nonprofit community bike shops to divert bicycle parts from hauled bulky waste.

8. HAZARDOUS WASTE IN GARBAGE CREATES ISSUES AT MULTIPLE STAGES.

Challenges:

Hazardous waste in garbage, especially syringes, is dangerous for waste handlers and incurs contamination surcharges. High charges encourage haulers to dispose of contaminated waste outside of the region. Many buildings have insufficient syringe disposal boxes.

Clear garbage bags make contamination more visible to inspectors, but are required for use in some supportive housing facilities.

Surcharges for items identified as *banned hazardous and operational impact materials* are likely to increase in the near future. If there is no on-site program for non-medical hazardous waste, tenants are more likely to dispose of these items in garbage.

Discussion:

In some buildings where there is high volume of syringe waste, there are not enough syringe disposal boxes or these boxes are not placed in strategic locations. Without improvements to the provision of syringe disposal boxes, individuals who put syringes in garbage receptacles are unlikely to change their behavior. They are not motivated by the $50 fine per syringe that is

applied to haulers at transfer stations, and subsequently passed on to building operators, because they do not receive any negative feedbacks from this. Syringe disposal boxes in public alleys are often full and thus unusable, resulting in individuals disposing of syringes directly into dumpsters, or leaving them on the street.

Image: A syringe disposal box in a public alley, in need of emptying.

Metro Vancouver's current 2015 Tipping Fee Bylaw includes a ban on *hazardous and operational impact materials*, including syringes and excrement, intended to discourage disposal of these materials in municipal solid waste. However, Metro Vancouver is considering easing the ban on excrement and finding ways to manage it safely, due to its increasing prevalence in the waste stream. A similar approach could be used to address the presence of syringes in the waste stream, from specific customers.

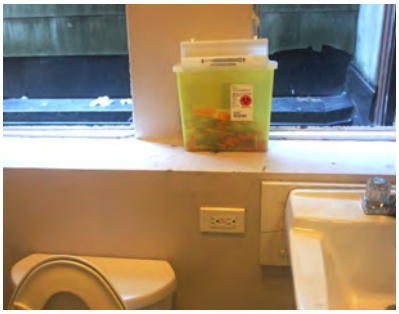


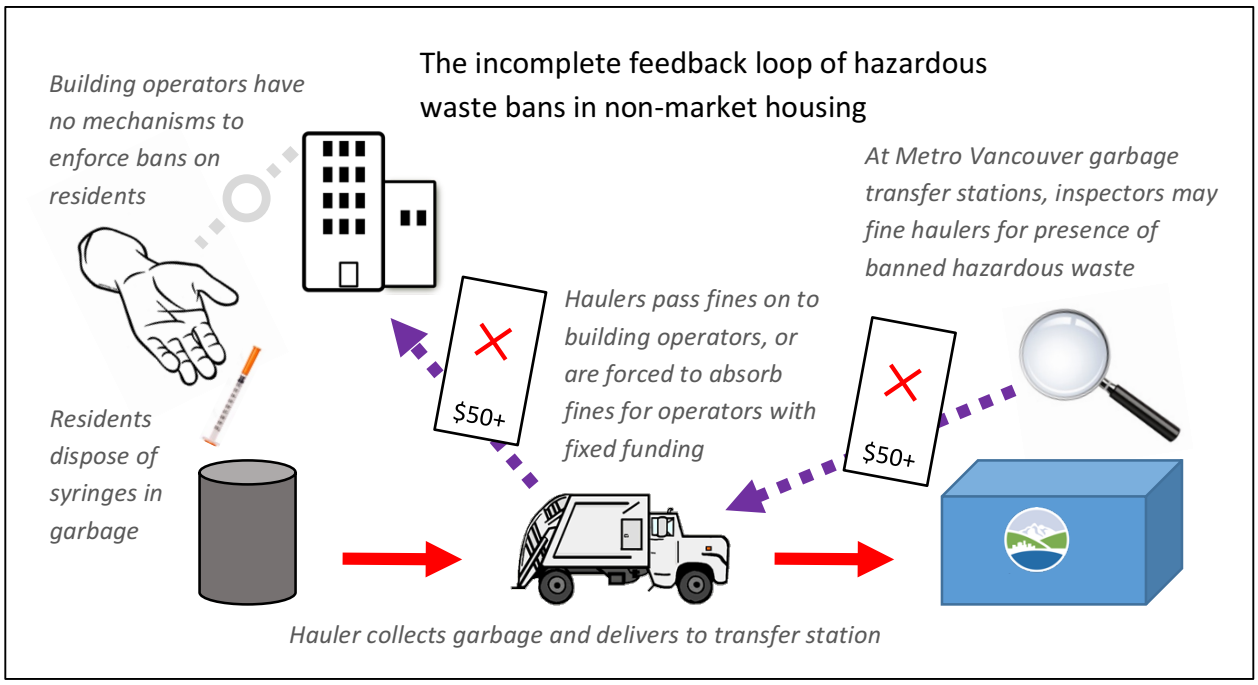
Image: A syringe disposal box in a shared washroom in an SRO.

Most haulers encourage the use of black or opaque waste bags to hide contamination, while in some supportive housing facilities, clear bags are required in order to protect tenant support workers. Clear bags increase the visibility of contamination and banned materials in garbage, resulting in a higher incidence of surcharges from Metro Vancouver inspectors.

Surcharges for banned materials may soon be increased, according to the Proposed 2017 Tipping Fee Bylaw Changes: *"Disposal bans on any single items listed under Banned Hazardous and Operational Impact Materials or Banned Product Stewardship Materials are enforced through a flat $50 surcharge for each occurrence... An increase in that flat fee could provide an increased incentive for residents and other haulers to divert such materials. The $50 surcharge has remained constant since 2009. Considering inflation increases since 2009, an appropriate current surcharge would be in the range of $65."* Costly bans encourage haulers to dispose of waste at transfer stations outside of the regional jurisdiction.

Image: A syringe in the garbage, a common occurrence in some buildings.

CASE: In TCH buildings, hazardous and electronic waste can be given to a Building Manager for storage in a locked room until pickup. Building Managers can then call the City to arrange free hazardous waste pickup via the "toxic taxi". For all MURBs in Copenhagen, hazardous waste is given to the building manager who then holds it for a special truck that comes by for pickup once per month.



Recommendations:

- Improve syringe disposal programs in relevant buildings. Require building operators to affix syringe disposal boxes in every shared washroom, beside every garbage bin, and allow residents to keep one in their room if they desire which they can then exchange for an empty one from building staff.
- Improve the frequency of maintenance and of public syringe disposal boxes.
- Encourage Metro Vancouver to remove syringes from the list of hazardous banned materials so that they no longer incur a $50 fine per item. Customers should still be strongly encouraged to separate syringes from garbage.
- Require buildings that regularly have hazardous waste in garbage to use high-visibility identifiers to mark bags, thus alerting handlers to their potential danger; this could include tinted bags, stickers, or marked tape.
- Require all garbage bags deposited at Metro Vancouver disposal facilities to be clear.

9. CONTAMINATION RUINS THE VALUE OF ORGANICS AND RECYCLING

Challenge:

Contamination of plastic bags in organics bins is common, as residents prefer to bag organic waste to avoid smells and contact.

Highly contaminated loads of organics and recycling are disposed as garbage, with associated contamination fees.

Discussion:

Numerous options exist for residents to manage the "ick factor" of their organics waste, however most of these options have barriers: freezing waste requires having access to a freezer with adequate freezer space, and most other options require users to purchase inputs. Especially for individuals who produce little food waste and/or have limited kitchen access, the extra effort required to manage their organic waste may seem impractical.

CASE: In MURBs in many other jurisdictions, all compost bins in common waste rooms are lined with compostable bags. In Copenhagen and many European cities, all organics waste must be bagged by users when deposited in receptacles, which is later de-bagged at processing facilities.

CASE: The Seattle Housing Authority has trialed supplying permitted biodegradable bags for free to residents through dispensers in common waste rooms, with good uptake from residents. Bags were purchased through Ecosafe (a Surrey-based company) and cost approximately $160 per month for 100 units.

When garbage receptacles are located in remote corners of buildings, they are more susceptible to contamination. Receptacles located in central common areas put subtle pressure on residents to sort waste correctly and typically have lower contamination rates.

Image: An organics bin with a liner and free in-unit bin liners help to keep bins tidy in an SHA building.

Image: garbage bins in a nonprofit SRO are centrally located, which decreases contamination due to subtle peer pressure.

Recommendations:

- Pilot a program to supply residents at privately serviced buildings with free compostable bags for their organics waste, through a dispenser in an easily-accessible common space. Consider providing this service to other non-market buildings that experience challenges in organics program uptake.
- Provide bin placement consultation to buildings, and encourage bins to be located in central areas.

IV. WASTE STORAGE

10. WASTE STORAGE IN OUTDOOR PUBLIC AREAS CREATES ISSUES.

Challenges:

Secured waste bins in public areas are frequently broken into or left unlocked.

Numerous problems arise when waste is stored in outdoor public areas: waste is piled on top of bins, waste gets opened and rifled through by binners, pests will open bags of garbage if exposed, and bins become a target for illegal dumping. This is true for bins in allies, outdoor parking lots, and large housing sites where bins are stored on the edge of the property.

Some buildings have no space for adequate waste storage facilities, even in public areas, so special arrangements must be made with haulers, which typically have associated issues.

In some alleys and public areas, there is insufficient space to store all of the dumpsters needed by neighbouring buildings. The more dumpsters there are, the greater chance that a disposal truck may be unable to enter the alley to collect waste, causing inefficiencies and missed pick-ups.

Discussion:

Many MURB staff complain of bins being frequently broken into and damaged, and some building operators believe recycling is not possible due to constant bin infiltration when bins are stored in alleys, especially in the DTES. Haulers are responsible for replacing broken locks and wheels, but often it takes them considerable time to complete these repairs, and in the meantime large messes can accumulate. Operators are occasionally charged by haulers when this happens, but are powerless in these situations and have no alternatives.

Image: An overflowing unsecured garbage dumpster (photo credit: Donna Taylor).

CASE: At one MVHC site, receptacles were switched from centralized dumpsters to individual curbside bins in order to make residents more responsible for contamination, and to remove the focal point for illegal dumping. If there is contamination in the bins, then they are not picked up.

The increased cost of providing and servicing the extra bins is compensated by decreased costs for illegal dumping and decreased contamination rates.

CASE: The Strathcona BIA currently coordinates an extended waste pick-up service for its members called *Recycle in Strathcona* which launched in November 2015. The service is offered through a community preferred service agreement between the enlisted BIA members and two local companies: Recycling Alternative (a large local hauler), and Shift Delivery (a bicycle-powered cargo delivery company). The service provides small to large recycling pickup services for numerous waste streams at a reduced rate.

The Strathcona BIA is also interested in supporting a trial of shared waste bins for neighbouring sites on parallel blocks that share an alley. Sharing bins has the benefits of: reducing hauling costs, reducing the numbers of dumpsters and clutter, reducing the number of trucks visiting the alleys, and making the alleys more attractive for other uses. Specialized shared organics containers can decrease smells and pests, and process organics onsite to decrease volume, thus reducing the frequency of pickups. Shared bin systems also appeal to businesses with very small organics and recycling waste outputs, whose volumes are not large enough to warrant individual waste contracts for these streams. The Yaletown BIA is exploring similar concepts to reduce the numbers of bins on streets, due to concerns that they are unsightly, create crowding, and attract crime and informal shelters.

Shared underground automated waste bins are commonplace in numerous European cities, and address several prevailing waste storage issues. The waste is stored out of sight, in a unit that is pest-proof and inaccessible to binners, and easily shared among multiple neighbouring users. Depositing waste into the bins can be restricted by key-card access with charges per volume or weight, or made open to all users. The waste volume in bins can be monitored remotely so that bins are only emptied when needed, improving efficiency of pickups. Bins can be installed in just

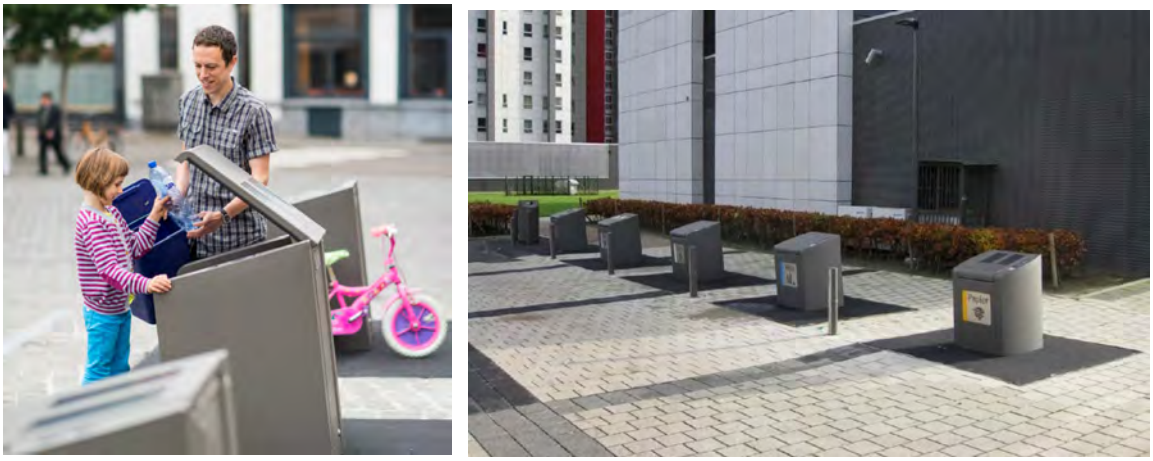


Image: underground waste storage containers in use in the Netherlands (photo credit: Eurete Enterprises).

one day, require no wiring due to solar panel operation, and can be configured for side-unloading or overhead-crane-unloading depending on space restrictions and the collection vehicle available. This fully-automated bin unloading system also reduces sanitation crews' exposure to waste, and can be operated by a crew of one. The bins are much less aesthetically intrusive than dumpsters, and therefore can be placed in more central, high-visibility areas, which makes them more accessible for residents, puts subtle pressure on residents to sort correctly, and deters illegal dumping.

CASE: CleanStart is a local social enterprise that provides waste pickup services to buildings using a "front door" manual waste removal model, where waste is collected frequently from multiple bins within each building. Buildings are serviced four days per week, and building staff then manage waste between service days.

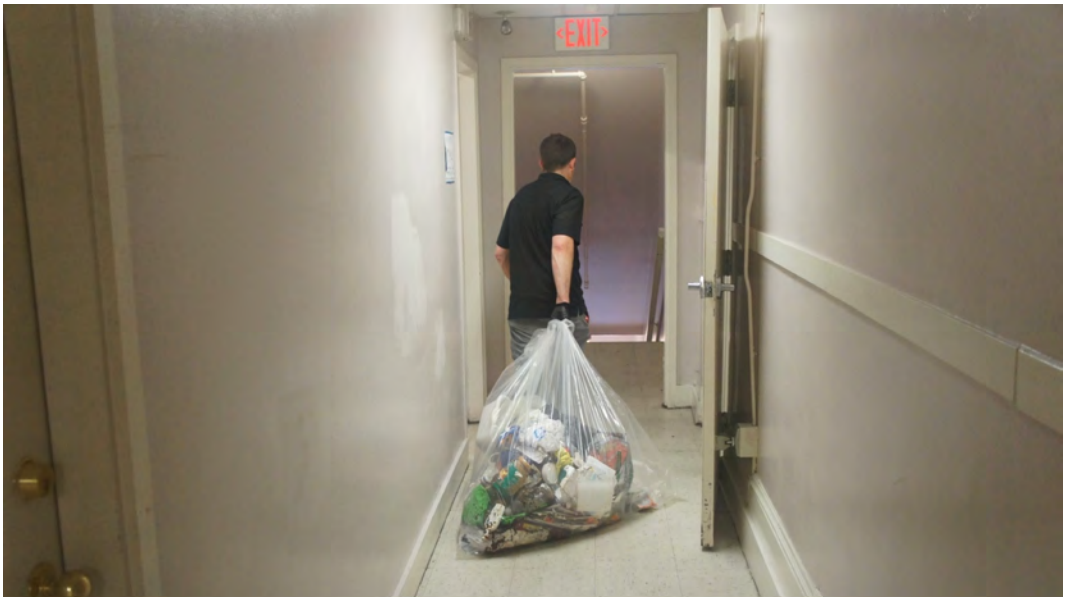


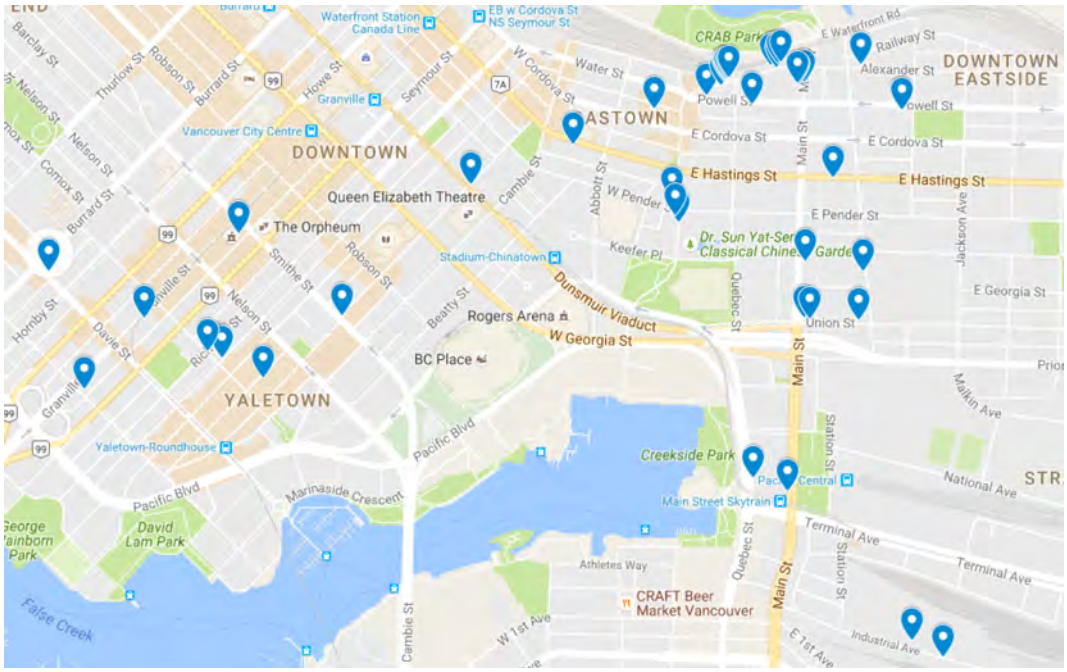
Image: "front-door" waste removal in an SRO means bags are manually hauled from each floor.

Metro Vancouver waste room design guidelines recommend that new multi-family buildings include "Flex Space" as part of centralized recycling storage space, "for storage of other reusable or recyclable materials that may be added to collection services over time, in addition to garbage and recycling storage space"; here, this flex space is suggested to be an additional 50% of the space allocated for garbage and recycling storage. These guidelines are suggestions for municipalities, as an addition to existing municipal bylaws. Such flex space also permits the creation of designated bulky waste deposit areas.

Recommendations:

Note: A third party coordinator, such as the BC Nonprofit Housing Association, would be needed to facilitate the following pilots. The City can initiate and provide indirect support.

- Create a pilot of coordinated waste management zones, where one hauler is contracted to provide services to a group of neighbouring sites. A partnership between the City, the BC Nonprofit Housing Association, and the local BIA could be established to provide services to both businesses and housing facilities. Such a pilot could start small, with just one full block, and later be expanded to include larger neighbourhood areas. The following are sites where this pilot could be explored:
    - Sites sharing the alley behind the 600 block of Alexander Street and Powell Street between Princess Ave and Heatley Ave (recommended by the Strathcona BIA).
    - Currently there are 43 sites receiving special Wednesday night garbage collection from the City, due to their limited capacity for on-site waste storage. Many of these sites are in very close proximity (*see map below*).
    - A redesign of Blood Alley is currently underway, and would benefit from a reduction in the number of dumpsters.
    - Other areas of high dumpster concentration in Gastown, Strathcona, the DTES, and Yaletown.
- Implement a pilot of shared underground automated waste storage bins. Opportunities for pilot installations include: upcoming MVHC and BC Housing site redevelopments, and the sites mentioned above for coordinated waste management zones.
- Consider using in-vessel volume-reducing organics units in shared bin pilots, to reduce pickup frequency, and prevent smell and pest exposure.
- Where shared bins are not possible, and organics or recycling volumes are low, engage a third party (such as the BC Nonprofit Housing Association) to coordinate community preferred service agreements between haulers and non-market buildings & kitchens to enable them to participate in more cost-effective organics and recycling pickup services. The service could be offered in areas with high concentrations of non-market buildings and community kitchens, such as the DTES.
- Encourage social and environmental procurement preferences to be a part of all waste hauler RFPs, so that points are given for haulers that can provide these additional benefits such as requirements to hire local workers and individuals with barriers, as well as use of low- and no- emissions vehicles and bicycles. Alternatively, RFP writers can incorporate a value proposition at the beginning of an RFP, with a preference for businesses that emphasize a social return on investment. Add language to this effect on the City's "Find a Hauler" webpage.



Map: Location of sites receiving specialized Wednesday night garbage collection from the City.

11. ON-SITE ORGANICS MANAGEMENT DEPENDS ON CHAMPIONS.

Challenge:

On-site organics management (composters), can fail without proper user training and dedicated champions.

Discussion:

On-site organics management systems can take many forms, including: simple low-capacity three-bin systems, more advanced systems that break down organics to reduce volumes for hauling, as well as complete in-vessel anaerobic and aerobic systems that produce food-grade compost and can capture methane. More complex systems can become feasible when costs are shared across multiple organizations or large housing facilities, but all require dedicated and well-trained users to manage the systems effectively.

With the introduction of region-wide organics pickup and processing, on-site systems are less popular. However, shared systems that quickly breakdown organics to reduce volumes for hauling may be effective, especially for shared-bin installations.

CASE: At two MVHC sites, in-vessel organics management systems were trialed with mixed results. In order for such systems to work there must be a dedicated staff person and team of well-trained resident volunteers. In one case, with staff turnover the new staff did not share the same passion for the project, and system failure resulted. Simple low-capacity three-bin compost systems have been run successfully at several housing sites, and continue to be managed by resident gardeners.

CASE: Union Gospel Mission (UGM) uses an on-site in-vessel composting unit provided by hauler Recycling Alternative. The unit reduces food waste volumes by 80% within 24 hours, resulting in significantly reduced frequency of pickups. The non-food grade compost is then trucked to an industrial composting facility to complete the process. The system is contained, and is smell- and pest-proof.

Recommendations:

- Consider using in-vessel volume-reducing composting units in shared bin pilots, to reduce pickup frequency, and prevent smell and pest exposure.

V. BULKY WASTE MANAGEMENT AND ILLEGAL DUMPING

Disposing of bulky waste according to regulations is often prohibitively difficult and costly for residents and building operators. Prevalence of illegal dumping has increased significantly in Vancouver in recent years, and has become a commonplace way of dealing with bulky waste.

12. LAW-ABIDING BULKY WASTE MANAGEMENT COMES WITH SIGNIFICANT BARRIERS.

Challenges:

Car ownership rates are declining, making VSTS inaccessible for bulky waste disposal, and hiring bulky waste haulers is cost prohibitive for many households.

Responsible bulky waste management comes with an immense cost for buildings with limited operating budgets.

Discussion:

Properly disposing of bulky waste is a major challenge for residents, especially those who are lower income and without access to a large vehicle. When there is no city-wide program for bulky

waste, each MURB may or may not have their own program, with mixed efficacy in communicating those programs to tenants. In some MURBs with tight budgets, building staff direct tenants to abandon bulky waste on city property so they can call for free pickup in order to avoid paying for a hauler.

Image: a pile of bulky waste in a secured space behind a supportive housing facility. Much of this waste could be diverted.

CASE: At buildings run by The Bloom Group, residents coordinate with building staff to arrange bulky waste pickup directly from units, due to there being no storage space in buildings. At buildings run by RainCity Housing, each building typically receives 1-2 bulky waste pick-ups per month, or when a hoarder room needs to be emptied.

CASE: At MVHC sites in Vancouver, bulky waste management costs have steadily increased over the past four years. In that period, a successful 'cleanup day' program was implemented at three Vancouver sites in 2012 and scaled up to six sites in 2015, which reduced abandoned waste at those sites (see this link for more information). Annual cleanup days give residents the opportunity to exchange unwanted bulky items, build community connections, participate in waste management education programs, and dispose of their bulky waste in a responsible way. Cleanup day events are typically combined with a community BBQ meal, and the waste is hauled away at the end of the day. MVHC is challenged to absorb the increasing costs of removing illegally abandoned waste (see table below), which is often dumped beside waste bins on the edges of housing sites by non-residents.

MVHC bulky waste removal costs for sites in the City of Vancouver from 2012-2015

	2012	2013	2014	2015
Total waste costs, all sites	$27,725.15	$41,058.65	$39,703.72	$52,233.47
Total abandoned waste costs	**$26,015.77**	**$34,893.65**	**$34,977.42**	**$43,717.75**
Average, abandoned waste costs per building	$1,734.38	$2,326.24	$2,331.83	$2,914.52
Average, abandoned waste costs per unit	$31.68	$41.35	$40.03	$46.81
Total clean up day costs	$1,709.38	$6,165.00	$4,726.30	$8,515.72
Average, clean up day costs per building	$569.79	$1541.25	$945.26	$1419.29
Average, cleanup day costs per unit	$15.67	$14.67	$8.79	$22.42

Data source: Ulrvke Weissaerber, Supervisor of Tenant Proarams, MVHC.

Many cities have bulky waste pickup services, with variations in frequency and pricing structure. Some examples of current bulky waste management programs include:

- The City of Toronto: provides free bulky waste pick-up weekly on recycling day, and will send a staff member out to MURB sites to determine an appropriate site for depositing bulky waste for pickup.
- The City of San Francisco: offers all residents two free bulky waste pickup days per month.
- The City of Copenhagen: requires all MURBs to have a designated room or place for bulky waste, where it can be stored until specified free collection days, which occur four times per year. Row houses and detached houses also get free bulky waste pickup four times per year.
- In Seattle at SHA sites, a bulky waste pick-up service is offered to building managers by the SHA, charging $17.54 per item including mattresses which must be wrapped for bedbugs, and $22.22 per item for large appliances.

Image: mattresses piled up for disposal in a secured area behind a supportive housing facility are bagged due to bedbug contamination.

In 2006 there were approximately 2200 abandoned mattresses picked up in the City of Vancouver, and in 2015 there were over 8000[10]. Many mattresses are disposed of due to bedbugs and high tenant turnover. Metro Vancouver is currently investigating the plausibility of including mattresses in a future EPR program.

Image: a map of the 11 recycling stations for residents, spread across the City of Copenhagen (indicated by the large black and red dots).

[10] Interview with Jim Heeps, Superintendent of Street Cleaning, City of Vancouver

CASE: In Copenhagen there are eleven recycling centres across the city where residents can take excess waste, and delivery by bicycle is highly encouraged. Bulky waste is accepted for free at these recycling centers which have very user-friendly signage, numbered waste streams that do not change, and attendants on hand to answer questions. There are five "Recycling Stations" which accept 36 streams of recycling, and six "Collection Points" which accept 12 streams, including: hazardous waste, electronics, household appliances, bulky waste (furniture, mattresses, wood boards, carpets, etc), mixed metals, paper, cardboard, glass, PVC, treated wood, hard plastics, and textiles. There are also re-use centers, where residents can exchange unwanted household items, and one experimental waste-reuse design lab called "Goldmine" where new products are built from upcycled waste.

Image: recycling stations in Copenhagen have 36 clearly identified recycling streams, including 31: household appliances and electrical equipment, 32: monitors, 36: cables, and 24: light bulbs.

Recommendations:

- Implement recommendations from the 2008 staff report on bulky waste, starting with the implementation of a pilot bulky waste pickup service in Vancouver, with the intention to scale-up the program to include all residential buildings.
    - Regular annual bulky waste disposal days give the opportunity for residents to plan to look for free items on those days, and gives the city a day to focus delivery of waste-reduction messaging.
- Encourage all MURBs to have a bulky waste management plan including a designated bulky waste drop-off area in their buildings or an option for residents to leave bulky waste with building staff.
- Offer free bulky waste pickup for all non-market housing sites, especially those that house residents with multiple barriers.
- Explore the feasibility of opening a small transfer station for residential waste and specialized recycling programs, located close to high-density neighbourhoods such as in the False Creek Flats. This centre could be a hub for recycling education programming, include a free item exchange space, a waste up-cycling design workshop, and be a distribution point for waste management materials.

13. ILLEGAL DUMPING HAS BECOME COMMONPLACE.

Challenges:

Residents and building staff have learned that the City will pick up abandoned items for free. This system rewards people who break littering laws.

Illegal dumping often occurs on non-market housing sites from people outside of the housing community. Illegal dumping is also common on or around dumpsters in public areas, which accumulates quickly if not cleaned up quickly by the City.

Discussion:

Social norming indicates that people will do what they see others getting away with, and so abandoned waste can accumulate quickly. Therefore, bulky waste pickup turn-around times are very important.

CASE: Burnaby has a multi-pronged approach to tackle illegal dumping:

- Crews make regular weekly visits to frequent illegal dumping sites, unprompted by complaints, to prevent accumulation.
- There were significant reductions in illegal dumping once a mandatory bulky item pickup program was implemented, even where buildings already had private haulers.
- Burnaby has purchased six high definition security cameras to monitor illegal dumping hot spots (costing approximately $5000 - $6000 each). They can set polygons to monitor specific activity areas, can alert staff of activity, live footage can be viewed remotely, and they can easily capture license plates. They swap the cameras through different hot spots, as they take only 20 minutes to install. Cameras have been highly effective in reducing dumping.

CASE: As part of the current TCH pilot, programs were implemented to combat illegal dumping at 20 housing sites, including: installation of security cameras, improving lighting in hot spots, and hiring security guards for move-out times when Superintendents are not on site.

Recommendations:

- Use a multi-pronged approach to reduce illegal dumping, including:
    - Install high-definition, moveable cameras to aid in monitoring illegal dumping hotspots.
    - Improve lighting at hotspots.
    - Implement a city-wide bulky waste pickup program.

VI. SUPPORTING AND BUILDING RELATIONSHIPS WITH BUILDING STAFF

14. BUILDING STAFF NEED MORE TRAINING AND SUPPORT.

Challenges:

There is high staff turnover, and building staff (including Building Managers and Superintendents) lack sufficient training and support on waste management.

In many cases, waste management is not a priority for building staff, due to more pressing issues and lack of motivation, so they do not encourage residents to sort or reduce waste accumulation in private rooms. They need lots of support, and programs need to be 'served on a silver platter'.

External contractors working in non-market buildings may lack training and knowledge of the building's waste management system, causing contamination.

There is potential to hire more residents to improve waste management in their own buildings.

Discussion:

Building Managers and Staff hold the power to improving waste management in buildings, and engaging them in a supportive way is the key to improving diversion. Staff training is especially important before the introduction of any new programs, and should be offered well in advance of resident engagement efforts. Some haulers do offer building staff training for a fee, but most building operators are not inclined to pay for this service.

CASE: Toronto Community Housing (TCH) is the largest single waste service client operating about 8% of all Toronto MURBs. Due to the challenges that arise in servicing these buildings, the City of Toronto has dedicated resources and staff specifically to working with TCH to address waste management needs. Also, a new "Customer Service and Waste Diversion Implementation Unit" was established under the Collections and Litter Operations group with about five staff "Account Managers". Every MURB in the City is assigned to an Account Manager, who offers free consultation and support to building staff including trainings, lobby displays, troubleshooting, and waste management system design. The program allows Account Managers to build ongoing relationships with building staff, and develop a complete understanding of a building's needs. The City of Toronto offers free waste management training to all MURB staff at an annual training event. A "train the trainer" workshop format is used to equip MURB staff with strategies to educate their tenants. The training events are funded in part by the Continuous Improvement

Fund, a funding program created through a partnership between Waste Diversion Ontario, the City of Toronto, and Stewardship Ontario.

As part of a new City of Toronto initiative (in conjunction with a pilot study), 550 TCH building staff were trained at 20 half-day workshops, which will continue beyond the completion of the pilot. In TCH buildings there is no financial incentive for tenants and staff at TCH buildings to reduce garbage volumes because the bill for waste services goes directly to the TCH head office. In order to improve feedback to building managers and residents, City Account Managers are creating a new "report card" feedback program for building staff that will detail waste volumes, prevailing contamination issues, and other issues to bring to their attention.

CASE: The former *North Shore Recycling Program* included outreach, follow-up and troubleshooting supports for MURBs in three municipalities. Today, the City of North Vancouver continues with their Zero Waste Ambassadors program, which "can provide additional information, support and resources to help increase recycling and food scraps diversion in your building. We can also visit your building to assess your recycling needs, educate residents on proper recycling and help you with signage and posters."

CASE: In Peel Region (Ontario), the Public Works department has implemented an RFID system for waste collection reporting, complemented by a report card feedback process for building managers, to inform them of their building's performance and waste collection history.
Many buildings house unemployed residents, some of whom are keen to take on additional responsibility in the form of small waste management jobs for pay. Hiring tenants can be a good way to increase support to building staff for expanded waste management programs, and build support and empowerment among residents.

Recommendations:

- Create a program at the City that proactively provides free and comprehensive building staff support services. This would include free annual trainings for all MURB staff, a team of dedicated City staff to provide one-on-one support and build relationships with building staff, implementation tools for building staff, and free engagement programming for residents.
- Master Recycler is currently developing a staff training workshop for BC Housing, which should be replicated for all building managers and staff in the region. The workshop could be made into a video or interactive training website and widely distributed.
- Training and support can be directed through organizations such as the BC Building Owners and Managers Association, the BC Apartment Owners and Managers Association, and the Waste Management Association of BC.

15. BUILDING TRUST AND IMPROVING CITY SERVICES.

Challenges:

Some building operators distrust the City and Metro Vancouver, as they see the implementation of mandatory organics diversion programs as the creation of a new lucrative business for private haulers, where contamination is inevitable due to the capacity of operators, staff, and residents.

Illegal shelter construction beside dumpsters in public areas causes fire hazards and a backlog of waste, and is not dealt with quickly enough by the City and Police.

The City does not offer specialized waste pickup services (carry-out, dumpsters, etc).

Discussion:

Several building operators indicated that enrolling in an organics or recycling pickup program did not significantly reduce their garbage volumes and garbage hauling costs, and thus the change was far from cost effective. Measures should be taken to improve the cost effectiveness of implementing multi-stream waste systems. Also, buildings need more specialized support to roll-out these programs successfully, including staff training and tenant engagement.

When illegal shelters are constructed in alleys, they cause safety and fire issues for adjacent buildings. When they are dismantled, the Police are responsible for managing the people, and City crews are responsible for managing the leftover waste. Some buildings are concerned that these illegal shelters are not dealt with quickly enough, and would like to see a quicker response time from the City.

Because many non-market housing facilities become magnets for abandoned waste, these sites should be prioritized when they request a pickup for abandoned waste.

CASE: The City of San Francisco offers extended services for waste pickup for a fee, including key service, distance and elevation services.

With the upcoming update of the Municipal Ticketing Information system to include provisions for solid waste management by-law enforcement, organizations that have a history of violations should be given advance warning of when the new program will come into effect, along with a list of regulations and suggestions to help them achieve compliance. This way, they are given fair warning, which may be effective in moving them to action.

Recommendations:

- Incentivizing buildings to enroll in organics and recycling collection programs can be helped though the implementation of shared bins and community preferred service agreements, which lower service costs.
- Give support and preferential treatment to haulers that support the local community (through social enterprise mandates, and hiring individuals with barriers) and enact best practices (such as using low-emissions vehicles and providing extra supports to customers).
- Reach out to organizations that have a history of bylaw violations to inform them of upcoming changes in the MTI system, and provide them with suggestions to help them achieve compliance.
- Prioritize non-market buildings for abandoned waste pickups, especially when illegal shelters require removal. Explore the feasibility of offering free or reduced-price bulky waste pickup for buildings that accumulate abandoned waste from elsewhere.
- Explore the feasibility of offering multiple levels of waste pickup service, such as carry-out services, and a "platinum" service that could include organics bin liners and bin washing.

VII. HAULER-RELATED ISSUES

There are very mixed reviews of haulers: some operators praise their haulers for extra supportive services provided, while others lambaste their hauler for unfair binding contracts, mischarges, and providing inaccurate data.

16. ISSUES WITH PICK-UPS.

Challenges:

Incorrect bin-sizing and missed pick-ups result in overflowing bins and contamination. If bins are visibly contaminated, some haulers will not pick up waste, requiring building managers to pay for a more expensive waste removal service.

Haulers are occasionally challenged to get access to where bins are located, due to layers of building security and scarcity of building staff.

Haulers are exposed to numerous health hazards when handling waste.

Discussion:

Numerous issues can cause a missed pickup, including building staff forgetting to put bins out on the right day, bin access being blocked by delivery trucks or other waste trucks, contamination, bulky waste blocking bin access, or waste piled too high on bins. Missed pick ups cause significant issues for buildings, especially buildings with many units. And when the garbage bins get full, residents are more likely to pile up garbage or put it into bins for other streams causing contamination.

Image: a garbage bag infested with cockroaches.

Haulers are exposed to numerous health hazards when handling waste, which could be mitigated through improved waste management practices. Hazards include: leaky bags, bags containing sharp hazardous waste (syringes, knives) that can poke through bags, pests (cockroaches, bedbugs), mold-infested waste, and overweight bags and bins.

Recommendations:

- Improve hauler safety by requiring clear bags for all garbage, and require buildings to use smaller bins especially when bins are emptied manually.

17. ADDRESSING SENSE OF DISTRUST AND FRUSTRATION WITH HAULERS.

Challenges:

Haulers do not fulfill their contractual obligations, provide insufficient or incorrect data to customers, and provide more waste hauling service than is necessary.

There is more potential for haulers to hire people with barriers, especially those that service buildings in the DTES.

Discussion:

Many building operators expressed frustration with feeling trapped by some haulers' restrictive contracts that contain auto-renewal clauses, small windows for contract termination, and high contract cancellation fees. While other building operators appreciate their haulers, citing

contract flexibility, courtesy waste audits, staff training, and provision of totes as key benefits.

Image: A CleanStart BC waste truck out for pickups.

CASE: CleanStart BC is an example of a social enterprise hauler that brings added benefits to the communities they serve. They actively hire individuals with barriers, some of whom live in non-market housing. Not only are they bringing good employment opportunities back to the communities they serve, because of their lived experience their employees have a deeper understanding of the unique waste needs of these buildings and how best to manage their waste effectively. Their customers have expressed a desire for an expansion of nonprofit, community benefit-oriented haulers.

Some haulers have a tendency to over-prescribe garbage service, while under-prescribing organics and recycling. This is in part because garbage service is typically more lucrative for haulers.

Recommendations:

- Encourage the growth of nonprofit, social enterprise, and cooperatively-owned haulers. Encourage social and environmental procurement preferences to be a part of all waste hauler RFPs, so that points are given for haulers that can provide these additional benefits such as requirements to hire local workers and individuals with barriers, as well as use of low- and no- emissions vehicles and bicycles. Alternatively, RFP writers can incorporate a value proposition at the beginning of an RFP, with a preference for businesses that emphasize a social return on investment.
- Add language to this effect on the City's "Find a Hauler" webpage.
- Investigate potential to implement legislation at the provincial level that protect the rights of waste service customers, to give them more power to negotiate and end contracts with problematic waste haulers.
- Require all haulers operating in Metro Vancouver to collect and provide waste data (weights, volumes, and contamination prevalence) to customers, and to municipal and regional authorities.

VIII. BUDGET LIMITATIONS FOR BUILDING OPERATORS

18. SOME NON-MARKET BUILDING OPERATORS FACE ADDITIONAL SYSTEMIC AND SITUATIONAL CHALLENGES THAT PUT THEM AT A DISADVANTAGE RELATIVE TO OTHER BUILDINGS.

Challenges:

When servicing a building with fixed funding, haulers cannot pass fines on to building operators, and it tends to be the buildings with higher contamination rates that also cannot afford increased waste disposal fees. There is an inappropriate distribution of fines: additional costs are often handed to the organizations most challenged to pay them (fines for hazardous medical waste, contamination, removing hoarders' waste, and large amount of bulky waste).

New organics disposal program fees are not sufficiently offset by a decrease in garbage volumes and disposal fees in many buildings, and these buildings do not have enough resources to improve diversion rates. Buildings with fixed budgets cannot afford improved waste management systems.

Implementation of new fine programs will be prohibitive for the operational budgets of some buildings.

In buildings where residents collect and hoard abandoned waste, building operators are stretched to cover costs to deal with such waste, while the City saves money as volumes of abandoned waste are reduced in public areas elsewhere.

Discussion:

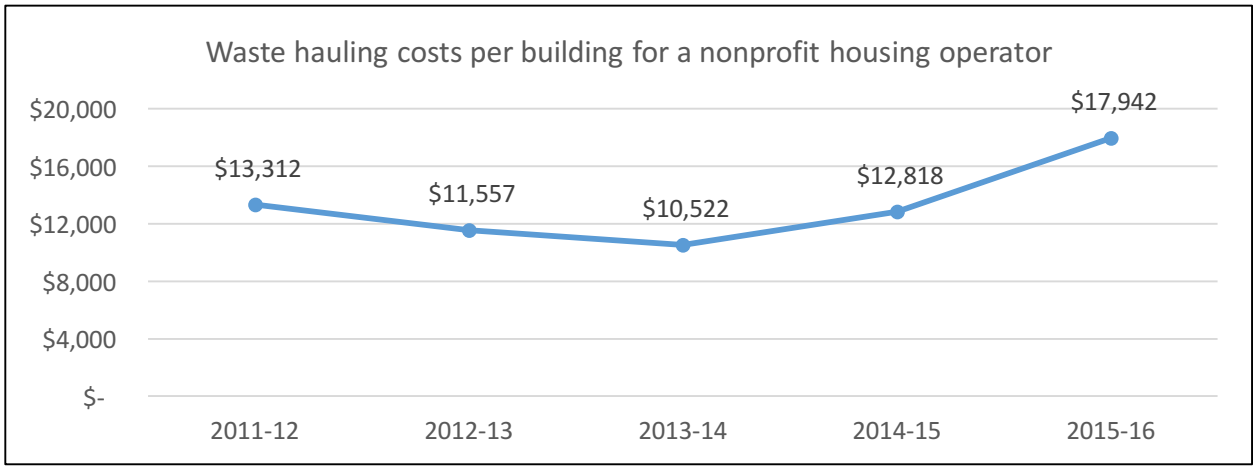
The strength of a negative feedback loop must be set relative to the behaviour it is designed to correct[11], meaning that regulations that are designed to create negative feedback loops to modify behaviours, such as contamination fines and tipping fees, must have appropriate severity but also must reach the people who's behaviour they are attempting to modify. Fines for syringes, for example, do nothing to change behaviour, but do put great strain on nonprofit haulers and building operators who are already stretched. For haulers who service buildings that produce contaminated waste, they are caught in a difficult position because the contamination cannot be effectively decreased, and frequent disposal surcharges increase costs while buildings with fixed funding are unable to pay more for disposal.

[11] Meadows (1997): *Places to Intervene in a System*.

In many SROs, waste carts are stored in hallways which present a fire hazard. Often there is no official internal system for collection, and tenants are paid $5 to take bins down to the alley when full. Many SROs have very tight budgets and are not interested in taking extra effort for waste management.

CASE: In Portland, San Francisco, and New York, public housing authorities are exempt from organics diversion programs. In Toronto, Toronto Community Housing buildings receive special support from the City to increase their participation in the City's waste diversion programs. In Copenhagen, public housing buildings are required to participate fully in the City's waste diversion programs, but receive no extra support.

All housing operators have seen recent rising waste services costs. One operator shared their cost data, which showed significant variability in costs over the past five years, with costs peaking in the most recent period (see chart below).



Due to the nature of tenants in some low-income buildings, especially those located close to the Hastings Street Markets, hoarding of collected abandoned waste is common. Some buildings become centers of concentrated abandoned waste because of this, and building operators are challenged to keep on top of bulky waste management and associated costs.

Recommendations:

- Reconsider the way fines and fees are applied to non-market buildings. Explore mechanisms to reduce or eliminate fines for these building types, and instead implement feedback loops that directly affect residents' behaviour (*see Challenges 1 and 2*).

19. AN INEFFICIENT PRACTICE OF "FOOD DONATIONS" PUTS MEAL PROVIDERS IN A DIFFICULT SITUATION.

Challenge:

Many housing organizations that offer meal programs depend on food donations, but get trapped in a situation where they are forced to accept unwanted donations, which increases their operational costs, disposal costs, and the overall volume of food waste.

Discussion:

There are 25 organizations offering regular free or low-cost meals in Vancouver[12], and up to 133 organizations offering infrequent free or low cost meal programs in Vancouver[13]. *"Most organizations that accept food donations are non-profits operating on very limited budgets and resources to receive, sort, store and use donated food items. There is a certain cost associated with each step to use the donated food items".*

Doris Chow, Manager of the DTES Kitchen Tables Project, explains that supermarket organics waste, rebranded as "food donations", can be burdensome for nonprofit kitchens to accept. While volume data has not been recorded due to resource constraints, nonprofits have anecdotally identified an increase in food waste dumping since the introduction of the Metro Vancouver organics ban.

A study commissioned by LOCO BC in 2010 on DTES community meal programs estimated there was potential to divert approximately 60 tonnes of food waste. At that time, only one kitchen in their study was composting organic waste; participation in organics recycling has since increased, but a follow up study could identify areas for improvement. For smaller kitchens, the report suggested a group solution could be sought to make organics recycling more cost effective.

[12] City of Vancouver (2015): *Food - Free*

[13] Vancouver Coastal Health (2013): *Free low cost and community meals in Vancouver*

"Many sites, even those with purchasing budgets, receive food donations. Although much of the food is edible, some is not, either due to pest exposure or due to product spoilage, and must immediately be disposed. Many donors have an all-or-nothing policy, and so kitchens feel pressured to take food that adds heavily to their waste disposal costs. Many of the sites make good use of products they cannot use, relying on extensive networks to redistribute excess edible food donations. Others cannot redistribute it as effectively. At sites where the disposal of donated food adds significantly to disposal costs, staff should be investigating the total cost of accepting food donations and creating the business case for purchasing the materials they need rather than paying for disposal of excess food. One issue with this, however, is that sometimes food donors offer other products (disposable dinnerware, cleaners, etc.), and refusing to accept donated food can compromise the relationship with the donor."

- Amy Robinson, LOCO Business Network Society of BC (2010): *Greening DTES Charity Kitchens, (Draft) Final Report.*

The report suggests that better coordination and communication among kitchens, and between donors and kitchens, could reduce food waste generated and thus reduce disposal and food transportation costs.

Presently the federal government is exploring new tax incentives to increase food donations, taking inspiration from new legislation in France that mandates all edible food waste to be donated. However, focus should be given first to establishing effective food distribution networks to manage current food donations, before donation volumes are increased.

"The problem of feeding people in this region is not a food shortage issue, but rather a food distribution issue"

- Doris Chow, Project Manager, DTES Kitchen Tables Project

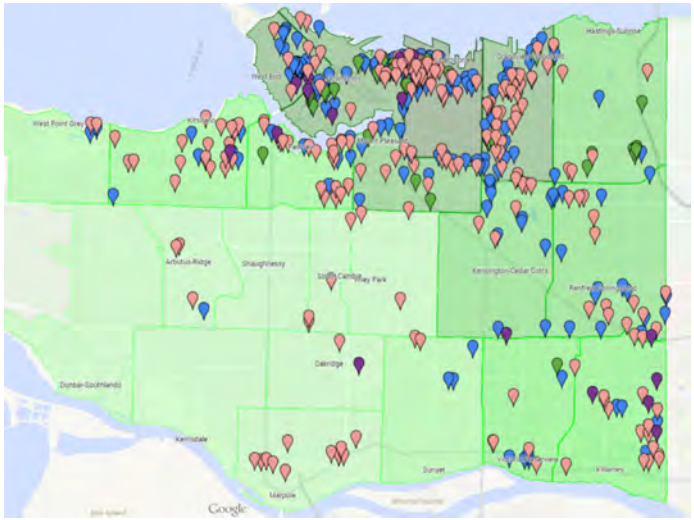
Recommendations:

- Commission a study that follows up on LOCO BC's 2010 study to examine waste stream volumes and management practices in DTES community kitchens, and identify opportunities to reduce waste. This study should also look at potential for community organizations that accept food donations to charge for redistribution, a practice that is currently prohibited in some contexts (such as for New Hope Cuisine, a former project of the Salvation Army) but allowed for organizations (such as Quest Food Exchange). The study could also explore the prevalence of disposable cutlery and dishes in meal service programs, and how to reduce their use.
- Use the Strathcona BIA's model of *Recycling in Strathcona* to procure a community preferred service agreement with a local hauler to make organics recycling more cost effective for smaller kitchens. The service could be offered in areas with high concentrations of community kitchens, such as in the DTES.
- Explore the feasibility of setting up a low-cost food terminal to centralize the management of food donations and to create a market for B-grade local produce.
    - Such a facility could incorporate necessary infrastructure such as: vehicle docks, walk-in fridge and freezer space, space for processing food into value-added food products, efficient waste management, and low-emissions vehicles to move product.
    - It could also provide added benefits such as: hiring local residents with barriers for skills development, giving power to kitchens to collaborate and say no to inappropriate food donations thus reducing their costs, facilitate the purchasing of local B-grade produce which also reduces food waste on local farms, enable group purchasing discounts, streamline food procurement creating cost and staff efficiencies for both purchased and donated food, increase access to fresh, healthy and affordable food for residents in the DTES, and selling direct to low-income customers through a discount community supermarket and/or cafeteria.
    - Support for such a study could be sought from: the BC Ministry of Agriculture, the Vancouver Coastal Health, the BC Centre for Disease Control, and the Vancouver Food Policy Council.
    - For inspiration, the study should look to:
        - The Ontario Food Terminal, an initiative of the Ontario Ministry of Agriculture, who partners with a local nonprofit to distribute B-grade produce.
        - Daily Table in Boston, a low-cost nonprofit food retailer, who resells donated and deeply discounted food as well as selling prepared meals.
        - Table Matters, a nonprofit in North Vancouver that engages in food-related community development projects including preventing food waste by processing food donations into frozen meals.

ASSESSING WASTE VOLUMES

ASSESSING SECTOR WASTE VOLUMES

There are 634 non-market housing sites in the City of Vancouver, according to internal City records (see map above for their approximate distribution). The following section provides data on actual and estimated waste volumes for each non-market housing sector.



Map: Distribution of non-market housing sites in Vancouver, 2015 (map credit: Hooman Shahrokhi).

Notes on data accuracy:

- These measures are proxies for actual waste volumes, as volumes of actual waste disposed of are less than the total bin capacity that is provided and paid for.
- Recycling service volumes are high because every building has a minimum of three 360 liter bins (one for each paper, mixed containers, and glass), and actual waste volumes are likely much less.
- Data is based on City hauling service data, and so does not include waste volume data from other haulers. This has a significant impact on data accuracy, as some buildings may receive only one or two waste stream pickup services, resulting in abnormally high waste volumes in some streams. This limitation has been accounted for in the section *Comprehensive City service*, where data is provided for buildings that receive City waste pickup for all three streams.

Shelters (see table below for data summary)

There are 24 shelters in Vancouver according to an annually updated list provided by the Greater Vancouver Shelter Strategy. During the homeless count on March 10th, 2016, there were 1308 people counted in shelters including year-round shelters, winter & HEAT shelters, transition houses, detox centres, safe houses, and shelters for youth.

- The City of Vancouver provides recycling service to five shelters, which have a combined total of 372 beds. No garbage or organics services are contracted, so no further data is available.

- Due to the very limited data available for shelters, we are unable to make any estimates on waste volumes produced.

Table: Summary of waste volumes in shelters

	Shelters					
	Number of buildings serviced by the City	Corresponding number of units (beds) serviced by the City	Total cart capacity volume allocated per week (litres)	Average cart capacity volume allocated per unit per week (litres)	Number of buildings in sector	Estimated total sector cart capacity volume allocated per week (litres)
Garbage	-	-	-	-	24	
Organics	-	-	-	-		
Recycling	5	372	-	-		

SROs (see table below for data summary)
There are 110 SROs in Vancouver based on internal City data, totaling 4406 units.

- The City of Vancouver provides both garbage and organics pick-up service to 17 buildings, totaling 217 units, with combined volumes of 10860 litres per week of garbage and 2940 litres per week of organics. The City also provides recycling pickup to two buildings, totaling 40 units, and the service volume is unknown.
- Of all City-serviced SROs, the average SRO unit is serviced with 50.0 L per week of garbage pick-up service, and 13.5 L of organics pick-up service.
- If all SRO units in Vancouver were serviced to the same level as the average of SROs with City service, the total weekly service volume would be 220,300 L per week of garbage, and 59,481 L of organics.

Table: Summary of waste volumes in SROs

	SROs					
	Number of buildings serviced by the City	Corresponding number of units (beds) serviced by the City	Total cart capacity volume allocated per week (litres)	Average cart capacity volume allocated per unit per week (litres)	Number of buildings in sector	Estimated total sector cart capacity volume allocated per week (litres)
Garbage	17	217	10,860	50.0	110	220,300
Organics	17	217	2,940	13.5		59,481
Recycling	2	40	-	-		

Supportive housing and non-market rental (see table below for data summary)
Due to constraints on the data available, data sets for supportive housing and non-market rental are combined. There are 500 non-market MURBs (including supportive housing) in Vancouver according to internal City data, totaling 25,621 units.

- The City provides garbage pickup service to 41 buildings, totaling 1510 units, with combined service volumes of 183,915 L.

- The City also provides organics pickup to 123 buildings, totaling 5100 units, with combined service volumes of 186,360 L.
- The City provides recycling service to 366 buildings totaling 20,654 units, and totaling approximately 1866 360-liter bins, which totals 671,760 litres of service volume.
- Of all the City serviced buildings, the average unit is serviced with 123.8 L of garbage pick-up service, 48.0 L of organics pick-up service, and 57.8 L of recycling service.
- If all non-market rental and supportive housing units in the City were serviced to the same level as the average of buildings with City service, the total weekly service volume would be: 3,171,880 L for garbage, 1,229,808 L for organics, and 1,480,894 L for recycling.

Table: Summary of waste volumes in supportive housing and other non-market rental buildings

	Supportive housing and non-market rental					
	Number of buildings serviced by the City	Corresponding number of units (beds) serviced by the City	Total cart capacity volume allocated per week (litres)	Average cart capacity volume allocated per unit per week (litres)	Number of buildings in sector	Estimated total sector cart capacity volume allocated per week (litres)
Garbage	41	1510	183,915	123.8	500	3,171,880
Organics	123	5100	186,360	48.0		1,229,808
Recycling	366*	20,654*	671,760*	57.8*		1,480,894*

*Note: These amounts are approximate estimates, as a few buildings are serviced with small blue bins, and were therefore are not included in the figures.

Comprehensive City service: all three streams (see table below for data summary)
There are 12 building sites that receive comprehensive garbage, organics and recycling service all from the City, and for which there is complete and accurate date on service volumes. Nine of these 12 sites are co-op housing associations, and the others are run by nonprofit housing societies.

- These sites are provided with very high volumes of organics and recycling service, because they likely have well-established waste sorting programs in place. Actual waste volumes, especially for recycling, are likely much lower than the volumes indicated here because the total service volumes are based on bin size, not on actual waste volumes produced.
- Of all the comprehensive City serviced buildings, the average unit is serviced with 46 L of garbage pick-up service, 39 L of organics pick-up service, and 163 L of recycling service
- If all non-market rental and supportive housing units in the City were serviced to the same level as the average of buildings with comprehensive City service, the total weekly service volume would be: 1,178,566 litres for garbage, 999,219 litres for organics, and 4,176,223 litres for recycling.

Table: Summary of waste volumes in supportive housing and other non-market rental buildings based on data from buildings with comprehensive City service

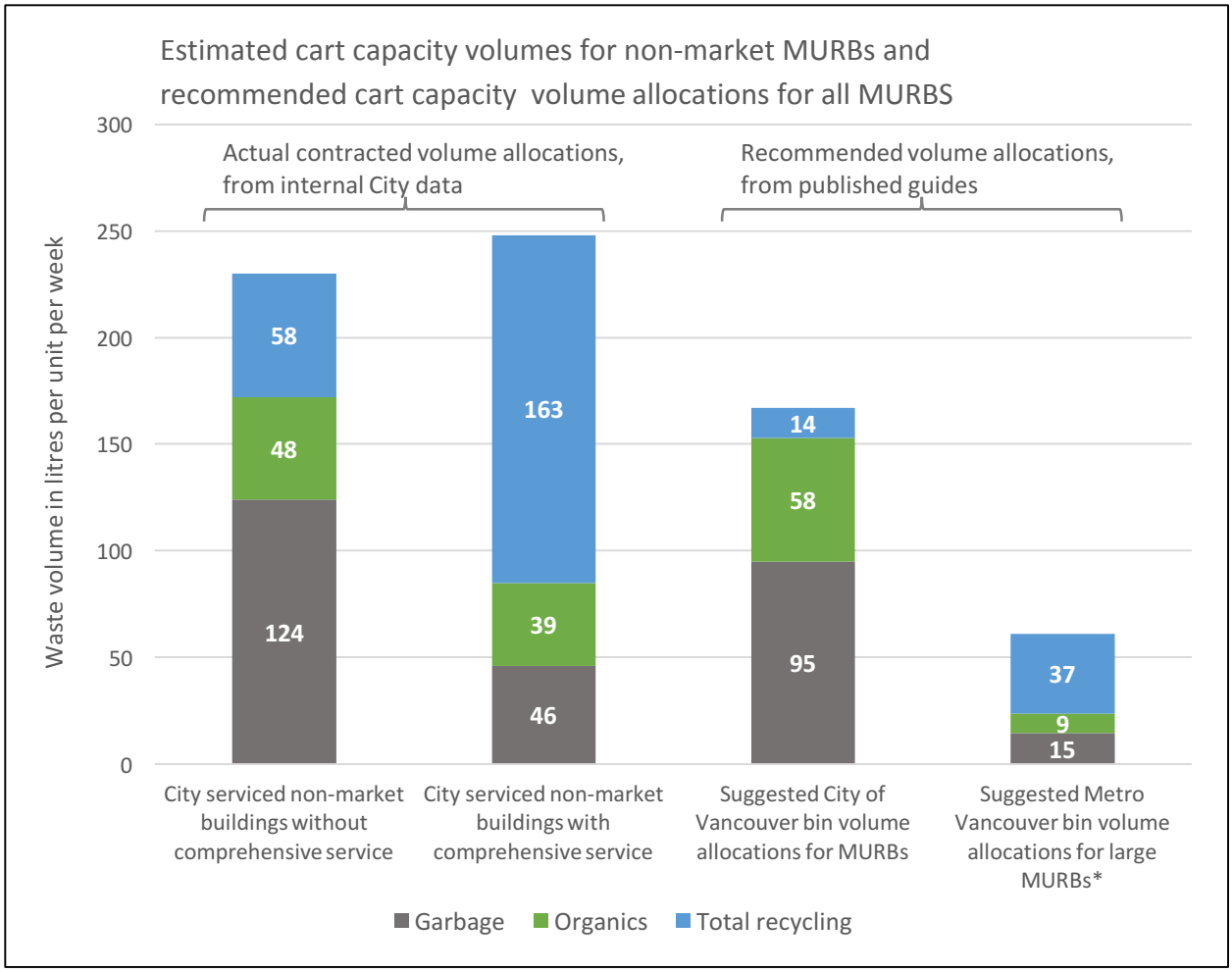
	Supportive housing and non-market rental, with comprehensive City service					
	Number of buildings serviced by the City	Corresponding number of units (beds) serviced by the City	Total cart capacity volume allocated per week (litres)	Average cart capacity volume allocated per unit per week (litres)	Number of buildings in sector	Estimated total sector cart capacity volume allocated per week (litres)
Garbage	12	257	12,420	46*	500	1,178,566
Organics	12	257	12,660	39*		999,219
Recycling	12	257	23,040	163*		4,176,223

*Note: averages are calculated first for each building, then the amounts for each building are averaged together.

OBSERVED NON-MARKET WASTE VOLUMES & RECOMMENDED MURB VOLUME ALLOCATIONS

Both non-comprehensive and comprehensive City-serviced buildings have similar total cart capacity volumes of 230 litres and 248 litres allocated per unit per week. However, the diversion rates are very different, and these two categories cannot be directly compared because data from non-City haulers is unavailable for buildings without comprehensive City pickup service, so there are likely other waste stream volumes unaccounted for in these tabulations (for example, a building that receives City service for garbage may or may not have another hauler providing organics and recycling pickup). However, by comparing data from these two housing groups we can get a sense of the range of actual service volumes in the non-market sector.

In the chart below, service volume data from non-market housing is displayed beside recommended volume allocations for all MURBs; it is important to note that these data sets are not directly comparable because the average MURB has very different characteristics from non-market housing sites, so it is to be expected that their waste volumes are inherently different. However, the stark difference between recommendations for MURBs and actual service volumes for non-market housing should be taken into consideration: a separate cart capacity volume allocation guide should be made for non-market housing, to support non-market buildings in implementing new organics or recycling services where none yet exist.



*Where a range of bin volumes or units was recommended, the midpoint of the range was used for calculations; assumes presence of a dedicated cardboard bin, and lowest recycling levels.

WASTE AUDITS

WASTE AUDIT OF FIVE CITY SERVICED SITES

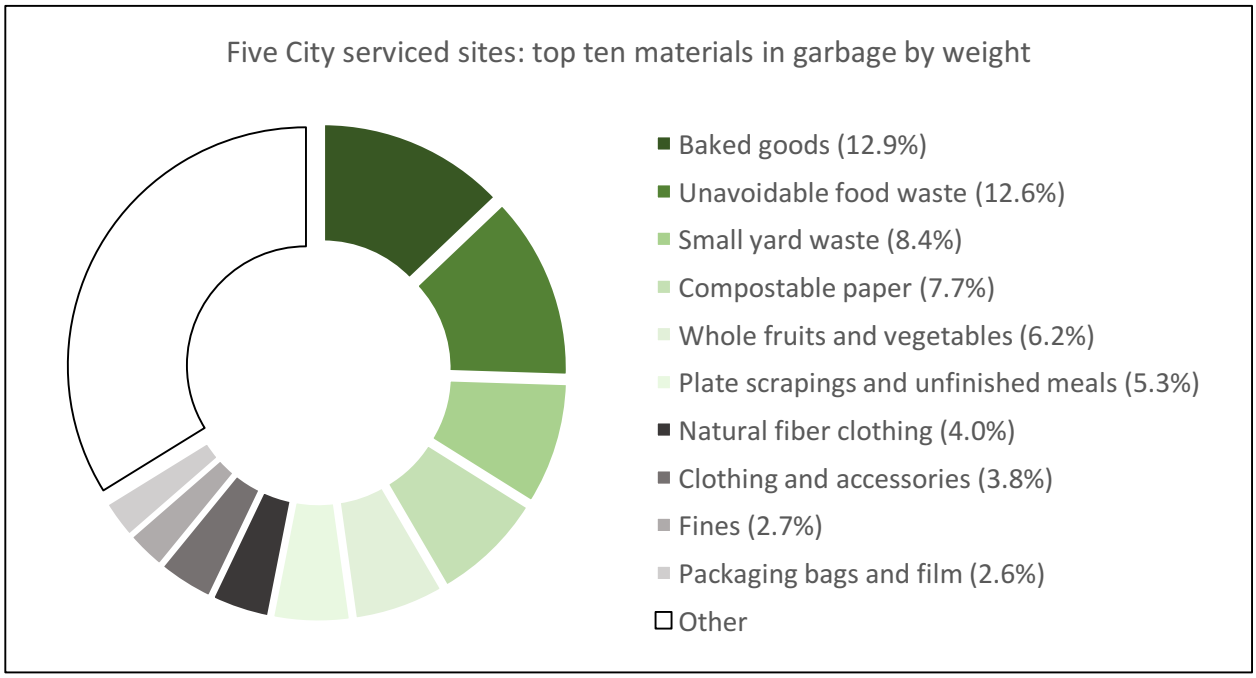
Five non-market housing sites that receive City garbage pickup service were selected to participate in a Metro Vancouver Waste audit. The analysis found that 78.4% of material could have been diverted. The waste was analyzed by TetraTech Consulting at the Vancouver South Transfer Station on July 7th 2016. Housing sites were selected because they are serviced by a single truck route. All together the five sites contain 186 units. One of the sites receives City organics pickup service, but that is the only non-garbage pickup service provided by the City to these five buildings; it is likely that they do not contract additional services for organics and recycling, however this is not confirmed. Garbage volume data is based on service contracts and is likely an over-estimate of total volumes as some of this garbage is put out in bags.

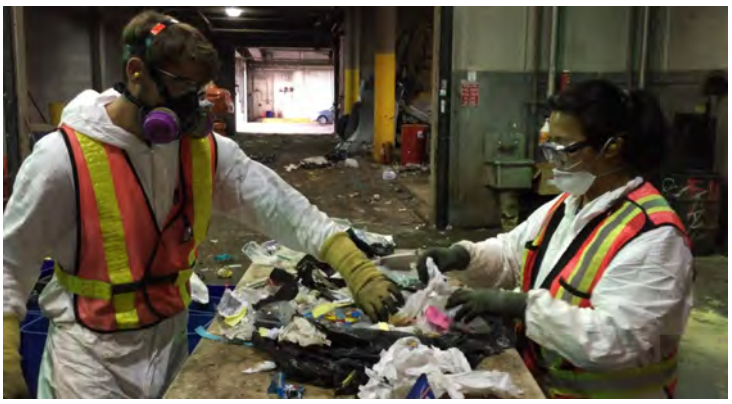
Table: Summary of contracted waste service volumes from the five City serviced sites

	Building type	Number of units	Garbage service volume (litres)	Organics service volume	Recycling service volume
Europe Hotel	Nonprofit SRO	84	5400	-	-
Alexander Residence	Seniors housing	30	7875	-	-
Ross House	SRO	24	1260	-	-
Creekside Student Residence	Private SRO	22	720	120	-
Mount Everest Rooms	Private SRO	26	240	-	-

Waste audit results:

- 198.23 kg of waste from load was sampled, weighed, and sorted into 142 waste categories.
- The sample contained: 21.6% garbage, 19.8% recycling, 56.7% compostable materials, and 1.9% refundable-deposit recycling.



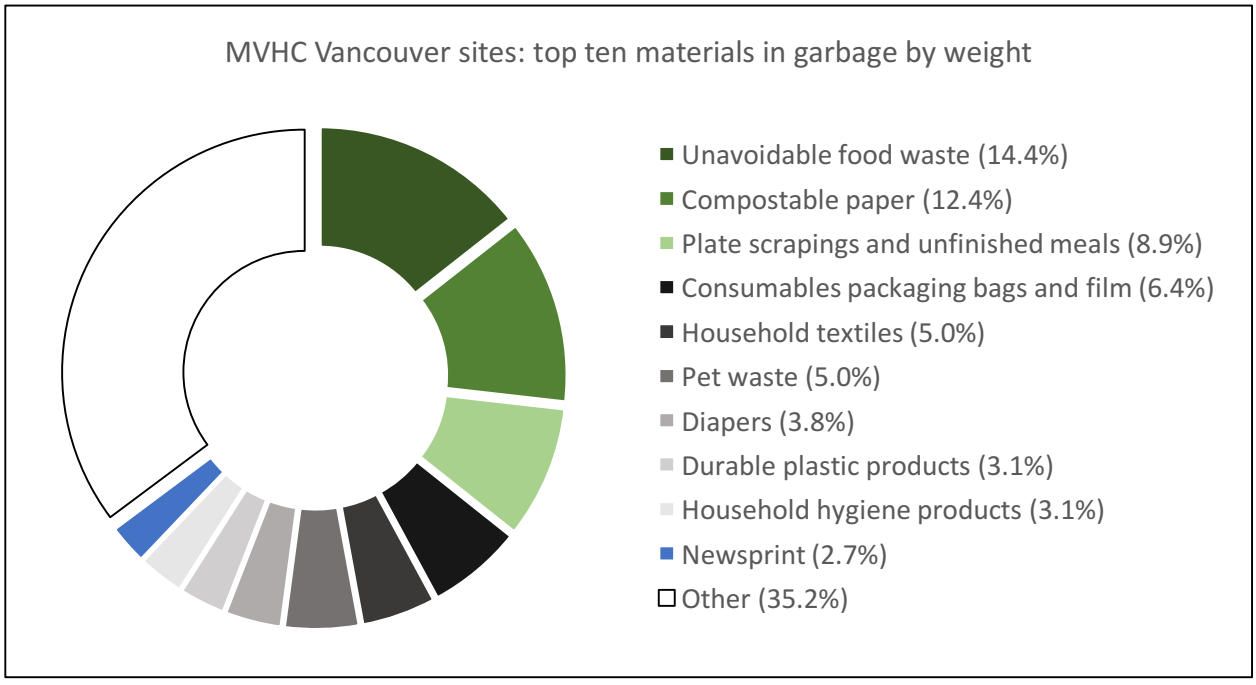


Images: Baked goods were the largest single waste type in the audit of garbage from the five City serviced sites, and the crew from TetraTech Consulting sorting the waste.

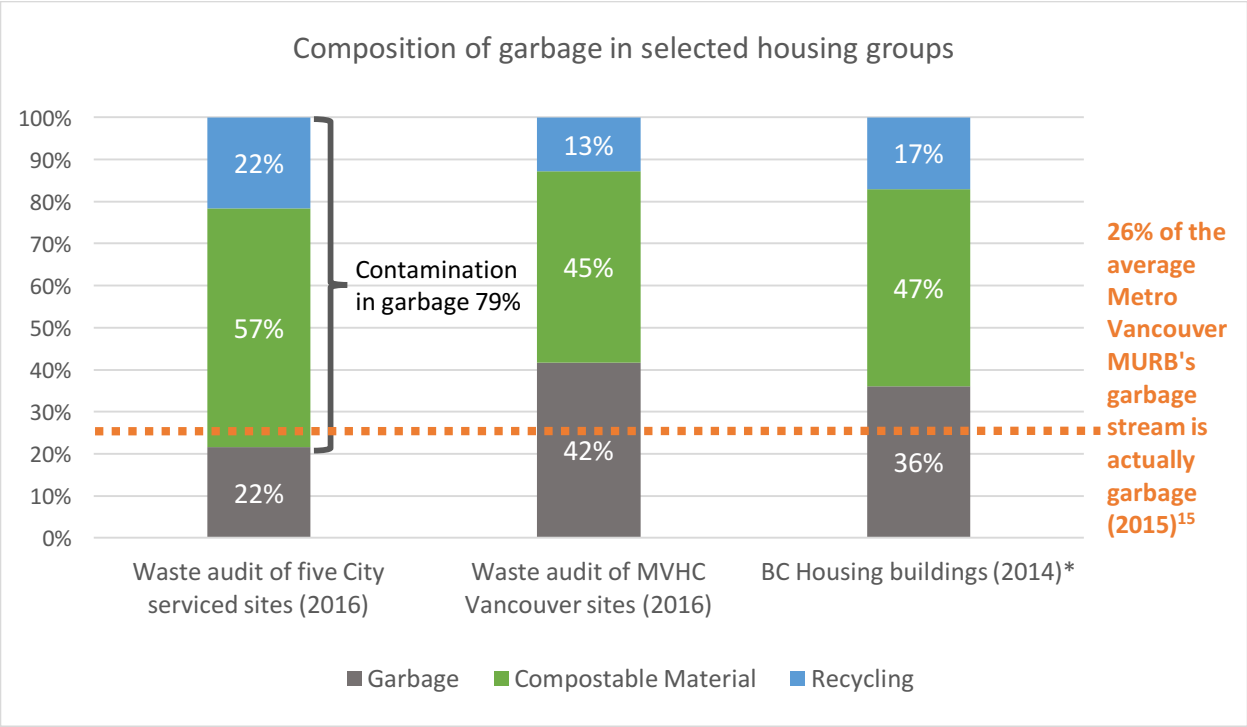
WASTE AUDIT OF MVHC SITES IN VANCOUVER

Garbage loads from nine MVHC sites were analyzed on July 5th 2016 by TetraTech Consulting. The analysis found that 58.3% of the material in the garbage could have been diverted.

- The nine sites are all located in the City of Vancouver: Habitat Villa, Strathearn Court, Ashdown Gardens, Heather Place, Tivoli Gardens, Euclide Square, Hemlock Court, Kelly Court, & Semlin Terrace. All sites receive three-stream waste pickup from a private hauler.
- 101.76 kg was sampled, weighed and sorted into 142 categories. The sample contained: 41.7% garbage, 12.8% recycling, 45.4% compostable materials, and 0.1% refundable-deposit recycling.



SUMMARY OF WASTE AUDITS



*The methods used to determine data for BC Housing may be different from the methods employed for data in the previous two sets.[14]

The chart above summarizes aforementioned waste audit data, showing the composition of garbage samples. In all cases, more than half of sampled garbage contained waste that could have been diverted, with 45%-57% being compostable material. The relatively large portion of compostable material compared to the smaller portion of recycling is explained by the considerable time it takes for new diversion programs to become effective: organics programs are relatively new compared to long-established recycling programs. Evidently there is much room for improvement in all diversion programs, and some housing groups are doing much better than others. Both the MVHC Vancouver sites and BC Housing sites appear to be diverting more waste than the average Metro Vancouver MURB (where 26% of garbage composition is actually garbage[15]), while the five City serviced sites lag behind likely due to a lack of organics and recycling collection programs.

[14] BC Housing and Dillon Consulting (2016): *Tenant Engagement on Sustainability: Focusing on Waste Reduction and Diversion*

[15] Metro Vancouver (2015): *2015 Waste Monitoring Program*

RECOMMENDATIONS

These recommendations have been compiled for the City of Vancouver, however most of them require collaboration with external organizations for implementation. All zero waste programs should emphasize relationship-building among the stakeholders involved. It is only through fostering relationships across service hierarchies that we can build the trust, sense of accountability, and collaborative spirit that is needed for effective program implementation.

In order to reach zero waste, many of these recommendations will have to be implemented at some point in the near future. Recommendations are ranked in order of feasibility starting with the easiest to implement at the top, however it is the more challenging policy and systems changes further along in the list that stand to have the largest impact on waste diversion.

SHORT TERM (BY 2020)

1. **Update the City of Vancouver Garbage and Recycling Storage Facility Design Guidelines to include examples of waste management best practices** (*see Challenge 5*).
   - Add language and visual examples to the City of Vancouver Garbage and Recycling Storage Facility Design guidelines that encourage waste room best practices, including:
     - Standardized colour-coded wall sections with corresponding bins.
     - Garbage receptacles placed to be slightly more convenient than receptacles for other streams.
     - Designated spaces for bulky items, electronics, batteries, and hazardous waste.
     - Creating exchange centres in buildings to facilitate re-use of goods that are still in good condition.
     - Separation of user-accessible common space from room where waste is stored, by connecting chutes ("recycling lounge" concept).
     - Include flex space in anticipation of additional waste stream sorting requirements.
     - Considerations for accessibility needs, especially when dumpsters will be used. Ensure there are mechanisms to make them accessible to people with physical disabilities, including ramps, or hatches in the side of dumpsters. (*see Challenge 6*)
   - Also include design guidelines for multi-stream in-unit waste storage space.

2. **Revise waste bin volume allocation guides, for both City of Vancouver and Metro Vancouver (*see Assessing Sector Waste Volumes section*).**
   - Create volume allocation guides specifically for non-market buildings that are setting up new organics or recycling programs.

3. **Encourage social and environmental procurement preferences to be incorporated in hauler RFPs** (*see Challenge 17*).
   - Encourage social and environmental procurement preferences to be a part of all waste hauler RFPs, so that points are given for haulers that can provide these additional benefits such as requirements to hire local workers and individuals with barriers, as well as use of

low- and no- emissions vehicles and bicycles. Alternatively, RFP writers can incorporate a value proposition at the beginning of an RFP, with a preference for businesses that emphasize a social return on investment.
- Add language to this effect on the City's "Find a Hauler" webpage.

4. **Encourage public syringe disposal boxes to be emptied and maintained more frequently** (*see Challenge 8*).
   - The Street Cleaning Team should establish a connection with Vancouver Costal Health to report syringe disposal boxes that are in need of attention, and to encourage more frequency maintenance.

5. **Create a dedicated *Zero Waste Community Engagement Team* within the Solid Waste Management Division solely focused on engaging Building Staff and Residents.**
   - Responsibilities would include training and consulting with Building Staff, running public education campaigns, and recruiting and assisting resident volunteers in MURBs to create effective recycling programs.
   - These individuals should have knowledge of waste management systems, as well as skills in facilitation, coaching, organization, and project management.
   - This initiative could also be administered and funded through a partnership with Metro Vancouver.

6. **Create a program that proactively provides free waste management system consultation to MURB Building Staff, administered by the *Zero Waste Community Engagement Team.***
   - Support for building staff could include training, implementation tools, and one-on-one consulting, with an emphasis on relationship building. Focus areas include:
     - Helping staff to develop waste management plans that bring buildings into compliance with existing bylaws, including setting up recycling and organics diversion programs (*see Challenge 7*).
     - Encouraging buildings to setup waste management plans for EPR program items, hazardous waste, and bulky waste (*See Challenge 12*)
     - Providing materials and guidance on how to educate residents about waste diversion programs in the building, to help them be in compliance with clauses 5.15 and 6.7A.4 in Solid Waste By-Law 8417 (*see Challenge 3*).
     - Proactively distributing free informational flyers, posters and bin stickers to Building Staff as needed.
     - Implementing informational feedback loops to inform residents of the progress of their diversion efforts and related environmental impacts, through bulletin boards, emails, and-outs, etc (*see Challenges 2 & 3*).
     - Advising Building Staff on syringe waste management and bin placement best practices (*see Challenge 8)*.
     - Advising staff on waste room configuration best practices, including bin configuration (*see Challenges 9 & 12*).
   - Each building would be assigned to one staff member where they can receive direct

support form the same person who understands their case.
- Start with consulting high-density MURBs and buildings that have a history of bylaw violations, and inform them of upcoming changes in the MTI system.

7. Create a program that provides free training for MURB Building Staff, administered by the *Zero Waste Community Engagement Team* (*see Challenge 14*).
- Offer one free annual training workshop open to all MURB staff.
- Create training resources for Building staff including a training manual, and online videos or interactive training website.
- Training and support can be directed through organizations such as the BC Building Owners and Managers Association, the BC Apartment Owners and Managers Association, and the Waste Management Association of BC.
- Reach out to non-profit training organization Master Recycler for advising on this.

8. Create initiatives that build momentum around zero waste ideals, administered by the *Zero Waste Community Engagement Team.*
- Create a city- or region-wide competition for buildings to reduce their garbage volumes and contamination levels, based on data provided by haulers. See "The Mayor's Towering Challenge" in the City of Toronto, as an example (*see Challenge 2*).
- Similarly, create a city- or region-wide competition for schools to reduce their garbage volumes and contamination levels.
- Design specific awareness campaigns that are released annually on the same day, such as Earth Day.

9. Create a Recycling Ambassadors program with volunteer residents, administered by the *Zero Waste Community Engagement Team.*
- Recruit and train volunteers to join an official citizen-powered movement supporting zero waste programs. This program could be branded as an extension of the *Keep Vancouver Spectacular* program. Such a program could include:
    - Free training workshops for MURB residents.
    - Allocate funding to provide small grants to Recycling Ambassador teams, which can be delivered through the existing Greenest City Neighbourhood Small Grants program. These grants can cover costs such as printing, translation, workshop organization, etc.
    - Provide supportive materials to volunteers to run resident engagement programming in their own MURBs (*see Challenge 4*).

10. Encourage BC Housing to specifically fund bulky waste diversion efforts for shelters
- Seasonal shelters funded by BC Housing should be required to budget staff time or contractors to sort remaining bulky waste when shelters are closed to improve diversion rates (*see Challenge 7*).
- Encourage haulers to partner with local nonprofit community bike shops to divert bicycle parts from hauled bulky waste.

11. **Aggressively target and reduce illegal dumping** (*see Challenge 13*).
    - Install high-definition, moveable cameras to aid in monitoring illegal dumping hotspots.
    - Improve lighting at hotspots.

12. **Initiate a pilot of shared waste bins, implemented by a third party** (*see Challenge 10*).
    - A third party coordinator (such as the BC Nonprofit Housing Association) would be needed to facilitate the following pilots. The City could initiate and provide indirect support.
    - Create a pilot of coordinated waste management zones, where one hauler is contracted to provide services to a group of neighbouring sites. A partnership between the City, the BC Nonprofit Housing Association, and the local BIA could be established to provide services to both businesses and housing facilities. Such a pilot could start small, with just one full block, and later be expanded to include larger neighbourhood areas. The following are sites where this pilot could be explored:
        - Sites sharing the alley behind the 600 block of Alexander Street and Powell Street between Princess Ave and Heatley Ave (recommended by the Strathcona BIA).
        - Currently there are 43 sites receiving special Wednesday night garbage collection from the City, due to their limited capacity for on-site waste storage. Many of these sites are in very close proximity (*see map of sites under Challenge 10*).
        - A redesign of Blood Alley is currently underway, and would benefit from a reduction in the number of dumpsters.
        - Other areas of high dumpster concentration in Gastown, Strathcona, the DTES, and Yaletown.
    - Implement a pilot of shared underground automated waste storage bins. Opportunities for pilot installations include: upcoming MVHC and BC Housing site redevelopments, and the sites mentioned above for coordinated waste management zones.
    - Consider using in-vessel volume-reducing organics units in shared bin pilots, to reduce pickup frequency, and prevent smell and pest exposure (*see Challenges 10 & 11*).

13. **Initiate a pilot of community preferred service agreements for organics and recycling collection from non-market buildings and kitchens with small outputs** (*see Challenges 10 & 19*).
    - Where shared bins are not possible, and organics or recycling volumes are low, engage a third party (such as the BC Nonprofit Housing Association) to coordinate community preferred service agreements between haulers and non-market buildings & kitchens to enable them to participate in more cost-effective organics and recycling pickup services. The service could be offered in areas with high concentrations of non-market buildings and community kitchens, such as in the DTES.

14. **Expand the selection of waste hauling services offered by the City** (*see Challenge 15*).
    - Explore the feasibility of offering multiple levels of waste pickup service, such as carry-out services, dumpsters, and a "platinum" service that could include organics bin liners and bin washing. Consider expanding City hauling services to new types of clients as opportunities arise.

15. **Implement a City-operated bulky waste collection program** (*see Challenge 12*).
    - Implement recommendations from the 2008 staff report on bulky waste, starting with the implementation of a pilot bulky waste pickup service in Vancouver, with the intention to scale-up the program to include all residential buildings.
        - Regular bulky waste disposal days give the opportunity for residents to plan ahead, look out for free items on those days, and gives the city a period to focus delivery of waste-reduction messaging.
    - Regardless of the implementation of a city-wide collection program, consider offering free bulky waste pickup for all non-market housing sites, especially those that house residents with multiple barriers where scavenged waste tends to accumulate.

16. **Encourage Metro Vancouver to remove syringes from the banned materials list** (*see Challenges 8 & 18*).
    - Encourage Metro Vancouver to remove syringes from the list of hazardous banned materials so that they no longer incur a $50 fine per item, recognizing that these penalties do not impact the behaviour of people who put syringes in garbage but rather penalize building operators. Users should still be strongly encouraged to separate syringes from garbage (*see Challenge 8*).
    - In lieu of a ban, focus energy on challenged buildings by creating and distributing more effective signage, advising building staff on best practices in placement of syringe disposal boxes, and implementing new informative feedback loops.

LONG TERM (BEYOND 2020)

17. **Encourage Metro Vancouver to require waste haulers to collect and disclose data**
    - Require all haulers operating in Metro Vancouver to collect and provide waste data (weights, volumes, and contamination prevalence) to customers, and to municipal and regional authorities (*see Challenge 17*).

18. **Encourage all waste bags to be clear.**
    - Encourage haulers and MURB building staff to use clear waste bags, especially for garbage. This creates subtle anti-contamination pressure and protects the health of waste management workers (*see Challenges 2 & 16*).
    - Encourage Metro Vancouver to explore the feasibility of implementing a bylaw that requires all bagged waste to be in clear bags.

19. **Introduce requirements for new buildings and major redevelopments to follow waste management best practices as part of the development permit application process** (*see Challenge 5*).
    - Add language to the existing Building Bylaws to require new buildings to follow waste management best practices in their designs, similar to the way electric vehicle charging requirements were recently implemented.
    - Consider creating multiple levels of "green design standards" in waste management facility best practices, where buildings are incentivized to implement improved designs.

20. **To improve occupational health and safety standards for hauler workers, work towards avoiding direct contact with bagged garbage waste.**
    - New technical solutions should be tried, and automated collection systems should continue to develop.
    - Bin hoppers should be required for all waste trucks to avoid workers having to lift waste.
    - Where waste is hauled manually, maximum 180 liter carts should be used.

21. **Encourage Metro Vancouver to standardize recycling practices in the region.**
    - Encourage Metro Vancouver to continue to engage and collaborate with municipalities to standardize recycling practices across the region (*see Challenge 3*).

22. **Collaborate with government partners to create a fund for waste management infrastructure and service improvements for non-market buildings.**
    - Collaborate with the Provincial Government, MMBC, and Metro Vancouver to create a fund to support waste management program improvements in non-market housing facilities. Building operators could apply for grants for specific projects, which would include monitoring and reporting requirements. Waste management consulting provided by the proposed *Zero Waste Community Engagement Team* could help to identify projects eligible for grant support (*see Challenge 7*).
    - Collaborate with Metro Vancouver and MMBC to provide free organics kitchen-catchers and blue recycling tote bags to non-market buildings upon request, and allow building staff to order up to 10% replacement per year. Encourage these in-unit bins for organics and recycling to become standard required items in all living spaces as part of lease agreements, so that replacements become unnecessary over time (*see Challenge 5*).

23. **Encourage Metro Vancouver to implement policies that permit contamination surcharge exemptions for specific non-market buildings.**
    - Encourage Metro Vancouver to create allowances in disposal ban regulations for non-market buildings that house individuals with significant barriers. Building operators could apply directly to Metro Vancouver for exemption, with special bag stickers or printed bags issued by Metro Vancouver directly to the approved buildings for use to identify their waste in the stream. This would allow haulers to reduce service costs for these buildings due to reduced contamination surcharges (*see Challenge 1*).

24. **Support the establishment of a low-cost food terminal** (*see Challenge 19*).
    - Explore the feasibility of setting up a low-cost food terminal to centralize the management of food donations and to create a market for B-grade local produce.

25. **Open a small scale resident-only transfer station near areas of high population density.**
    - Explore the feasibility of opening a small transfer station for residential waste and specialized recycling programs, located close to high-density neighbourhoods such as in the False Creek Flats. This centre could be a hub for recycling education programming, include a free item exchange space, a waste up-cycling design workshop, and be a distribution point for supportive waste management materials (*see Challenge 12*).

AREAS FOR FURTHER RESEARCH

This study is only an initial step in understanding the complexity that surrounds waste management in non-market buildings, and MURBs in general. The stark lack of existing academic research on the matter makes evident the need for more study on this topic, especially as we implement new strategies to get to zero waste over the next decades.

- Follow up on LOCO's 2010 study to examine waste stream volumes and management practices in DTES community kitchens, and identify opportunities to reduce waste. (*see Challenge 19*).
- More extensive future waste audits across different housing types could produce detailed data to focus waste management strategies. This could be combined with studies that engage and collect input from corresponding building residents.
- BC Housing and BC Healthy Communities have partnered with The Centre for Sustainable Development at SFU to research improvements to waste management in social housing. There is good potential for collaboration and consultation on refining these topic areas, which include:
    - How to develop long term tenant capacity and concurrently identify effective drivers for long term change in sustainability behaviour (specifically focusing on waste diversion) among social housing tenants in BC?
    - How effective is CBSM when applied to waste diversion in a social housing setting, and how might this compare to the general population?
    - What are the most effective drivers for a long term change in terms of adoption of a sustainability behavior specifically focusing on waste diversion among social housing tenants in BC? How can tenant capacity at social housing sites be built through linking food security and sustainability?

REFERENCES

ARTICLES, BOOKS AND WEBSITES

Amager Resource Centre. (2016). *Sådan sorterer du ("How to sort")*. Retrieved from https://www.a-r-c.dk/privat/saadan-sort

Anderson, R. (2015). *The Compassionate Systems Theory of Change*. Retrieved from http://www.smallanddeliciouslife.com/the-compassionate-systems-theory-of-change/

BC Centre for Disease Control. (2015). *Industry Food Donation Guidelines*. Retrieved from http://www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/EH/FPS/Food/Food%20Donation%20Guidelines%20Complete.pdf

BC Housing. (2015). *Tenant Engagement on Sustainability Guide: for social housing providers; focus on waste reduction and diversion, Version 1*. Richmond, BC: Dillon Consulting. Retrieved from http://www.bchousing.org/resources/Partner_Resources/Ongoing_Maintenance/Waste_Diversion_Guide.pdf

BC Housing. (2015). *Tenant Engagement on Sustainability Facilitator's Handbook: for social housing providers; focus on waste reduction and diversion, Version 1*. Richmond, BC: Dillon Consulting. Retrieved from http://www.bchousing.org/resources/Partner_Resources/Ongoing_Maintenance/Waste_Diversion_Facilitator_Handbook.pdf

BC Housing. (2016, April 7). *Tenant Engagement on Sustainability: Focusing on Waste Reduction and Diversion*. Richmond, BC: Dillon Consulting. Retrieved from http://www.rcbcconference.ca/uploads/3/8/4/1/38412063/3--tenant_engagement_on_sustainability.pdf

BC Housing. (2016). *Single Resident Occupancy Hotels*. Retrieved from http://www.bchousing.org/Initiatives/Access/SRO

BC Housing. (2016). *Supportive Housing*. Retrieved from http://www.bchousing.org/Options/Supportive_Housing

Birley, D., Murton, P., Phillips, P. & Tudor, T. (2007). A Key UK Issue: Managing Municipal Solid Food Waste – A Case Study from Hackney, London. *Journal of Solid Waste Technology and Management*, 33(1).

Bentley, A. (2011). *I'll have what she's having*. Cambridge, MA: The MIT Press.

City of Calgary. (2012). *Multi-Family Diversion Program Best Practices*. Guelph, ON: Stantec Consulting Ltd. Retrieved from http://www.calgary.ca/UEP/WRS/Documents/WRS-Documents/Multi_Family_Best_Practices.pdf?noredirect=1

City of Stockholm. (2013). *Waste management plan for Stockholm 2013-2016*. Retrieved from http://www.stockholmvatten.se/globalassets/pdf1/riktlinjer/avfall/avfallsplan/avfallsplanen_eng_webb.pdf

City of Toronto. (2013). *Staff report: Green bin implementation in multi-residential buildings and waste reduction/diversion education initiatives.* Retrieved from http://www.toronto.ca/legdocs/mmis/2013/pw/bgrd/backgroundfile-59186.pdf

City of Toronto. (2016). *Final Long Term Waste Management Strategy*. Retrieved from http://www.toronto.ca/legdocs/mmis/2016/pw/bgrd/backgroundfile-94037.pdf

City of Vancouver. (2008). *City of Vancouver Bulky Item Collection Program: Preliminary Discussion Report.*

City of Vancouver. (2009). *West End Illegal Dumping Project.*

City of Vancouver. (2011). *Housing and Homelessness Strategy 2012-2021.* Retrieved from http://vancouver.ca/files/cov/Housing-and-Homeless-Strategy-2012-2021pdf.pdf

City of Vancouver. (2012). *Garbage and recycling storage facility design supplement*. Retrieved from http://vancouver.ca/files/cov/Garbage_and_Recycling_Storage_Facility_Supplement.pdf

City of Vancouver. (2015). *Food - free*. Retrieved from http://vancouver.ca/files/cov/low-cost-food.pdf

City of Vancouver. (2016, June 7). *Subject: Zero Waste 2040, Memorandum to Mayor and Council, from Jerry Dobrovolny, City Engineer / General Manager*.

City of Vancouver. (2016). *Vancouver takes next steps to becoming a zero waste community by 2040.* Retrieved from http://vancouver.ca/news-calendar/vancouver-takes-next-step-to-becoming-a-zero-waste-community-by-2040.aspx

City of Vancouver. (2016). *Administrative Report, subject: Enhanced Solid Waste Management and Diversion By-Law Authority.* Retrieved from http://council.vancouver.ca/20160203/documents/cfsc7.pdf

City of Vancouver. (2016). *Solid Waste By-Law No. 8417*. Retrieved from http://former.vancouver.ca/bylaws/8417c.PDF

City of Vancouver. (2016). *Prevent food waste at your business*. Retrieved from http://vancouver.ca/doing-business/prevent-food-waste.aspx

Compost Collective. (2012). Final Report. Retrieved from http://citystudiovancouver.com/wp-content/uploads/2013/01/Compost-Collective-Final-Report.pdf

Downtown Eastside Kitchen Tables Project. (2010). *Final Report & Action Plan*. Retrieved from http://dteskitchentables.org/wp-content/uploads/2011/11/DTES-Kitchen-Tables-Community-Action-Plan-Phase-1-FINAL-REPORT.pdf

European Union. (2013). *Copenhagen: European Green Capital 2014*. Luxembourg: Publications Office of the European Union. Retrieved from http://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2012/07/ENV-13-004_Copenhagen_EN_final_webres.pdf

Futureproof. (2009). *Using Community Based Social Marketing to increase recycling in multi-family buildings*.

Greater Vancouver Shelter Strategy. (2015). *Shelter Directory.* Retrieved from http://www.gvss.ca/PDF-2014/Shelters%20list%20150917.pdf

M Thomson Consulting. (2016). *Vancouver Homeless Count 2016*. Retrieved from http://vancouver.ca/files/cov/homeless-count-2016-report.pdf

McKenzie-Mohr, D. (2011). *Fostering Sustainable Behaviour*. Gabriola Island, BC: New Society Publishers.

Meadows, D. (1997). Places to Intervene in a System. *Whole Earth*, Winter 1997. Retrieved from https://center.sustainability.duke.edu/sites/default/files/documents/system_intervention.pdf

Metro Vancouver. (2016). *About Food Scraps Recycling*. Retrieved from http://www.metrovancouver.org/services/solid-waste/food-scraps-recycling/background-implementation/Pages/default.aspx

Metro Vancouver. (2014). *On-site Organics Management Options Review*.

Metro Vancouver. (2013). *Greater Vancouver Sewerage and Drainage District, Bylaw No. 280, 2013; A bylaw to regulate municipal solid waste and recyclable materials*. Retrieved from http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/ProposedBylawNo280-submittedtoProvince2013.pdf

Metro Vancouver. (2016). *Proposed 2017 Tipping Fee Bylaw Changes, from Andrew Marr to the GVS&DD Board, dated July 8, 2016.*

Metro Vancouver. (2016). *2015 Disposal Ban Inspection Program Update, from Brandon Ho to the Zero Waste Committee.*

Metro Vancouver. (2011). *The Blue Book - Draft*.

Metro Vancouver. (2015). *Technical Specifications for Recycling and Garbage Amenities in Multi-family and Commercial Development.*

Metro Vancouver. (2016). *Guide to estimate the recycling and garbage bins your complex needs for weekly collection*. Retrieved from http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/RecyclingGarbageBinMatrixwithoutsinglestream.pdf

Metro Vancouver. (2015) *2015 Waste Composition Monitoring Program.* Retrieved from http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/2015_Waste_Composition_Report.pdf

Mollard, M. & Wong, C. (2014). *Vancouver Trash Talk Final Report*. Retrieved from https://vancouvertrashtalk.files.wordpress.com/2012/08/finalreport-july312014.pdf

Nicolás, Angie. (2014). *Building Volunteerism Capacity to Support Waste Reduction at Special Events*. Retrieved from https://sustain.ubc.ca/sites/sustain.ubc.ca/files/GCS/FINAL_ANGIE_AN_GCScholar_Report_2014_Zero_Waste_Volunteers_Events.pdf

Pearson, H., Dawson, L., & Radecki Breitkopf, C. (2012). Recycling Attitudes and Behavior among a Clinic-Based Sample of Low-Income Hispanic Women in Southeast Texas. *PLoS ONE*, *7*(4), e34469. Retrieved from http://doi.org/10.1371/journal.pone.0034469

Pentland, A. (2008). *Honest signals: how they shape our world*. Cambridge, MA: The MIT Press.

RainCity Housing and Support Society. (2016). *Program Agreement, The Budzey.*

Region of Peel. (2013). *Professional Services to supply, install and integrate radio frequency identification (RFID) system for waste collection reporting.* Retrieved from https://www.peelregion.ca/council/agendas/pdf/2013/wm-4a.pdf

LOCO Business Network Society of BC. (2010). *Greening DTES Charity Kitchens, (Draft) Final Report.*

Roy, R., Caird, S. & Potter, S. (2007). People centered eco-design: consumer adoption of low and zero carbon products and systems. *Governing Technology for Sustainability*. London, UK: Earthscan.

Seattle Housing Authority. (2014). *Quick Facts*. Retrieved from https://seattlehousing.org/about/pdf/SHAFactsheet.pdf

Strathcona Business Improvement Association. (2015). *Request for Proposals – Preferred Zero Waste Service Provider.*

United Nations Centre for Human Settlements (Habitat). (1989). *Community Participation - Solid Waste Management in Low-income Housing Projects: The Scope for Community Participation.* Nairobi, Kenya: UN Habitat. Retrieved from http://www.chs.ubc.ca/archives/files/community%20participation%20in%20solid%20waste%20management%20in%20low%20income%20housing%20projects.pdf

Vancouver Coastal Health. (2013). *Free low cost and community meals in Vancouver.* Retrieved from https://www.vch.ca/media/Free-Low-Cost-and-Community-meals-in-Vancouver-final-May-1-2013.xls

Washington State Recycling Association. (2014). *Sorting it out: The State of Multifamily Recycling in Washington State.* Retrieved from http://c.ymcdn.com/sites/www.wsra.net/resource/resmgr/Multifamily_Study/Sorting_it_Out-The_State_of_.pdf

Waste Diversion Ontario. (2011). *Best practices for the storage and collection of recyclables in multi-residential buildings*. Retrieved from http://cif.wdo.ca/pdf/reports/219/report_219.pdf

INTERVIEWS AND WRITTEN INPUTS

Angie Nicolás, Master Recycler

Anna Dyer, Recycling and Waste Reduction Analyst, Seattle Housing Authority

Brian Beck, City of Vancouver

Brian Butt, Housing Policy, City of Vancouver

Brian Wong, Solid Waste Management, City of Vancouver

Celine Mauboules, Housing Policy, City of Vancouver

Charlotte Ueta, Project Lead, Solid Waste Management Services, City of Toronto

Donna Taylor, Street Inspections, City of Vancouver

Doug Schell, Waste Management Coordinator, BC Housing

Doris Chow, Project Manager, DTES Kitchen Tables Project

George Simpson, Operations Manager, RainCity Housing

Hanna Musslic, Landfill Operations, City of Vancouver

Jeff Wint, Dispatch and Customer Service, Recycling Alternative

Jim Heeps, Street Cleaning, City of Vancouver

Jordan Parente, Solid Waste Management, City of Vancouver

Kathleen Belton, Green Programs & Services Co-op Student, Engineering Department, City of Delta

Katrusia Balan, Project Lead, Solid Waste Management Services, City of Toronto

Kenny Siu, SUCCESS BC

Laura Barreca, Business Development Manager, CleanStart BC

Linh Huynh, City of Richmond

Liz Blakeway, District of North Vancouver

Marta Sanchez-Blasco, Facilities Manager, The Bloom Group

Monika Czyz, Housing Policy, City of Vancouver

Municipal Waste Reduction Coordinators Committee, Metro Vancouver

Patrick Chauo, Solid Waste Management, City of Vancouver

Ruben Anderson, Futureproof

Sandra Mills, Solid Waste Management, City of Vancouver

Shannon Hadley, Corporation of Delta

Shaun McKibben, City of Vancouver

Sherri Matt, Operations, RainCity Housing

Sepideh Datoobar, Eurete Technologies

Terry Fulton, Metro Vancouver

Tina Winberg, Technical and Environmental Department, City of Copenhagen

Tracey Tobin, City of Burnaby

Ulryke Weissgerber, Metro Vancouver Housing Corporation

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