Overview of Organics Diversion Requirements and Practices for the Canadian Industrial, Commercial and Institutional Sector

Final Report

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- Wasteco

EXECUTIVE SUMMARY

This study focused on developing a better understanding of industrial, commercial and institutional (ICI) food and organic waste generation and management. The organic waste types considered include food waste and, where data was available, other organic wastes which included leaf and yard waste, compostable products and packaging, diapers, and soiled paper products.

The objectives of this study were to:

- To source and compile, where available, the most recent waste characterization data, with a focus on organics, for key ICI subsectors across Canada.
- To compile a summary of existing and proposed provincial, territorial and municipal policy and regulatory initiatives aimed at increasing diversion of ICI organic waste, and to identify recent/emerging requirements for the ICI sector.
- To identify new and emerging ICI organic waste collection approaches and technologies.

Characterization of Waste Generated by ICI Subsectors

Results from 421 Canadian ICI waste audits were obtained, primarily from companies that undertake ICI waste audits, such as companies that manufacture/process food and those that sell/serve food. The data provided were used to create normalization factors (e.g., food waste disposed/full time equivalent/year), which were used to estimate food and organic waste disposed and diverted from different types of ICI facilities.

Most of this waste audit data was from 2019-2020 but with datapoints as far back as 2014. The waste audits were mostly from Ontario (77%) and western Canada (Manitoba to British Columbia) (22%) and other (1%). While most waste audit data was obtained from ICI facilities in Ontario, it is reasonable to assume that similar types of ICI facilities tend to generate similar types of wastes regardless of the province in which they may be situated.

This represents the most comprehensive analysis of Canadian ICI organic waste generation and management and offers insights to both public and private entities to assist with ICI food and organic waste management planning or reduction efforts. On average ICI facilities had 29% (unweighted) food and organic waste in their disposal stream and approximately 61% of them had food and organic waste diversion programs.

Table ES-1 illustrates the range in organic waste generation between ICI facilities and how materials are managed. Certain facilities represent a larger opportunity to reduce organic waste generation and improve management. Based on the data obtained from manufacturers (food processing), restaurants, grocery stores and hotels generate and dispose the greatest amount of food and organic waste. While data from some of these facility types show considerable food and organic waste diversion (e.g., manufacturing (food processing)) they also represent potential opportunities for greater reduction and diversion.

Table ES- 1: Overview of Food and Organic Waste Generation, by Normalizing Factors

NAICS Code	Facility Types	Total Waste Disposed	Food waste disposed	Other organic waste disposed	Total food and organic waste disposed	Food and Organic Waste diverted	Food and organic waste disposed	Food and organic waste diverted
		kg/FTE/year					kg/ft^2/yr	
31-33	Manufacturing (food processing)	1,338	367	118	485	3,632	0.18	2.52
	Manufacturing (non-food processing)	622	28	32	60	10	0.13	0.02
41, 44-45	Malls and Retail	358	39	21	61	8	0.16	0.12
	Grocery Stores	1,747	757	92	849	no data**	0.93	no data
51-56, 81, 91	Offices	62	7	2	10	11	0.03	0.05
61*	Elementary Schools	14	6	3	9	1	0.05	no data
	Secondary Schools	24	10	3	13	12	no data	no data
	Post-Secondary Schools	26	8	3	11	7	0.13	0.14
62	Hospitals	321	31	16	46	33	0.14	0.08
71	Arts, Entertainment, Recreation	615	130	72	202	126	0.14	0.18
72	Hotels	930	419	54	472	206	0.50	1.07
	Restaurants	1,515	890	101	991	no data	6.50	3.81

* number of students was used as the FTE
** no data means there was no data or insufficient data to make the relevant calculation

Future data collection should focus on more detailed province-by-province waste audit data collection and building up waste audit data collection from some ICI sectors (e.g., wholesale trade, grocery stores).

Existing ICI Organic Waste Collection Business Structure in Canada

The existing ICI organic waste collection and processing structure across the country continues to be highly influenced by access to cheaper and more convenient waste disposal options. Although the average landfill tipping fees vary significantly, they are on average lower than ICI diversion (Table ES-2). As an example, in southern Ontario ICI mixed waste landfill rates are as low as $30 / tonne.

Table ES- 2: Average Costs for Various Aspects of Food and Organic Waste Disposal and Diversion

Waste	Facility	Average Tipping Fees	Range
ICI Mixed Waste	Landfill	>$100 / tonne	$30.00 - $150.00 / tonne
Pre-Processed Slurry/ Fats, Oils & Greases (FOG)	Anaerobic Digestion	$25.00 / tonne	$20.00 - $60.00 / tonne
ICI Source Separated Organics	Compost / Anaerobic Digestion	$110.00 /tonne	$75.00 - $150.00 / tonne
Clean Food Processing Waste	Compost / Anaerobic Digestion	$55.00 / tonne	$20.00 - $60.00 / tonne

There are also other factors that increase the costs for the diversion of ICI organic waste (e.g., ICI facility infrastructure, staff/customer training, convenience), collection (e.g., less dense routing, more frequent collection, increased maintenance), and transfer and processing (Figure ES-1).

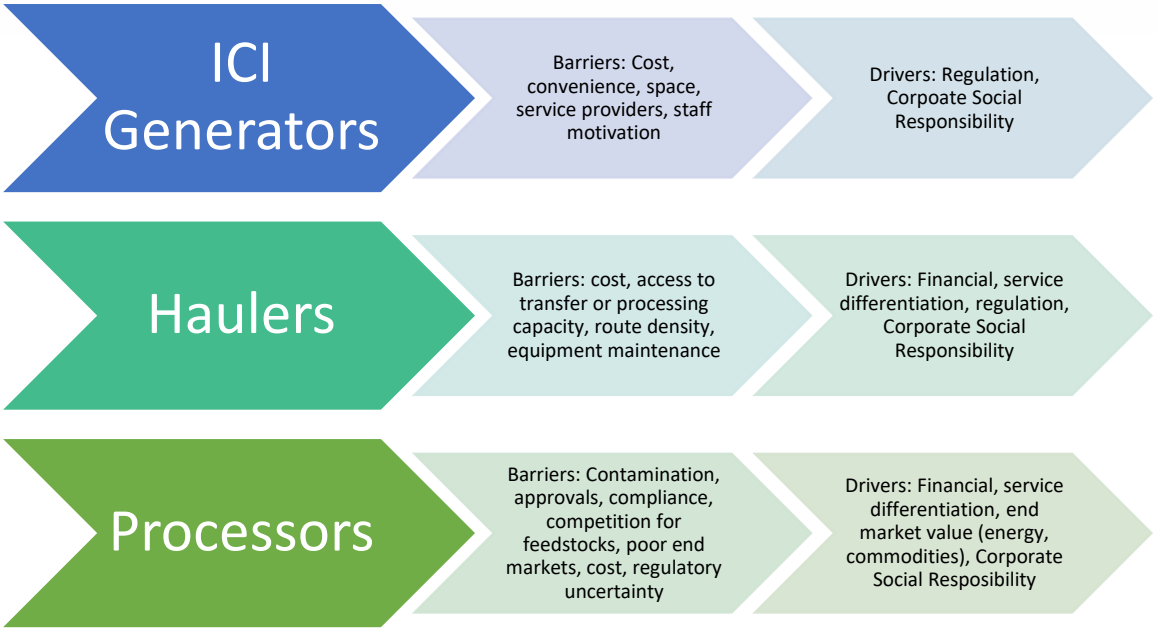

Figure ES 1: Current Barriers and Drivers for ICI Organic Waste Diversion Across the Value Chain

As a result, the majority of ICI organic waste in Canada continues to be landfilled. Any organic waste diversion occurring in the ICI sector is generally happening because of:

- A desire by the company due to corporate social responsibility goals or consumer demands;
- A need to meet regulatory requirements;
- Certain organic wastes may be more problematic to landfill (e.g., liquid, odour); or
- The associated commodity value (e.g., ability to generate renewable natural gas or electricity).

Notable barriers and limitations to enhancing ICI organic waste diversion include:

- Increased cost of organic waste management
- A lack of infrastructure (both transfer facilities (i.e., to consolidate organic waste) and processing facilities (i.e., compost, anaerobic digestion, pre-processing / de-packing sites);
- Issues with contamination that impact operating costs and lower the value of outputs;
- A lack of regulatory requirement or the oversight / enforcement of them; and
- A lack of best practice guidance for generators

Regulatory/Policy Initiatives – Canada and the U.S.

There is growing action by all levels of government to implement policies to increase the reduction and diversion of ICI organic waste. This regulatory action is not unique to one province in Canada but happening across the country with similar activity in the US. The predominance of this regulatory activity is focused on the largest generators of food and organic waste, and requires them to source separate and divert organic waste. As these practices are normalized, and organic waste collection and processing infrastructure is built, some of these jurisdictions have also gradually lowered the thresholds to increase the amount of organic waste generators captured under these requirements.

This approach has been replicated across the northeast United States and has been adopted by the two largest provinces in Canada - Ontario and Québec. There also appears to be a growing trend towards implementing disposal levies. Although landfill levies in the many US states tend to be minor, Québec and Manitoba have implemented more substantial disposal levies. These levies act as a broad influence on diversion activities and the revenues generated in both Québec and Manitoba are being used to support diversion activities including organic waste diversion.

The gradual implementation of source separation requirements and disposal levies offers a tremendous opportunity across the country to achieve greater organic waste diversion in a manner that allows for the development of the appropriate infrastructure over time. The advice from those that have implemented source separation requirements is consistent:

- Allow for adequate time for generators and service providers to properly plan and develop infrastructure (e.g., at least two years);
- Start with the largest generators who have a greater ability to reduce organic waste generation and economies of scale to manage materials efficiently;
- Ensure ongoing consultation and resources to allow generators to adapt (e.g., reduce organic waste generation); and
- Consider additional incentives for infrastructure for areas with lower population densities that may not have access to organic waste diversion infrastructure.

For disposal levies, the predominant advice was to ensure for:

- A gradual increase in disposal levies;
- Ensure all similar waste materials are captured, including those being exported for disposal outside the jurisdiction; and
- Ensure funds raised are used in a manner that does not hinder already functioning markets.

Local governments are also active in supporting policies that ensure greater organic waste diversion and reduction. They do however have more difficulties in implementing policies given their limited jurisdiction (e.g., the movement of waste tends to extend past municipal boundaries and municipalities tend to have more limited powers over waste management operations). As a result, source separation requirements and disposal levies are more effective if implemented at the provincial / territorial level.

There is also a great deal of voluntary activity happening through collaboratives and directly by individual businesses. The work by these organizations as early adopters is helpful to establish the base for regulatory action by governments. Each of the jurisdictions that were implementing regulatory requirements, emphasized the importance of fostering these voluntary efforts.

On-Site Composting Technologies

A summary of new and emerging on-site diversion technologies for the collection, processing and final end use of ICI food and organic waste was developed. This task was intended to showcase the variety of different types of on-site organic waste processing technologies currently used by the ICI, with an emphasis those currently used in Canadian facilities. As such the technologies presented are not an exhaustive list.

Presently all of the technologies reviewed are being used in ICI facilities, that generate large amounts (i.e., 25 kg/day) of food and organic waste, such as shopping malls, hotels, schools and arenas. Some of the technology providers are actively working to develop smaller scale units for ICI facilities that generate less organic waste, such as individual restaurants.

These technologies often and at minimum serve a useful intermediate step for ICI food and organic waste management. They can be used to replace bins and compactors often used to store food and organic waste, which can result in discharge of liquid, odour and/or attract vermin. A key benefit is that if managed properly they can avoid these nuisances.

A key advantage of these technologies is that some of them can be used in remote locations (e.g., mines) where there are no other waste management services and/or locations with land (e.g., some universities) where the compost can be viably used.

The environmental benefits include reduced transportation impacts, diversion of food waste from landfill, avoided GHG from disposal and in some cases the outputs can be used as a soil amendment.

All of these technologies are relatively costly to implement, mostly as a result of the infrastructure costs, and to a lesser extent operating cost (e.g., electricity, water consumption, wood pellets). All of these technologies discharge their products well before they would at industrial scale composting facilities and require either full processing or additional curing elsewhere. These technologies require considerable space, although they can replace other containers.

Conclusions

This study was able to considerably advance the understanding of ICI food organic waste disposal and diversion in Canada; how this material is managed; regulations and policies that impact how it is managed and examples of how this could be diverted on-site. It provides comprehensive data and analysis to aid both the public and private sector, for ICI waste management planning purposes.

Not surprisingly, food intensive ICI facilities such as manufacturers (food processing), grocery stores, restaurants and hotels are the largest food and organic waste generators and also represent the greatest opportunity to reduce food and organic waste generation and increase diversion.

The key drivers of ICI food and organic waste management continue to be cost and convenience. In most cases, disposal is currently simply cheaper and more convenient than diversion. As a result, in most provinces and territories disposal continues to be the main endpoint for this waste stream. Further, most jurisdictions do not have sufficient organic waste diversion infrastructure in place to manage significant volume increases.

This is not to say that efforts are not being taken to overcome these challenges. A growing number of companies have corporate social responsibility and other programs and are, in some cases, willing to pay the premium to divert food and organic waste. These companies are often voluntarily working together and aided by the efforts of government investments, programs and policies.

As well, there are growing governmental efforts, across the country, to drive food and organic waste diversion reduction and diversion. While the current regulatory/policy framework, across different provinces and territories, is a patchwork, there does appear to be a greater alignment in the tools being used including strong

early efforts to support food and organic waste reduction, followed by regulatory mechanisms like source separation requirements and disposal levies. A similar trend can also be observed in the US northeast. There is substantial opportunity for these jurisdictions to learn from each other as they implement or revise policies and programs.

While a considerable amount of data was collected for this study, the availability of ICI food and organic waste data, in particular for disposal and diversion, remain a challenge across the country. There are opportunities to build on the data collected for this report, to further improve both public and private sector understanding of ICI food and organic waste and how it is managed. A solid data driven understanding of ICI food and organic waste can ultimately be used to further inform comprehensive and effective provincial / territorial policy and regulation development for this waste stream, with an end goal of reducing the amount of ICI food waste that is produced and increasing ICI food and organic waste diversion.

1.0 INTRODUCTION

There is a growing recognition of the role that waste management has in reducing greenhouse gas (GHG) emissions Organic waste disposed in landfills creates methane, a powerful greenhouse gas. Methane emissions from landfills currently represent 2% of all GHG emissions in Canada. The federal government continues to evaluate opportunities for reducing GHG emissions, including in the solid waste sector. The purpose of this report is to provide insight into food and organic waste generated from the industrial, commercial and institutional (ICI) sectors[1] in Canada, which is currently not as well understood compared to organic waste generated in the residential sector, to allow for more informed decision-making.

This study focuses on food waste and other organic waste managed at landfills, composting and anaerobic digestion (AD) facilities. Other organic wastes considered included leaf and yard waste, compostable products and packaging, diapers, and soiled paper products.

This study excludes certain materials such as wastes that are associated with primary resource extraction or harvesting (e.g., farm manure, fish waste from fish processing, market garden waste, orchard and urban forest tree prunings), liquid effluents from processing or manufacturing sites, industrial sludge, and waste from portable toilets.

The purpose of this study was to provide a better understanding of:

- To source and compile, where available, the most recent waste characterization data, with a focus on organics, for key ICI subsectors across Canada.
- To identify new and emerging ICI organic waste collection approaches and technologies.
- To compile a summary of existing and proposed provincial, territorial and municipal policy and regulatory initiatives aimed at increasing diversion of ICI organic waste, and to identify recent/emerging requirements for the ICI sector.

The purpose of this report is that it will function as a resource for various decision-makers and that it will be widely shared across Canada.

This report is divided into four key tasks.

- Characterization of waste generated by ICI Subsectors
- Existing ICI organic waste collection business structure in Canada
- Regulatory/Policy Initiatives – Canada and the U.S
- New and Emerging ICI Organic Waste Diversion Approaches and Technologies

[1] Excluding multi-residential buildings which sometimes are included as commercial buildings as opposed to residential.

2.0 CHARACTERIZATION OF FOOD AND ORGANIC WASTE GENERATED BY ICI SECTORS

2.1 Methodology

The purpose of this section was to develop a better understanding of ICI food and organic waste disposal and diversion. Waste audit data was gathered to better characterize ICI food and organic waste generation and composition, particularly for ICI generators that manufacture/process food and those that sell/serve food. Companies or facilities that provided waste audit data did so on the basis that any waste audit data they provided to support this research would be treated as business confidential information and that this research would not disclose the origin of the waste audit data by company or facility name. The objective of this data collection was specifically to better understand the amount of food and organic waste that is disposed (i.e., in the waste disposal stream) and diverted (i.e., to composting, anaerobic digestion etc.). To the extent possible the data was normalized to a full-time equivalent (FTE) (i.e., staff) and, when data was available, to the square footage of the facility.

The scope of data collection included generator information (e.g., type, FTE, square footage of facility, tonnes of waste generated annually); the per-cent food waste and other organic waste (e.g., soiled paper products, leaf and yard waste) in the waste disposal stream; the amount of food and organic waste diverted (including how it was processed).

The project team collected, consolidated and analyzed waste audit data, collected primarily from companies that undertake ICI waste audits with supplementary data collection from an on-line literature review. Results from 421 waste audits were used. Most of this data was from 2019-2020 but with datapoints as far back as 2014. The waste audits were mostly from Ontario (77%) and western Canada (Manitoba to British Columbia) (22%) and other (1%). The reason most waste audit results were from Ontario is that ICI facilities in Ontario that meet prescribed size thresholds[2] are obligated to undertake waste audits. While most waste audit data was obtained from ICI facilities in Ontario, it is reasonable to assume that similar types of ICI facilities tend to generate similar types of wastes regardless of the province in which they may be situated.

All data was categorized by two-digit North American Industry Classification System (NAICS) code sectors, as depicted in Table 2.1, because this is a common way to categorize ICI sectors. A considerable amount of generic 'office' data was collected that included a range of NAICS codes including: 51 -Information and cultural industries; 52-53- Finance, insurance, real estate and leasing; 54- Professional, scientific and technical services; 55-56- Business, building and other support services; 81- Other services; and 91- Public administration. It should be noted that generally no NAICS code data was provided with waste audit results. All data was aggregated to ensure individual ICI generator anonymity.

Table 2.1 also presents the percent of facilities, by facility type that had a food and organic waste diversion program. Close to 61% of facilities reported having a food and organic waste diversion program.

Table 2-1: Overview of Waste Audit Data Collection, by Sector

[2] O. Reg 102/94 Waste Audits and Waste Reduction Plans https://www.ontario.ca/laws/regulation/940102

NAICS Codes - 2 digit	NAICS Codes- Other Details	Facility Types	Number of Waste Audits	Facilities with a Food and Organic Waste Diversion Program (%)
Manufacturing- 31-33	311 Food Manufacturing	Manufacturing (food processing)	20	75%
		Manufacturing (non-food processing)	56	38%
Trade- 41, 44-45	44-45 Retail Trade	Malls and Retail	56	79%
	445 Food and Beverage Stores	Grocery Stores	9	0%
Information and Cultural Services -51, Finance, Insurance, Real Estate and Leasing- 52-53, Professional, Scientific and Technical Services, Business, Building and Support Services- 55-56, Other Services- 81, Public Administration- 91		Offices	163	71%
Educational Services- 61	6111 Elementary and Secondary Schools	Elementary Schools	11	27%
	6111 Elementary and Secondary Schools	Secondary Schools	13	38%
	6112 Colleges, 6113 Universities	Post-Secondary Schools	28	71%
Health Care and Social Assistance- 62	621 Hospitals	Hospitals	18	61%
Arts, entertainment and recreation- 71		Recreation centres, arenas, zoo	4	75%
Accommodation and food services- 72	721 Accommodation services	Hotels	18	56%
	722 Food services and drinking places	Restaurants	25	32%
Total			421	61%

Further, waste audit weight data was normalized primarily by full time equivalents (FTE) (i.e., average weight/ average FTE), unless otherwise noted. This included calculating the amount of food waste and other organic waste, using the percent and weight-based waste audit data, and then dividing this by normalizing factors (e.g., FTE, square footage) included in this waste audit data. Essentially all waste audit data provided included FTE. For individual sectors (i.e., Sections 2.2.1-2.1.12) the range and standard deviation (SD) of this data waste also calculated. The SD is the amount of variation of data from the mean, with lower values indicating that values are closer to the mean and larger values indicating greater dispersion from the mean.

Waste audit waste data was also normalized by the size (i.e., average weight/ average square footage) of the facilities. About 70% of waste audit results included data on facility size and this ranged from 0% (secondary schools) to 96% (malls and retail).

2.2 Results

It is important to note that all the results are based on the 421 waste audits received. While there is a high level of confidence that the waste audit data received are representative of waste audits completed (i.e., because they were supplied by a variety of companies that undertake waste audits) there is a medium level of confidence that they are fully representative of all ICI generators. It seems likely, although not supported by empirical evidence, that ICI waste generators that undertake waste audits (either on a voluntary or mandatory basis) are more likely to pay closer attention to waste generation and more likely to have recycling and food and organic waste diversion programs.

Table 2.2 depicts the percentages of food and organic waste in total waste disposed and in total waste generated (i.e., waste disposal, recycling, organic waste diversion). The per-cent food waste in the waste disposal stream ranges from 9.68% (manufacturing: non-food processing) to 49.60% (restaurants). The per-cent total food and organic waste in the waste disposal stream ranges from 18.38% (offices) to 60.32% (elementary schools). The per-cent food and organic waste in total waste generated (i.e., total waste disposed and total waste recycled/diverted) ranged from 5.94% (manufacturing: non-food processing) to 49.81% (restaurants).

Table 2-2: Overview of Average Food and Organic Waste Percentages, in Total Waste Generated and Disposed, by Sector

NAICS Code	Facility Types	Total Waste Disposed			Total Waste Generated
		Food waste	Other organic waste	Total	Total Food and Organic Waste
31-33	Manufacturing (food processing)	20.03%	6.44%	26.47%	48.85%
	Manufacturing (non-food processing)	9.68%	11.38%	21.06%	5.94%
41, 44-45	Malls and Retail	21.36%	11.19%	33.05%	34.55%
	Grocery Stores	43.01%	5.22%	48.23%	no data
51-56, 81, 91	Offices	12.98%	4.61%	18.30%	26.17%
61	Elementary Schools	41.68%	18.64%	60.32%	39.51%
	Secondary Schools	40.33%	10.55%	50.88%	37.75%
	Post-Secondary Schools	31.65%	10.85%	43.57%	35.99%
62	Hospitals	14.10%	7.14%	21.24%	23.20%
71	Arts, Entertainment, Recreation	25.58%	14.23%	39.81%	36.66%
72	Hotels	44.13%	5.65%	49.78%	no data
	Restaurants	49.60%	5.63%	55.23%	49.81%

Table 2.3 depicts the normalized results for wastes disposed, food and organic waste disposed and diverted, by full time equivalents (FTE), which were generally staff and food and organic waste disposed by average facility size (i.e., in square feet).

There were wide ranges in waste disposal and food and organic waste disposal and diversion, between the various ICI sectors. Key results included:

- The most waste disposed was by grocery stores, restaurants and manufacturing (food processing) (1,338-1747 kg/FTE/yr) and the least by elementary, secondary and post-secondary schools (14-26 kg/FTE/yr);
- The most food waste disposed was by restaurants, grocery stores, and hotels (419-890 kg/FTE/yr) and the least by elementary schools, offices and post-secondary schools (6-8 kg/FTE/yr);
- The most other organic waste disposed was by manufacturing (food processing), grocery stores, and arts, entertainment and recreation (72-118 kg/FTE/yr) and the least by offices, elementary, secondary and post-secondary schools (2-3 kg/FTE/yr);
- The most total food and organic waste disposed was by restaurants, grocery stores manufacturing (food processing)(485-991 kg/FTE/yr) and the least by offices, elementary, secondary and post-secondary schools (9-13 kg/FTE/yr);
- The most total food and organic waste diverted was by manufacturing (food processing), hotels and arts, entertainment and recreation (126-3,632 kg/FTE/yr) and the least by elementary schools, post-secondary schools and malls and retail (1-8 kg/FTE/yr);
- Total food and organic waste disposed by ICI generator facility size ranged from 0.03 kg/ft^2/yr for offices to 6.50 kg/ft^2/yr for restaurants; and
- Total food and organic waste diverted by ICI generator facility size ranged from 0.02 kg/ft^2 for manufacturing (non-food processing) to 3.81 kg/ ft^2 for restaurants.

Table 2-3: Total Waste Disposed and Food and Organic Waste Disposed and Diverted, by ICI Facility Type, by Normalizing Factors

NAICS Code	Facility Types	Total Waste Disposed	Food waste disposed	Other organic waste disposed**	Total food and organic waste disposed	Food and Organic Waste diverted	Food and organic waste disposed	Food and organic waste diverted
		kg/FTE/year					kg/ft^2/yr	
31-33	Manufacturing (food processing)	1,338	367	118	485	3,632	0.18	2.52
	Manufacturing (non-food processing)	622	28	32	60	10	0.13	0.02
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	Grocery Stores	1,747	757	92	849	no data***	0.93	no data
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61*	Elementary Schools	14	6	3	9	1	0.05	no data
	Secondary Schools	24	10	3	13	12	no data	no data
	Post-Secondary Schools	26	8	3	11	7	0.13	0.14
62	Hospitals	321	31	16	46	33	0.14	0.08
71	Arts, Entertainment, Recreation	615	130	72	202	126	0.14	0.18
72	Hotels	930	419	54	472	206	0.50	1.07
	Restaurants	1,515	890	101	991	no data	6.50	3.81

* number of students was used as the FTE
**sum does not always fully add up due to rounding
*** no data means there was no data or insufficient data to make the relevant calculation

Some additional detail on the sectors from which waste audit data was collected is presented in the following sections.

2.2.1 Manufacturing (food processing)

Waste audit results were received from 20 food processing facilities, with an average 201 FTE and average size of 215,312 ft^2. On average, waste disposed from these facilities consisted of 20.13% (range 0.23%-91.22%, SD 30.02) food waste and 26.47% (range 0.23% - 91.56%, SD 30.28) total food and organic waste, and 485 kg/FTE/yr (range 1 kg - 4,396 kg, SD 1,050) of food and organic waste was disposed. Most of the food and organic waste would have come from the manufacturing of food (i.e., food processing). Fifteen of the 20 facilities had a food and organic waste diversion program and on average 4,358 kg/FTE/yr (up to 19,977 kg) was diverted by those facilities to a mix of animal feed, composting and anaerobic digestion facilities.

Table 2-4: Overview of Manufacturing (food processing)

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft^2	Food waste	Other organic waste	Total	kg/FTE/yr	kg/ft^2/yr	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
31-33	Manufacturing (food processing)	20	201	215,312	20.03%	6.44%	26.47%	485	0.18	3,632	4,358

2.2.2 Manufacturing (non-food processing)

Waste audit results were received from 56 non-food processing facilities, with an average 394 FTE and average size of 187,083 ft^2. On average, waste disposed from these facilities consisted of 9.68% (range 0.02%-42.18%, SD 9.96) food waste and 21.06% (range 0.62%-65.60%, SD 17.58) total food and organic waste, and 60 kg/FTE/yr (range 1 kg - 723 kg, SD 112) of food and organic waste was disposed. As these facilities did not process food most of this food and organic waste likely came from staff meals (e.g., lunches). Twenty-one of the 56 facilities had a food and organic waste diversion program and on average 23 kg/FTE/yr (up to 69 kg) was diverted by those facilities to a mix of composting and anaerobic digestion facilities.

Table 2-5: Overview of Manufacturing (non-food processing)

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft^2	Food waste	Other organic waste	Total	kg/FTE/yr	$kg/ft^2/yr$	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
31-33	Manufacturing (non-food processing)	56	394	187,083	9.68%	11.38%	21.06%	60	0.13	10	23

2.2.3 Malls and Retail

Waste audit results were received from 51 malls and 5 retail facilities (i.e., total of 56 facilities), with an average 760 FTE (based on 8 datapoints) and average size of 574,567 ft^2 (based on 54 datapoints). Malls (51 of the datapoints) typically have a food court and restaurants. On average, waste disposed from these facilities consisted of 21.36% (range 0-62.71%, SD 12.54) food waste and 33.05% (range 1.53%-62.71%, SD 14.56) total food and organic waste, and 61 kg/FTE/yr (range 1 kg - 200 kg, SD 14.56) and 0.16 $kg/ft^2/yr$ of food and organic waste was disposed. Most of the food and organic waste would likely have originated from the food courts and restaurants. 44 of the 56 facilities had a food and organic waste diversion program and on average 35 kg/FTE/yr (up to 69 kg) and 0.15 kg/ ft^2/ yr (included because almost all facilities provided size but not FTE data) was diverted by those facilities to a mix of mostly composting and some anaerobic digestion facilities.

Table 2-6: Overview of Malls and Retail

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft^2	Food waste	Other organic waste	Total	kg/FTE/yr	$kg/ft^2/yr$	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
41, 44-45	Malls and Retail	56	760	574,567	21.36%	11.19%	33.05%	61	0.16	11	35

2.2.4 Grocery Stores

Waste audit results were received from 9 grocery stores, with an average 25 FTE and average size of 60,926 ft^2. On average, waste disposed from these facilities consisted of 43.01% food waste (range 11.93%-78.20%, SD 12.54) and 48.23% (range 26.74%-78.20%, SD 16.51) total food and organic waste, and 849 kg/FTE/yr (range 315 kg - 1,854 kg, SD 65.43) and 0.93 $kg/ft^2/yr$ of food and organic waste was disposed. There were limited grocery store food waste audit results provided and none of the facilities from which waste audit data was received had a food and organic waste diversion program. It is known that some of the larger grocery store chains in Canada have food and organic waste diversion programs, unfortunately waste audit data was not able to be obtained before the report was finalized.

Table 2-7: Overview of Grocery Stores

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft^2	Food waste	Other organic waste	Total	kg/FTE/yr	$kg/ft^2/yr$	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
41, 44-45	Grocery Stores	9	25	60,926	43.01%	5.22%	48.23%	849	0.93	no data	no data

2.2.5 Offices

Waste audit results were received from 163 offices, with an average 1,495 FTE and average size of 282,780 ft^2. On average, waste disposed from these facilities consisted of 12.98% (range 0-57.08%, SD 17.89) food waste and 18.30% (range 0%-61.50%, SD 16.05) total food and organic waste, and 10 kg/FTE/yr (range 0 kg – 62 kg, range 16.05) and 0.03 $kg/ft^2/yr$ (range 0-0.36, SD 0.04) of food and organic waste was disposed. Most if not all of this food and organic waste would likely have come from staff meals (e.g., lunches). One hundred and sixteen of the 163 facilities had a food and organic waste diversion program and on average 14 kg/FTE/yr (up to 152 kg) was diverted by those facilities to a mix of mostly anaerobic digestion and some composting facilities.

Table 2-8: Overview of Offices

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft^2	Food waste	Other organic waste	Total	kg/FTE/yr	$kg/ft^2/yr$	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
51-56, 81, 91	Offices	163	1,495	282,780	12.98%	4.61%	18.30%	10	0.03	11	14

2.2.6 Elementary Schools

Waste audit results were received from 11 elementary schools, with an average 443 FTE (i.e., students used as FTE) and average size of 60,307 ft^2. On average, waste disposed from these facilities consisted of 41.68% food waste (range 17.42%-49.26%, SD 8.63) and 60.32% (range 29.61%-79.73%, SD 12.69) total food and organic waste, and 9 kg/FTE/yr (range 1 kg - 12 kg, range 3.33) of food and organic waste was disposed. Most of the food and organic waste would likely have come from student and staff lunches. Three of the 11 facilities had a food and organic waste diversion program and on average 4 kg/FTE/yr (up to 5 kg) was diverted by those facilities to composting or anaerobic digestion facilities.

Table 2-9: Overview of Elementary Schools

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft^2	Food waste	Other organic waste	Total	kg/FTE/yr	$kg/ft^2/yr$	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
61	Elementary Schools	11	443	60,307	41.68%	18.64%	60.32%	9	0.05	1	4

2.2.7 Secondary Schools

Waste audit results were received from 13 secondary schools, with an average 883 FTE (i.e., students used as FTE). No facility size data was provided. On average, waste disposed from these facilities consisted of 40.33% (range 20.00-76.00, SD 12.72) food waste and 50.88% (range 37.35%-76.00%, SD 10.3) total food and organic waste, and 13 kg/FTE/yr (2 kg - 66 kg, SD 17) of food and organic waste was disposed. Most of the food and organic waste would likely have come from student and staff lunches. Five of the 13 facilities had a food and organic waste diversion program and on average 32 kg/FTE/yr (up to 138 kg) was diverted by those facilities to off-site or on-site composting facilities or anaerobic digestion facilities.

Table 2-10: Overview of Secondary Schools

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft^2	Food waste	Other organic waste	Total	kg/FTE/yr	$kg/ft^2/yr$	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
61	Secondary Schools	13	835	-	40.33%	10.55%	50.88%	13	no data	12	32

2.2.8 Post-Secondary Schools

Waste audit results were received from 28 secondary schools, with an average 11,487 FTE (i.e., students used as FTE) and average size of 189,876 ft^2. On average, waste disposed from these facilities consisted of 31.65% (range 13.00-54.20, SD 11.86) food waste and 53.57% (range 16.60%-64.60%, SD 12.38) total food and organic waste, and 11 kg/FTE/yr (range 1.7 kg - 28.76 kg, SD 7.69) of food and organic waste was disposed. Most of the food and organic waste would have come from student and staff lunches. Twenty of the 28 facilities had a food and organic waste diversion program and on average 10 kg/FTE/yr (up to 21 kg) was diverted by those facilities to mostly composting and some anaerobic digestion facilities.

Table 2-11: Overview of Post-Secondary Schools

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft²	Food waste	Other organic waste	Total	kg/FTE/yr	kg/ft²/yr	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
61	Post-Secondary Schools	28	11,487	189,876	31.65%	10.85%	43.57%	11	0.13	7	10

2.2.9 Hospitals

Waste audit results were received from 18 hospitals (including one long-term care home), with an average 1,616 FTE and average size of 696,509 ft^2. On average, waste disposed from these facilities consisted of 14.10% (range 1.91%-50.71%, SD 14.53) food waste and 21.24% (range 1.91%-59.71%, SD 17.09) total food and organic waste, and 46 kg/FTE/yr (range 4 kg - 131 kg, SD 40) and 0.14 kg/ft/yr of food and organic waste was disposed. Most of the food and organic waste would likely have come from patient meals, with some from staff and visitor meals. Eleven of the 18 facilities had a food and organic waste diversion program and on average 40 kg/FTE/yr (up to 181 kg) was diverted by those facilities to composting or anaerobic digestion facilities.

Table 2-12 Overview of Hospitals

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft²	Food waste	Other organic waste	Total	kg/FTE/yr	kg/ft²/yr	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
62	Hospitals	18	1,616	696,509	14.10%	7.14%	21.24%	46	0.14	33	40

2.2.10 Arts, Entertainment and Recreation

Waste audit results were received from four arts, entertainment and recreation facilities (i.e., recreation centre, arena, zoo), with an average 169 FTE and average size of 145,436 ft^2. On average, waste disposed from these facilities consisted of 25.58% (range 2.60%-47.73%, SD 18.59) food waste and 39.81% (range 20.00%-66.13%, SD 20.41) total food and organic waste, and 202 kg/FTE/yr (range 38 kg -364 kg, SD 142) and 0.14 kg/ft^2/yr of food and organic waste was disposed. Most of the food and organic waste would likely have come visitor meals/snacks and from staff meals. Three of the 4 facilities had a food and organic waste diversion program and on average 168 kg/FTE/yr (up to 279 kg) was diverted by those facilities to composting and anaerobic digestion facilities.

Table 2-13 Overview of Arts, Entertainment and Recreation

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft²	Food waste	Other organic waste	Total	kg/FTE/yr	kg/ft²/yr	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
71	Arts, Entertainment, Recreation	4	169	145,436	25.58%	14.23%	39.81%	202	0.14	126	168

2.2.11 Hotels

Waste audit results were received from 18 Hotels, with an average 234 FTE and average size of 481,510 ft^2. On average, waste disposed from these facilities consisted of 44.13% (8.01%-93.00%, SD 17.85) food waste and 49.78% (range 8.01%-93.00%, SD 16.64) total food and organic waste, and 472 kg/FTE/yr (range 42 kg - 1,138 kg, SD 337) and 0.50 kg/ft^2/yr of food and organic waste was disposed. Most of the food and organic waste would likely have come visitor meals/snacks and smaller amounts from staff meals. Ten of the 18 hotels had a food and organic waste diversion program and on average 329 kg/FTE/yr (up to 971 kg) was diverted by those facilities to mostly composting and some anaerobic digestion facilities.

Table 2-14: Hotels

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft²	Food waste	Other organic waste	Total	kg/FTE/yr	kg/ft²/yr	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
72	Hotels	18	234	481,510	44.13%	5.65%	49.78%	472	0.50	206	329

2.2.12 Restaurant

Waste audit results were received from 25 restaurants, with an average 16 FTE and average size of 3,372 ft^2. On average, waste disposed from these facilities consisted of 49.16% (16.21%-83.20%, SD 16.45) food waste and 55.23% (range 16.21%-86.17%, SD 17.58) total food and organic waste, and 991 kg/FTE/yr (range 263kg - 3,145kg, SD 913) and 6.50 kg/ft^2/yr of food and organic waste was disposed. Most of the food and organic waste would likely have come from pre-consumer food preparation and post-consumer food wastage. Ten of the 18 hotels had a food and organic waste diversion program and on average 4.9 kg/ft^2/yr (up to 20.9 kg) was diverted by those facilities (i.e., there were no waste audit results that included FTE data and food and organic waste diversion programs) composting facilities.

Table 2-15: Restaurants

NAICS Code	Sector	Number of waste audits	FTE/Facility	Average Facility Size	Food and Organic Waste in Waste Disposed					Food and Organic Waste Diversion	
		#	#	ft^2	Food waste	Other organic waste	Total	kg/FTE/yr	kg/ft^2/yr	All facilities kg/FTE/yr	Facilities with program kg/FTE/yr
72	Restaurants	25	16	3,372	49.60%	5.63%	55.23%	991	6.50	no data	no data

2.2.13 Comparisons of this Waste Audit Data with Other Studies

The waste audit results were compared to data presented in some other studies and are summarized in Tables 2.16 and 2.17.

The average percentage total food and organic waste disposed (i.e., from all waste audit results received) in this study compares well to a recent ECCC waste characterization report[3] but is higher than a 2018 Vermont, USA waste characterization study[4].

Except for grocery stores the average percentages of total food and organic waste disposed for manufacturing, malls and retail and hotels/restaurants in this study fall within the ranges for compostable organics presented in a 2019 Metro Vancouver commercial/institutional waste composition study[5].

The average percentage of food waste disposed for manufacturing (food and non-food processing) and hospitals are lower while elementary schools are higher in this study than food waste estimates presented in a Massachusetts Food Waste Estimation Guide[6].

*Table 2-16: Comparison of Food and Organic Waste Percentages with Other Studies**

[3] http://publications.gc.ca/collections/collection_2020/eccc/en14/En14-405-2020-eng.pdf
[4] https://dec.vermont.gov/sites/dec/files/wmp/SolidWaste/Documents/2018-VT-Waste-Characterization.pdf
[5] http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/2019CommercialInstitutionalWasteCompositionStudy.pdf
[6] https://recyclingworksma.com/food-waste-estimation-guide/

NAICS Code	Sector	This Study (Food Waste)	This Study (Other Organic Waste)	This Study (Total Food and Organic Waste)	Environment and Climate Change Canada National Waste Characterization Report (2020) (food and yard and garden)	Metro Vancouver 2019 Commercial/ Institutional Waste Composition Study (organics)	Massachusetts Food Waste Estimation Guide (food waste)	Vermont Waste Characterization Study (2018) (food and organic waste)
31-33	Manufacturing (food processing)	20%	6%	26%		15%-39%	63%	
31-33	Manufacturing (nonfood processing)	10%	11%	21%			45%	
41, 44-45	Malls and Retail	21%	11%	33%		23%-62%		
41, 44-45	Grocery stores	43%	5%	48%				
51-56, 81, 91	Office	13%	5%	18%				
61	Ellementary Schools	42%	19%	60%			30%	
61	Secondary Schools	40%	11%	51%				
61	Post-Secondary Schools	32%	11%	44%				
62	Hospitals	14%	7%	21%			36%	
71	Arts, Entertainment, Recreation	26%	14%	40%				
72	Hotel	44%	6%	50%		46%-59%		
72	Restaurants	50%	6%	55%				
	All sources			29%	28%			23%

*sum does not always fully add up due to rounding

The average kilograms of food waste disposed per FTE per year in this study is generally similar for elementary/secondary schools and post-secondary schools and lower for grocery stores, offices, hotels and restaurants than in the Massachusetts Food Waste Estimation Guide and/or US EPA 2018 Food Waste Report (Table 2.17).

Table 2-17: Comparison of Food Waste (kg/FTE/yr)) with Other Studies

NAICS Code	Sector	NAICS Code	This Study (Food Waste Disposed)	This Study (Other Organic Waste Disposed)	This Study (Total Food and Organic Waste Disposed)*	Massachusetts Food Waste Estimation Guide	US EPA 2018 Waste Food Report
31-33	Manufacturing (food processing)	31-33	367	118	485		
31-33	Manufacturing (nonfood processing)	31-33	28	32	60		
41, 44-45	Malls and Retail	41, 44-45	39	21	61		
41, 44-45	Grocery stores	41, 44-45	757	92	849	1,363	1,856
51-56, 81, 91	Office	51-56, 81, 91	7	2	10		77
61	Ellementary Schools	61	6	3	9	20	12
61	Secondary Schools	61	10	3	13	6	
61	Post-Secondary Schools	61	8	3	11	41	9
62	Hospitals	62	31	16	46		
71	Arts, Entertainment, Recreation	71	130	72	202		
72	Hotel	72	419	54	472	593	517
72	Restaurants	72	890	101	991		1,250-1,386
	All sources				126		

*sum does not always fully add up due to rounding

2.2.14 Summary

This study represents the most extensive research conducted to date on the characterization of Canadian ICI food and organic waste disposal and diversion via the collection of waste audit data.

This included the results from 421 Canadian waste audits and subsequent analysis to present food and organic waste percentages and disposal and diversion data normalized by FTE and square footage. This data can potentially be used by various stakeholders, such as provinces and ICI business owners, to develop estimates that they can use for planning purposes.

Overall, the data shows that high food waste generating sectors include manufacturing (food processing), grocery stores, hotels and restaurants and this is not surprising as these sectors are actively engaged in the processing/preparation and/or food retail/service. The data compare reasonably well to other US based studies.

Almost 60% of the facilities from which waste audit results were received have a food and organic waste diversion program of some kind and direct some or all of their organic waste mostly to composting or anaerobic digestion and in a few cases animal feed. Manufacturing (food processing) facilities diverted by far the most food and organic waste (i.e., 3,632 kg/FTE/yr) and this is considerably higher than the amount of food and organic waste disposed (i.e., 485 kg/FTE/yr).

As noted at the start of Section 2.2 there is a high level of confidence that the waste audit results received are representative of waste audits completed (i.e., because they were supplied by a variety of companies that undertake waste audits) and there is a medium level of confidence that they are fully representative of all ICI generators (i.e., because they do not include ICI generators who do not complete waste audits).

There is a high level of confidence in data from most sectors because most consist of at least 10 waste audits (Table 2.1). For this reason, there is also a high level of confidence in the per-cent and normalized food and organic waste disposed and diverted, which was a key objective of this data collection.

There is a medium to high level of confidence that this data is representative of the country. While 77% of waste audit results were from Ontario this is largely a function of the requirement to undertake waste audits. Waste audit data is not equally available by province because most do not require it and it represents a cost to business.

While there were insufficient datapoints to undertake province by province analysis it is reasonable to assume that activities at the various facility types (e.g., schools, restaurants, hotels etc.) would be similar across the country because the activities that take place at these facilities do not vary much (e.g., all restaurants include some level of food preparation, food service and post-consumer waste generation)

Recommended next steps in refining the estimates presented in this chapter include:

- More detailed province-by-province waste audit data collection;
- Additional waste audit data collection across ICI sectors particularly for:
  - Wholesale trade
  - Retail trade (food), i.e., grocery stores;
  - Health care and social assistance, i.e., ambulatory health care services, nursing and residential care facilities and social assistance;
  - Arts, entertainment and recreation facilities; and
- Gathering additional data to better understand the percentage of Canadian ICI facilities that have a food and organic waste diversion program.

3.0 EXISTING ICI ORGANIC WASTE COLLECTION BUSINESS STRUCTURE IN CANADA

3.1 Methodology

The purpose of this section is to provide an overview of the current economic/business structure of organic waste collection from the ICI sectors in Canada, and where possible, from ICI sub-sectors. A literature review was

undertaken to better understand the current context in Canada and the US. Surveys and interviews of organic waste management companies across the country were also completed. In total fifteen private sector companies were reached out to and responses were received from nine with operations across the country. Large organic waste generators with a national footprint (e.g., grocers and food processors) were also contacted but responses were minimal.

3.2 Current Cost Structure

The cost structure of managing ICI organic waste is reflective of the service needs and service limitations associated with organic waste generators and the infrastructure and operational model deployed by service providers. The following are five primary components impacting the cost of managing organic waste from the generator to final processor:

1. Collection;
2. Transfer;
3. Pre-processing (if necessary);
4. Final processing including compost and digestate management; and
5. Contamination/disposal.

In any given geographic area not all cost elements are necessarily relevant. If processing locations are in close proximity to processing (pre-processing or final processing) from a transportation distance/cost perspective, transfer may not be required and therefore not reflected in cost. Likewise, the pre-processing of organic waste is generally associated with anaerobic digestion and not relevant to the costs associated with other final processing technologies. The five primary cost components are relatively consistent on average across Canada, noting that contamination costs are incorporated into processing costs. This is largely reflective of the similar economic activities; the nature of ICI entities generating organic waste; and the consistent business models and technologies deployed by service providers to manage organic waste.

3.2.1 Collection

3.2.1.1 Overview – Types of Containers

Organic waste is collected from generators utilizing a variety of container types and methods. The type of collection container is determined by several factors including the moisture content of the waste material, weight of the waste material, storage space at the generator's location, frequency of collection and the need to mitigate odour. The most common containers are:

- Totes – wheeled (2) containers with lids that range in volume from 32 - 64 gallons;
- Bonars – insulated containers with lids, forklift mobilized from 635 - 950 kg;
- Bins/compactors – various sizes, lined to be leakproof, truck mobilized from 2 - 20 cubic yards; and
- Slurry tanks – on-site liquid storage tanks pumped by vehicles.

Note packaged food items that are surplus or do not meet quality standards can also be a source of organic waste – this is typically collected in skids.

Tote collection: Totes are collected in two ways from the generator. Most common is the use of a 'straight truck' or cube van with a hydraulic or electric loading platform which is used to manually load the full totes for transport off-site. The truck carries empty, clean totes to replace those that are full and removed. The generator would be serviced as part of a collection route. The vehicle servicing the route would pre-determine the number of totes to

be picked up on the route and would ensure that the same number of empty clean totes were on-board for exchange.

Figure 3-1: Example of a Tote/Cart used for Organic Waste Collection

Heavier totes are often collected in a rear-load waste recycling vehicle which uses semi-automated hydraulic systems to lift and dump the cart into the vehicle hopper.

Most service providers have a minimum charge requirement to justify service to the site. The charge can be based on number of totes (e.g., 3 minimum) or a minimum financial charge (e.g., $50 per generator).

Bonar collection: Bonars are collected with straight trucks, cube vans and in some cases flatbed trucks. Bonars are larger containers with thick insulated sidewalls and lids. Bonars range in weight (when full) from 635 – 950 kg and are too heavy to be moved manually. Bonars are loaded and unloaded with a forklift, which is the primary constraint on the expanded use of these containers as a limited number of generators have forklift equipment. Some flatbed trucks have integrated forklifts on-board however these are not common service vehicles.

Figure 3-2: Example of a Bonar used for Organic Waste Collection

Bin/Compactors collection: Bins and compactors are collected and transported on specialized waste management vehicles.

Roll-off bins are collected with a roll-off vehicle incorporating a hook and rail system that tilts to load the bin. The constraint in utilizing bins is the fact that loading 'tips' the bin making it impossible to use for organic waste with a high liquid content. Bins are generally replaced on site as the service vehicle brings an empty bin and replaces the full bin at the time of removal.

Figure 3-3: Example of a Roll off Bin used for Organic Waste Collection

Front-end bins are collected with a front-end collection vehicle that utilizes forks on the truck inserted into slots on the bin. The bin is then lifted over the cab of the vehicle and dumped into the vehicle body. These containers are also utilized for organic waste with lower liquid content due to potential spillage because of the mechanics of emptying the bin.

Figure 3-4: Example of a Tote or Cart used for Organic Waste Collection

Compactors are integrated (self-contained) units with a compactor and enclosed compartment for the compacted waste. Compactors are collected and transported with a roll-off vehicle in the same manner as bins. In the case of compactors, the compactor is emptied and then returned to the generator.

Figure 3-5: Example of a Compactor used for Organic Waste Collection

Storage Tank collection: some large volume generators utilize liquid storage system to grind clean food waste and store in a liquid form in on-site (usually above ground) tanks. The tanks are emptied by a specialized pumper vehicle.

3.2.1.2 Containers and ICI Generator

The specific type of container (Table 3.1) used to collect organic waste is related to the moisture content of the organic waste material and the volume/weight of material being generated. The nature of organic waste requires frequent servicing and influences the length of time organic waste can be stored in containers on-site. The following chart indicates the most common types of collection containers for various classes of ICI generators:

Table 3-1: Most Common Container Type and Collection Method Used by ICI Facilities

Facility Type	Container Type	Collection Method
Institutions (e.g., schools, hospitals, long-term care homes), Sporting and Entertainment Venues	Totes (32-64 gallon) Bins	Straight Truck Front End Truck
Malls	Totes (32-64 gallon)	Straight Truck
Hotels	Totes (32-64 gallon)	Straight Truck
Restaurants	Totes (32-64 gallon) Bins	Straight Truck Front End Truck
Grocery Stores	Grinder/Slurry Tanks Compactors Totes	Pumper Truck Roll Off Truck Straight Truck
Food Processors	Bonars Bins Tanks	Straight or Flat Bed Truck Roll Off Truck Hydrovac Trucks
Offices	Totes (32-64 gallon)	Straight Truck

3.2.1.3 Factors Impacting Collection Costs

The cost of collecting organic waste (Table 3.2) in the ICI sector is influenced by many factors. The following is not an exhaustive list, but represents some of the significant factors:

- **Container Type:** Collection costs vary by container type. The majority of organic waste collection from generators is via totes and the most common container size is 32 gallons (approximately 100 kg). This container is the most versatile and can be easily moved manually at both the generator location and by service providers. The average cost to collect a tote is $18.00, with a range from $13.00 to $20.00 per tote. Note the cost would be higher for tote replacement which increase the cost by 50-100%.

It is a service industry practice to have a 'minimum' to justify the cost of servicing. This can be a minimum number of totes per service call (e.g., a 3-tote minimum) or a minimum service fee (e.g., $50.00 per service call). The service fees generally equate to a 3 tote pick up minimum. The tip charge will often be the same whether the bin is full or not.

The average weight of a 32-gallon tote for organic waste is 100 kg. This equates to a collection cost of $180.00/tonne.

The cost to service customers with smaller (2-4 yard bins) lined bins is $160.00/tonne on average with a cost range of $150.00 to $175.00/tonne.

The cost to service generators with larger than 4-yard bins either by a front-end truck or a roll off truck varies considerably depending on several factors (e.g., collection location, location and logistics to transfer station or processing facility). The cost per tonne is generally lower than the cost for 2-4 yard bins as cost efficiencies are realized with larger volume servicing.

The cost to service larger food waste generators such as grocery stores or food processors using a tank model (liquid) varies according to storage tank size and location relative to processing facilities. The average cost for collection of grinder liquids is $60.00/tonne with a range of between $50.00 to $60.00/tonne. The cost for tank pumping servicing ranges from $150.00 to $1500.00 per tank with an average cost of $500.00 per service call. In most cases servicing of tank-based systems is efficient as tanks have sensor systems that communicate with ICI facilities operators to inform them when the tanks are full and require collection services.

Table 3-2: Average Cost by Collection Method

Waste Stream	Container	Average Cost	Cost Range
ICI Source Separated Organics	32 gallon totes	$18.00 / tote ($180.00 / tonne)	$13.00 - $20.00 / tote ($130.00 - $200.00 / tonne)
ICI Source Separated Organics	2-4 yard bins	$160.00 / tonne	$150.00 - $175.00/ tonne
Liquified Food Waste	storage tanks	$60.00 / tonne	$50.00 - $60.00 / tonne

- **Collection Equipment and Collection Method**: Automated, semi-automated, and manual collection methods exist, each with different capital, operating, and maintenance costs for both collection containers, collection equipment and vehicles. The collection method also impacts the labour required to provide the collection service.

  The same general principle that governs the cost of waste collection applies to organic waste collection – i.e., larger volume collection either by container and/or route reduces the cost per tonne for collection. The influence of labour is also significant with manually managed collection modes such as the loading of totes on straight trucks adding to the cost per tonne. Service providers indicate that the collection costs for organic waste are generally 50% higher than the cost of collecting waste for disposal, due primarily to container and vehicle liners, worker health & safety issues (e.g., closed bag versus open top, manual handling), and generally reduced volumes upon which to base route efficiencies. Additional cost can also be incurred for tote cleaning and for bin liners.

- **Collection Location**: The high variability of space availability for organic waste collection containers at the point of generation or at generator locations often dictates inefficiencies and increases costs. If the collection vehicle needs more time to access the totes or bins (e.g., retrieve from a shed at the back of building as opposed to direct vehicle access), it can increase costs.
- **Routes & Collection Frequency**: There is a component of collection costs that is not volume related and represents the basic costs of capital, equipment and labour necessary to dispatch a vehicle to a service site. The basic costs to operate a waste collection vehicle are roughly $200.00/hour (i.e., fuel, equipment, capital and labour costs). This basic cost is determined for the entire route (time) and then divided by the number of pickups to determine the tonnage-independent basic service fee. This is why most companies will have a minimum number of totes collected per servicing or a minimum service fee.

  Many generators, especially restaurants have limited space that restricts the size and mobility of collection containers, that necessitate more frequent servicing. They may also have greater needs to be serviced, due to odours and other noxious factors (e.g. rodents, flies and other vectors) in proximity to the public or workers.

  The density of collection customers on a given vehicle 'route' is also a significant influencer of costs. On any route, there is a level of customer service that establishes efficiency and lowest cost. A lower route density will increase costs (i.e., as collection points are far apart).

  Costs can also be lower when other materials are being co-collected (e.g., meat and bone sent to rendering facilities and vegetable waste sent for animal feed).
- **Organic Waste Diversion Regulations**: The nation-wide patchwork or absence of regulatory obligations to divert organic waste creates an inconsistent and reduced customer base to achieve cost efficiency. In many cases, the relationship between the cost to send organic waste to disposal versus the cost to have organic waste recycled will influence organic waste generators to make management decisions.

  Likewise, the lack of regulatory obligations on organic waste generators creates challenges in establishing efficient routing. When left to choose between disposal or recycling, the choice is often disposal due to both lower costs and the convenience of a 'one-bin' approach. Without regulatory requirements, generators are free to make decisions on a financial basis. In these cases (and given the higher cost of organics processing versus disposal), ICI generators that are diverting organics are mainly doing so to demonstrate leadership in corporate social responsibility, support green marketing approaches, and/or respond to consumer expectations.
- **Proximity**: The closer the drop-off (i.e., unloading) location in terms of distance and/or travel time to the collection location or collection route, the more efficient collection operations become. Transfer stations, pre-processing facilities and processing facilities also have their own unique factors which influence how quickly a vehicle can unload, and how much time they spend before returning to collection operations.
- **Other Economic Variables**: The variability of key elements of collection costs such as fuel, capital and operating costs for equipment and vehicles will directly influence collection costs. These costs are often beyond the control of service providers. Potential increases in costs are often built into collection costs by service providers from a very conservative perspective. An example would be estimating the cost of fuel

increasing over the life of a service agreement and that cost being incrementally based on a 'worst case' scenario.

To contend with variable costs that are beyond the control of service providers (e.g., fuel), service providers often establish 'fees' that are separate from the basic service cost. This fee is adjusted periodically to reflect fluctuations in variable costs (i.e., higher or lower) under the terms of the service contract.

The degree of competition can also influence costs. If little competition exists, the service provider is often able to charge higher service fees.

3.2.2 Organic Waste Transfer

Transfer stations have become essential infrastructure in managing organic waste in a cost-efficient manner. Transfer stations are interim consolidation points where collected materials are delivered, re-loaded into larger capacity transport vehicles and sent to pre-processing and/or processing facilities.

It is a general rule, applicable to organic waste as well, that every time the waste is 'handled' after the initial collection, there is a cost component increase. The rationale for incurring this extra handling cost at a transfer station (Table 3.3) is based on the savings from larger volume transportation, which offsets the extra handling cost. In any given scenario, a calculation is made in terms of the cost of transporting collected organic waste directly to pre-processing or processing facilities versus to a transfer station for consolidated and transport in larger volume vehicles. The primary factor in this calculation is the distance from the point of collection to the pre-processing or processing facilities. Longer distances favour and rationalize the consolidation of organic waste at a transfer station. The dominant collection system – totes & bonars do not support cost efficiency by direct transport to processing.

Transfer stations are also associated with urbanization. By their nature (e.g., due to odour/leachate issues), organics pre-processing, and processing facilities can be incompatible with urban land uses. As a result, these facilities are often located in more rural or industrial areas, often far from the urban areas where organic waste are collected. In these cases, transfer is efficient.

Table 3-3: Average Transfer Cost for ICI Organic Waste

Waste Stream	Facility	Average Cost	Range
ICI Source Separated Organics	Transfer Station	$18.00 / tonne[7]	$10.00 - $30.00 / tonne

The average cost to transfer organic waste at a transfer station is $18.00/tonne with a range of $10.00 to $30.00/tonne depending on the characteristics of the organic waste and the ability of the transfer station to manage associated odour and leachate from the tip floor. This transfer cost on average, is similar to the transfer station cost to manage ICI waste.

[7] If tote replacement was included cost would be higher.

It is estimated that of the total volume of organic waste collected, the majority is managed through a transfer station. This is consistent with the urban nature of organic waste generation and collection and the non-urban (rural) nature of organic waste processing.

3.2.3 Organic Waste Pre-Processing Costs

Pre-processing facilities remove inert contaminants (e.g., plastic) and solids to create a slurry or paste used as feedstock for anaerobic digestors (Table 3.4). There are a variety of technologies and types of equipment that 'squeeze' organic waste to remove water and organic materials to produce the required liquids. In most cases these pre-processing facilities are independent from the anaerobic digestion facility which means the pre-processed slurries must then be transported again to the anaerobic digestion facility.

Once organic waste has been collected and potentially consolidated at a transfer station, it is transferred to an organic waste processing facility (aerobic or anaerobic). Some anaerobic digestion facilities require materials to be pre-processed as a condition of their environmental approval and/or their inability to remove contaminates. Many on-farm anaerobic digestion facilities require pre-processing to handle source separated organics from off-farm sources (that may include municipal and ICI source separated organics).

These types of services may also be needed for larger anaerobic digestion facilities or compost facilities if materials need to be de-packaged (e.g., surplus or wasted food still in packaging). Few pre-processing facilities currently exist in the country but there is growing interest in this area.

Table 3-4: Average Pre-Processing Cost for ICI Source Separated Organic Waste

Waste Stream	Facility	Average Cost	Range
ICI Source Separated Organics	Pre-Processing Facility	$40.00 / tonne	$20.00 - $70.00 / tonne
De-packaging Organics[8]	Pre-Processing Facility	varies based on difficulty to de-package	$60.00 - $150.00

The average cost to pre-process organic waste for anaerobic digestion is $40.00/tonne. The range is from $20.00/tonne to $60.00/tonne. The variance in costs reflect the technology used to de-water the organic waste to create the anaerobic digestor feedstock and the geographic location and distance or the pre-processing facility from the collection routes at the front end and the processing facility at the back end.

The costs to de-pack organic waste would range from $60.00 to $150.00/tonne and is dependent on the ease /difficulty to de-pack the materials.

In the case of liquid organic waste, pre-processing removes water to create a thick paste which is transferred to anaerobic digestors. Grease trap and vegetable waste is decanted prior to being transferred to anaerobic digestors. Waste organic materials from meat processing and bakery facilities is non-decantable and is transported directly to anaerobic digestion facilities.

3.2.4 Organic Waste Processing

The overall percentage of ICI organic waste comprising the feedstock of current organic waste processors varies considerably depending on the type of waste processing technology being utilized and the niche markets forming

[8] For example, packaged food waste that needs to be de-packaged before it can be processed.

the business focus of the processor. The percentage of ICI organic waste in feedstock processed by aerobic composting or anaerobic digestion facilities ranges from 5% to 100%. Some facilities are purpose built to deal with food processing waste or other ICI organic waste streams however most try to balance a mixture of both ICI and residential sources which allows for longer term municipal contract, potentially cleaner materials from ICI generators and in the case of anaerobic digestion facilities higher gas generating feedstocks.

3.2.4.1 Anaerobic Digestion and Compost Facilities

The costs to process organic waste (Table 3.5) in an anaerobic digestor after pre-processing or delivered directly if suitable, is reflective primarily of the gas generating value and the absence of contaminants.

The cost to process pre-processed ICI source separated organics and Fats, Oils and Greases (FOG) can vary greatly depending on the value generated by the by-product of the process (e.g., renewable natural gas) and the level of contamination. If the organic waste is free of contaminate and the gas generating value is quite high then the tipping fee will be lower. The average cost is $25.00/tonne and the range is between $20.00 to $60.00/tonne. Some food processing liquids such as sugary water can be delivered directly to anaerobic digestors and the cost is at the low end of the range due to the absence of contaminants and the high gas generation potential (e.g., bakery wastes, FOG).

For other ICI source separated organic waste costs at an anaerobic digestion and compost facilities are similar and both vary depending on a range of factors including level of contamination. The cost to process ICI organic waste averages $110.00/tonne with a range that would vary across the country between of $75.00 to $150.00/tonne. The cost to process clean waste streams primarily from food processing with no contamination averages $55.00/tonne with a range of $20.00 to $60.00/tonne.

Table 3-5: Average Cost to Process ICI Organic Waste

Waste Stream	Processor	Average Cost	Range
Pre-Processed Slurry/ Fats, Oils & Greases (FOG)	Anaerobic Digestion	$25.00 / tonne	$20.00 - $60.00 / tonne
ICI Source Separated Organics[9]	Composting / Anaerobic Digestion	$110.00 /tonne	$75.00 - $150.00 / tonne
Clean Food Processing Waste	Composting / Anaerobic Digestion	$55.00 / tonne	$20.00 - $60.00 / tonne

Clean ICI organic waste streams can be processed at a lower cost than more contaminated residential or ICI source separated organics. These costs differences would take into account additional processing effort, maintenance needs, lower yields, and disposal costs.

3.2.5 Revenue from End-products of Organic Waste Processing

The revenue generation of compost and digestate products has been trending upwards due to product availability, specialization of compost products and improved public understanding of the value of compost and the improved agricultural community understanding of the value of digestate (Table 3.6).

[9] Refers to various organic waste collected but excludes food processing waste with little to no contamination and fast, oils, and greases collected separately.

The average revenue from compost is $15.00/tonne or lower with a range of $0 to $30.00/tonne. The revenue from digestate varies significantly with a range from $0.00 to $30.00/tonne, however most digestate is revenue neutral as the price only covers transportation to the site.

Table 3-6: Average Revenue from End-products of Organic Waste Processing

Facility	Material	Average Revenue	Range
Compost Facility	Compost	$0 - $15.00	$0 - $30.00 / tonne
Anaerobic Digestion	Digestate	$0	$0 - $30.00 / tonne
Anaerobic Digestion	Energy (e.g., Renewable Natural Gas)	$23-25/GJ	$23-25/GJ

Anaerobic digestion facilities can also derive revenue from the production of electricity through feed-in-tariff pricing or through the generation of renewable natural gas. The current market price for energy generation appears to be between $23-25/GJ.

3.3 Cost of Landfill Disposal in Canada

In Canada, the majority of waste is sent to landfills. Based on Statistics Canada's Waste Management Industry Survey in 2018, only 28% of all waste generated was diverted from landfills. This is largely the result of low tipping fees as compared to other waste diversion options. Consequently, much of the organic waste generated in Canada continues to be landfilled, especially where regulations banning disposal of organic waste or requiring diversion of organics from landfills are absent.

Landfill tipping fees are impacted by a number of broad factors:

- The scale of the operation (i.e., larger landfills can take advantage of economies of scale related to equipment, personnel);
- Landfill design and operational considerations (e.g., land purchase, design and construction, compensation to local community[10]);
- Environmental requirements (e.g., post-closure requirements, financial assurance[11], environmental monitoring, leachate / methane control and treatment);
- Waste type (e.g., inert materials that can be used as a landfill cover will often have lower fees as compared to materials that may pose greater issues with odour and leachate) and amount of material received;
- Capacity replacement costs (e.g., new cells, landfill gas capture systems); and
- The addition of a regulated disposal levy (e.g., Manitoba and Québec).

Several studies are undertaken on a regular basis that assess the posted tipping fees for landfills in Canada and United States. It is important to understand that the fees presented in these studies are based on posted tipping

[10] Landfill operators often provide compensation to the host municipality.
[11] Financial assurance is financial security (cash and non-cash) to guarantee you can cover the cost of complying with environmental objectives.

fees and not lower rates provided based on larger volumes or 'put-or-pay agreements' (e.g., contracts that oblige service providers to guarantee a predefined amount of waste over a specified time period at a fixed price). These rates tend to be substantially lower.

In Canada, the National Solid Waste Benchmarking Initiative (NSWBI) was established in 2011 with the primary goal to create a constantly evolving tool for managing and monitoring the performance of solid waste collection, processing, and disposal systems across Canada. It was developed and is run by AECOM. In 2019, 29 Canadian municipalities voluntarily participated from across the country.[12] Table 3.7 provides average rates for publicly owned municipal landfills in various Canadian provinces as well as the range of tipping fee rates. The national average tipping fee rate is $102.99 but rates do vary from $65 to $150. Note these rates do not include private landfill sites which typically have lower rates.

Table 3-7: National Solid Waste Benchmarking Initiative (NSWBI) Average Public Sector Landfill Tipping Fee Rates

Province / Region	2019 Average Tipping Fee (Tonne / CDN $)	Tipping Fee Range by Province / Region (Tonne / CDN $)
British Columbia	$117.63	$80 - $137
Alberta	$84.20	$65 - $113
Saskatchewan	$82.00	$69 - $105
Manitoba	$82.00	$82 - $86
Ontario	$109.86	$80 - $150
Atlantic Canada	$91.00	$68 - $125
National Average	$102.99	N/A

The Environmental Research and Education Foundation (EREF) publishes similar data in the US but includes both private and public landfills. The value of presenting this US data is it illustrates the range in fees at both private and public landfills and does illustrate the influence lower US tipping fees can have on waste export in some Canadian jurisdictions.

Based on the most recent EREF report (see Table 3.8), the US national average landfill tipping fee is substantially lower at $64.34/tonne (in Canadian dollars). It is important to note that average tipping fees ranged significantly within each of the regions in the chart below and by state. Kentucky had the lowest average tipping rate in 2019 at $34.65/tonne and Alaska the highest at $180.04/tonne. The lower average landfill tipping fees in the US study are likely the result of landfills of the inclusion of both private and public sites as well as the greater economies of scale associated with US landfills.

[12] National Solid Waste Benchmarking Initiative. SWANA – Association of Regional Waste Management Authorities of Saskatchewan Presentation: Landfill Capital and Operational Costs, August 2020.

Table 3-8: EREF US Average Private & Public Landfill Tipping Fee Rates[13]

Region	2018 Average Tipping Fee (Tonne[14] / CDN $[15])	2019 Average Tipping Fee (Tonne / CDN $)
Pacific (AK, AZ, CA HI,ID, OR, WA)	$79.56	$84.87
Northeast (CT, DE MC, MA, NH, NJ, NY, PA, RI, VT, VA, WV)	$78.32	$77.32
Mountains/Plains (CO, MT, ND, SD, UT, WY)	$50.63	$58.93
Midwest (IL, IN, IA, KS, MI, MN, MO, NE, OH, WI)	$54.49	$56.79
Southeast (AL, FL, GA, KY, MS, NC, SC, TN)	$50.34	$52.59
South Central (AR, LA, NM, OK, TX)	$40.44	$47.55
National Average	**$61.15**	**$64.34**

Based on the survey work undertaken for this report, the bulk volume landfill tipping rates (for mixed waste) in Canada for ICI waste were as low as $30 -$50 / tonne (see Table 3.9). These lower rates were generally tied to the disposal costs of exporting waste to neighbouring US jurisdictions. For example, Ontario landfills generally have higher tipping fees but lower transportation costs. In the Ontario marketplace, the overall cost to a generator to dispose of waste is roughly the same whether using a US landfill disposal option or an Ontario landfill disposal option. This creates a unique circumstance in Ontario however the impact of waste export also impacts costs in British Columbia and in Québec. By way of example, for the last ten years, over 3 million tonnes of Canadian waste has been exported annually to New York and Michigan for disposal.

Table 3-9: Average Canadian Landfill Tipping Fee Costs

Waste Stream	Facility	Average Cost	Range
ICI	Landfill	>$100 / tonne	$30.00 - $150.00 / tonne

The average landfill rate in Canada varies significantly however given the average tipping fees to process ICI SSO waste are above $100 (see Table 5), most landfill rates would be lower. Note there will be some organic waste materials (e.g., liquid organic wastes) that cannot go to landfills.

3.4 Role of Local Governments in Managing ICI Organic Waste

Local governments in Canada are generally responsible for the management of municipal solid waste, generated by their residential buildings. Across Canada, many local governments have established integrated waste management systems to address garbage, recyclables, household hazardous waste and organic waste. These

[13] Environmental Research and Education Foundation. Analysis of MSW Landfill Tipping Fees – April 2019, April 2020. Available at https://erefdn.org/wp-content/uploads/woocommerce_uploads/2017/12/MSWLF-Tipping-Fees-2019-FINAL-revised-revised-1-gcml72.pdf.
[14] 1 US Ton = 0.907185 Metric tonne
[15] 1 US $ = $1.27 CD $

systems are generally focused on residential waste but do sometimes also collect from ICI entities. The history of the rationale for servicing certain businesses is not often well understood, but the rationale tends to be based on following:

- Small ICI entities are often situated in residential areas (e.g., an apartment above a store) making it difficult for the collector to know which material is household and which from the ICI entity. As well ICI entities in highly residential areas may have difficulty receiving cost effective servicing.
- Collecting from ICI entities can help to improve economies of scale for the local government for both collection and processing.
- With new waste diversion programs and for smaller / more remote communities, there may be a lack of processing or collection opportunities. Local governments can help to address these gaps by providing servicing.
- Some local governments have established waste diversion goals that include non-residential materials and as a result seek to directly help to improve the outcomes.
- Some local governments also seek to provide cost relief to certain ICI entities such as religious institutions, charities, not-for-profit organizations and schools to reduce their costs.

Collection from these entities can be beneficial due to some of the reasons noted but can also come with challenges. ICI entities can often be more contaminated than residential materials meaning an increased cost to process. They also often need a different level of servicing than residential buildings as they are generating larger volumes of waste so may need more frequent servicing or different collection containers. Access to these sites may also require different considerations (e.g., servicing on private property, ability for standard collection vehicles to access containers safely – turn radius, slope, overhead clearance). There are also often concerns about local government services competing with the private sector that may already be offering similar services.

Table 3.10 illustrates examples of municipal organic collection program that include optional servicing for select ICI facilities. Most offer only limited organic waste collection servicing to ICI facilities.

Table 3-10: Examples of Municipal Organic Collection Programs that Include Optional Servicing for Select ICI Facilities

Municipality	Limitations	Fee Structure
City of Calgary, AB[16]	Site inspection required to ensure it can be properly serviced	Compete with private sector Negotiated price
City of Edmonton, AB[17]	Winding down commercial collection and no longer accepting new commercial clients	Fee per service
City of Toronto, ON[18]	All-or nothing service. If opt out of garbage collection, not eligible for green bin. Site inspection required to ensure it can be properly serviced	Compete with private sector Fee per service (bundled, premium green bin collection)
County of Wellington, ON[19]	Limited - Some small businesses, churches, etc. with limited organic waste	Property tax based

[16] More information can be found at https://www.calgary.ca/uep/wrs/commercial-services/services/calgary-commercial-collection-services.html.
[17] More information can be found at https://www.edmonton.ca/programs_services/garbage_waste/commercial-waste.aspx.
[18] More information can be found at https://www.toronto.ca/services-payments/recycling-organics-garbage/non-residential/fees-set-out-for-businesses/.
[19] More information can be found at https://www.wellington.ca/en/resident-services/sws-greenbin.aspx.

Municipality	Limitations	Fee Structure
Region of Halton, ON[20]	Site inspection required to ensure it can be properly serviced	Partial fee per service / Property tax based
Region of Niagara, ON[21]	Properties that retain private service for recycling will not be eligible for curbside collection of any other collectable material unless identified and approved as a registered charity through the Canada Revenue Agency Site inspection required to ensure it can be properly serviced	Property tax based
City of Montreal, QC[22]	Site inspection required to ensure it can be properly serviced Needs to be on existing route	Partial fee per service / Property tax based

ICI entities (i.e., servicing ICI entities along residential collection routes that can be serviced in a similar manner and frequency to single-family residences and multi-residential buildings).

Note that there are also a number of municipalities that operate organic collection programs but do not offer these services to ICI entities, such as the cities of Surrey and Vancouver in British Columbia, and the Region of Peel in Ontario.

There are generally three methods in which fees are charged to ICI entities that are serviced by municipal organic collection programs:

- **Property Tax** – services are paid through property tax rates. This type of approach is simple to administer as no billing system is necessary. It does however not incent waste reduction and may not be seen as fair given fees are not based on the quantity of material managed, nor are all ICI entities included. The County of Wellington and Region of Niagara are property tax-based systems, while the Region of Halton and the City of Montreal have hybrid systems as some ICI entities are based on property taxes and others pay a fee-per-service (e.g., in Halton businesses in business improvement areas are property tax based while those outside pay a fee-for service).
- **Fee for service (flat rate or variable)** – published rates paid by users of the system. These rates can be flat rates (e.g., City of Edmonton) or variable based on the size of the bin, the weight of the materials collected, the amount of lifts or some combination thereof (e.g., City of Toronto). Fee-per-service systems do require more effort and investment to implement and administer especially if the costs are variable. Billing systems are necessary and more work may be necessary to educate the customer. The advantage to these systems is they have the potential to ensure more stable funding to allow municipalities to better plan investments. Variable fee systems can also incent waste reduction and reduced contamination.
- **Negotiated fees** – user fees are negotiated between the municipality and the generator (e.g., City of Calgary). This approach provides greater flexibility based on unique circumstances and allows the municipal flexibility based on their feedstock needs. Similar to a fee per service approach it does require more effort and investment to implement and administer.

[20] More information can be found at https://www.halton.ca/For-Business/Business-Improvement-Areas-(BIA)-and-Commercial-Wa.
[21] More information can be found at https://www.niagararegion.ca/waste/collection/mixed-use-services.aspx.
[22] More information can be found at https://montreal.ca/en/collections/organic-waste-collection.

3.5 Role of Private Sector in Managing ICI Organic Waste in Canada

Recent reports by the Canadian Biogas Association[23], the Compost Council of Canada[24], and the Environmental Research and Education Foundation of Canada[25] help to provide a better picture of the current publicly and privately-owned organic processing facilities in Canada. Privately-owned organic processing facilities manage the majority of organic waste generated by the ICI sectors.

Table 3.11 provides an outline of some of the larger private sector organic waste management companies in Canada, including where they operate and the services they provide. It should be noted that generally there are not as many vertically integrated waste management companies (e.g., GFL Environmental, Waste Connection Canada, and Waste Management Canada) managing organic waste as there are for waste disposal.

Table 3-11: Organic Waste Management Companies Servicing the ICI Sector in Canada

Company	Provincial / Territory Operational in	Services Offered	Organic Waste Processing Facilities	Additional Information
Bio-En Power Inc	ON	Processing	ON (1 facility)	Ability to process 110,000 tonnes of organic waste per year[26]
Cleanit Greenit Composting System Inc.	AB	Organic Processing	AB (1 facility)	Process ~20,000 tonnes of organic waste per year [27]
Convertus Group	ON, BC	Organic Processing	BC, ON (4 facilities)	Ability to process more than 300,000 tonnes of waste annually
Cornerstone Renewables	ON	Organic Processing	ON (12 facilities) * Note Cornerstone is a co-operative	Process ~200,000 tonnes of organic waste per year[28]
Englobe	QC	Organic Processing	QC (3 facilities)	Composting sites produce over 100,000 tonnes / year of compost and soil amendments[29]
Envirem Organics Inc.	NB	Organic Processing	NB (8 facilities)	Process more than 500,000 tonnes of forestry and industrial residuals annually[30]
GFL Environmental	National	Collection, Transfer, Processing	BC, AB, SK, ON (11 facilities)	Processed 437,293 tonnes of organic waste in 2019[31]

[23] Available at https://biogasassociation.ca/about_biogas/projects_canada.
[24] Available at http://www.compost.org.
[25] Available at https://erefdn.org/eref-ca/.
[26] Bio-En Power Inc. Home, last retrieved March, 2021. Available at http://www.bio-enpower.com.
[27] Cleanit Greenit Composting System Inc. About, last retrieved March 2021. Available at https://www.cleanitgreenit.net/about.
[28] Cornerstone Renewables. Who We Are, last retrieved March 2021. Available at https://cornerstonerenewables.ca.
[29] Englobe. Solid Waste Management, last retrieved March 2021. Available at https://englobecorp.com/canada/en/services/solid-waste-management.
[30] Forest NB. Envirem Organics: Recycling organic and industrial waste, August 26 2016. Available at https://www.forestnb.com/archives/forest-nb-news/commentary/envirem-organics-recycling-organic-and-industrial-waste/.
[31] GFL Environmental. 2019 Environmental Sustainability Report, 2019. Available at http://gflenv.com/wp-content/uploads/2020/05/GFL-Sustainability-Report.pdf.

Company	Provincial / Territory Operational in	Services Offered	Organic Waste Processing Facilities	Additional Information
Loraas Environmental	SK	Collection, Transfer, Processing	SK (1 facility)	Ability to process over 20,000 tonnes of organic waste annually[32]
Miller Waste	ON	Collection, Transfer, Processing	ON (5 Facilities)	Process ~150,000 tonnes of organic waste annually
Overton Environmental Enterprises	MB	Processing	MB (2 facilities)	Ability to process 50,000 tonnes of organic waste annually[33]
Penner Waste Inc.	MB	Collection, Transfer, Processing	MB (1 facility)	Commercial facility contracted by City of Winkler with service to ICI
Planet Earth Recycling	ON	Transfer	None	Consolidate and transfer organic materials
Revolution Resource Recovery	BC	Collection, Transfer, Processing	BC (1 facility)	Also offer food waste de-packaging services
Seacliff Energy	ON	Processing	ON (1 facility)	Ability to process 110,000 tonnes of organic waste annually
Sea to Sky Soils	BC	Processing	BC (1 facility)	Ability to process 60,000 tonnes of organic waste annually
StormFisher	ON	Transfer, Processing	ON (2 facilities)	Ability to process 200,000 tonnes annually
SusGlobal Energy	ON	Transfer, Processing	ON (1 facility)	Ability to process 70,000 tonnes of organic waste annually, with an additional 50,000 tonnes per annum organic waste processing and transfer site[34]
Tomlinson	ON	Collection, Transfer, Processing	ON (1 facility)	Ability to process 20,000 tonnes of organic waste annually.
UPak	ON	Collection, Transfer	None	One of main service provider to ICI generators in Ontario
Walker Environmental	ON	Collection, Transfer, Processing	ON (8 facilities)	Processed over 400,000 tonnes of organic waste in 2019.[35]
Wasteco	ON	Collection, Transfer	None	One of main service providers to ICI generators in the Greater Toronto Area
Waste Connections of Canada	National	Collection, Transfer, Processing	MB, QC (2 facilities)	One of main service provider to ICI generators in Canada
WM Canada	National	Collection, Transfer, Processing	AB (1 facility)	One of main service provider to ICI generators in Canada

[32] Loraas Environmental. Our Facility, last Retrieved March 2021. Available at https://www.loraas.ca/organics/our-facility/.
[33] Overton Environmental Enterprises. Organic Resource Management, last retrieved March, 2021. Available at https://overtonenvironmental.ca/organics-management.
[34] SusGlobal. SusGlobal Purchases Additional Assets Including 6.8 Acres at Belleville Organic Waste Processing and Composting Site, November 2020. Available at https://susglobalenergy.com/2020/11/12/susglobal-purchases-additional-assets-including-6-8-acres-at-belleville-organic-waste-processing-and-composting-site/.
[35] Walker Environmental. 2019 Sustainability Report – Update Summary, 2019. Available at https://www.walkerind.com/news-reports/.

With the exception of the Surrey Biofuel facility operated by Convertus, all the facilities included in Table 3-11 are privately owned and operated.

3.6 Existing Limitations and Barriers

Based on interviews and other information sources gathered during this research, the issues and barriers to expansion of organic waste diversion services seemed to be pretty consistent across the country (Figure 3.6).

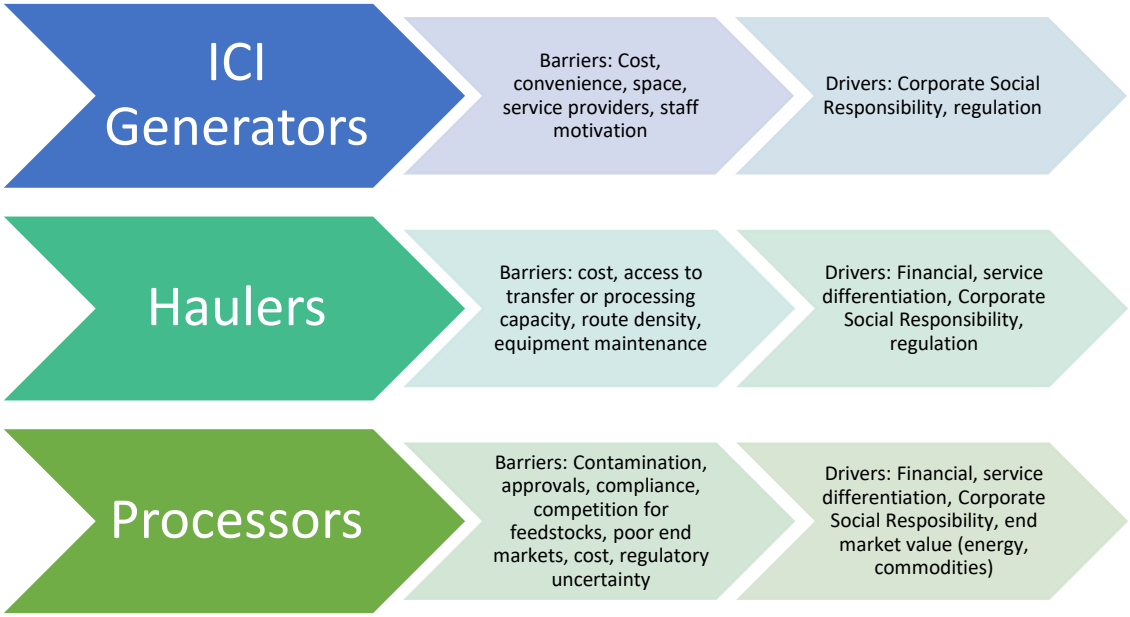


Figure 3-6: Current Barriers and Drivers for ICI Organic Waste Diversion Across the Value Chain

The main concerns were as follows:

- **Absence of Mandatory Diversion Regulations** – The primary limitation to expanding ICI organic waste diversion is the absence of a legislative or regulatory framework requiring generators to divert organic waste. Without a regulatory imperative, generators make economic decisions around the least cost options for managing their waste. In most jurisdictions this often favours landfill disposal. Organic waste diversion is occurring today because generators have developed marketing programs around good environmental stewardship, corporations have embraced environmental and social responsibility and business owners are personally committed to 'doing the right thing' and are willing to pay a higher cost.

  In some jurisdictions (provincial & municipal) with regulatory requirements for organic waste diversion, there is a chronic lack of enforcement resulting in an organic waste diversion landscape with minimal to no regulatory oversight.

- **Cost competition** – The decisions made by generators are most often cost-based in the absence of regulatory requirements to divert. This creates a circumstance where landfill disposal costs are lower than recycling organic waste and generators tend to gravitate towards the least cost option. It is not likely that the cost structure for landfill disposal will change significantly while the technical challenges in processing

organics waste are increasing and putting upward pressure on the costs to divert organic waste. The long-term solution is to create an environment where the cost to dispose of organic waste properly account for externalities and the value of reduction and resource recovery better recognized. However, it is important for any approach to recognize and counter the option to simply export organic waste.

It is also important to understand that costs are reflected in various ways throughout the value chain:

- ICI generator costs relate to the need to:
  - educate and train staff to properly sort waste materials and educate customers to properly do similar;
  - ensure there is adequate infrastructure and space to properly collect organic waste as well as maintain that infrastructure (e.g., cleaning green carts, managing potential vector related issues); and
  - compensate service providers to process the materials.
- Service Provider costs relate to the need to:
  - maintain collection vehicles requires more maintenance to reduce potential for leakage (e.g., upkeep of seals);
  - ensure proper health and safety protocols are met for front-line workers;
  - consolidate organic waste at transfer stations which requires additional controls (e.g., to address leachate and manage potential odour) and additional space (e.g., a separate pad for consolidation); and
  - process the materials and address any potential contamination.

This cost differential impacts companies who are purchasing waste management services and also influences service providers who collect and manage these materials.

- **Lack of infrastructure** – In most jurisdictions there is insufficient infrastructure to support and sustain a robust organic waste diversion system. There are major issues with siting, acquiring approvals and operating transfer stations and processing facilities. These difficulties have resulted in insufficient transfer and processing capacity to support increases in organic waste diversion.

  Many existing transfer station facilities have not been designed to transfer organic waste and only a limited number have been retrofitted or modified to manage the unique challenges associated with transferring organic waste materials. These challenges are largely in the area of odour control and leachate/surface water management. There is a significant role for government to play at all levels in terms of facilitating investment in organics waste transfer and processing infrastructure.

- **Issues with contamination –** The level of contamination in organic waste generated by the ICI sector continues to be a major concern, especially where staff are paid a minimum wage or a large component of the waste is post-consumer. As noted by one operator in most circumstances contamination is in excess of 15% to 20% of incoming organic waste and in some instances closer to 40% to 50%. This contamination

can be related to improper separation of organics but can also occur at food processors when cleaning chemicals are used. These contamination issues substantially increase operating costs at the organic waste processing facility and lower the value of the outputs.

- **The impact of integrated waste management –** The ongoing reduction in available landfill capacity throughout Canada has the potential to impact organic waste diversion by service providers that have integrated waste management business interests. Many service providers provide integrated collection services, meaning they provide both waste diversion and disposal services. These service providers due to the lack of sufficient landfill disposal capacity in some provinces make business decisions to ensure access to disposal and enter into "put or pay" arrangements with landfills for the disposal of ICI waste. These arrangements mean that a price per tonne is paid to the landfill according to an agreed upon annual volume, irrespective of whether the waste volumes are actually met. This creates a circumstance where towards the end of any calendar year or contract term a service provider with a 'put or pay' agreement that will not meet the volume requirements may be incentivized to redirect organic waste to disposal as the cost is essentially pre-paid under the agreement.
- **Lack of resources** – Several generators noted, the lack of clear guidance on best practices to manage and optimize organics diversion, in terms of a business economic and environmental footprint decision.
- **End Market** – While not a primary driver, in some cases limited demand and value in end markets for nutrient amendments (e.g., compost and digestate) and for renewable natural gas / energy could also act as disincentives for organics processing infrastructure growth and investment.

4.0 POLICIES TARGETING ICI ORGANICS

4.1 Methodology

The purpose of this section is to provide a summary of how governments (i.e., provincial, territorial and municipal), industry and other organizations across Canada are tackling the diversion of ICI food and organic waste (also referred to as "organics" in this report), including:

- applicable goals and commitments; and
- Regulatory and non-regulatory approaches (e.g., proposed or effective) being employed to meet these goals and commitments.

Emerging policies in select US states (e.g., California, Massachusetts, New York, Vermont) were also reviewed and summarized with an explanation as to how they might apply to Canadian jurisdictions.

A literature review was undertaken to better understand the current context in Canada and the US. Given the Canadian focus of this research, environment ministries from all provinces and territories were surveyed and a number of governments, industry and other organizations demonstrating leadership in fostering food and organic waste reduction and diversion from the ICI sector were interviewed, namely:

- City of Calgary;
- City of Saskatoon;

- Massachusetts Department of Environmental Protection (USA);
- Metro Vancouver;
- National Zero Waste Council;
- New York Department of Environmental Conservation (USA);
- Provision Coalition;
- Recycling Council of Ontario; and
- Québec Ministère de l'Environnement et de la Lutte contre les changements climatiques

Case study profiles for a number of leading Canadian and US organizations that are targeting ICI organics are included in Appendix A.

4.2 Goals and Commitments

There is a growing interest from various levels of government, companies, and other organizations across the country to decrease the amount of food waste generated and increase the diversion of organic waste.

Tables 4.1, 4.2 and 4.3 provide a summary of goals and commitments that provincial governments, municipal governments, and companies have made across the country related to ICI food and organic waste. Provincial and territorial goals/commitments (identified in Table 4.1) and municipal goals (identified in Table 4.2) tend to be more generic (i.e., not specific to ICI organic waste).

Table 4-1: Provincial and Territorial Food and Organic Waste Commitments

Provincial / Territorial Governments	Specific to ICI Organic Waste	Goal / Commitment
British Columbia	Yes	Organic waste diversion target of 95% for agricultural, industrial, and municipal waste[36]
Alberta	No	Reduce the quantity of municipal waste sent for disposal to 500 kg per capita[37]
Saskatchewan	No	Waste reduction targets of 30% by 2030 and 50% by 2040[38]
Manitoba	No	Organics diversion target of 100,000 tonnes.[39]
Ontario	Yes	Achieve 50-70% waste reduction and resource recovery of food and organic waste for certain ICI generators by 2025[40]

[36] BC Government. cleanBC: our nature. our power. our future, 2019. Available at https://blog.gov.bc.ca/app/uploads/sites/436/2019/02/CleanBC_Full_Report_Updated_Mar2019.pdf.
[37] Alberta Government. Too Good to Waste: Making Conservation a Priority, 2007. Available at https://open.alberta.ca/dataset/5357abb4-d4fa-4e23-a3b3-be4d50bf0f60/resource/a4818f28-411d-4be8-9a2e-91f07c9a33be/download/2007-toogoodtowaste-oct2007.pdf.
[38] Saskatchewan Government. Saskatchewan's Solid Waste Management Strategy, January 2020. Available at https://www.saskatchewan.ca/residents/environment-public-health-and-safety/saskatchewan-waste-management/solid-waste-management-strategy.
[39] Manitoba Government. A Made-in-Manitoba Climate and Green Plan, 2017. Available at https://www.gov.mb.ca/asset_library/en/climatechange/climategreenplandiscussionpaper.pdf.
[40] Ontario Government. Food and Organic Waste Policy Statement, April 30, 2018. Available at https://www.ontario.ca/page/food-and-organic-waste-policy-statement.

Provincial / Territorial Governments	Specific to ICI Organic Waste	Goal / Commitment
Québec	No	Recycle or recover 70% of the organic matter targeted by 2030 Reduce the quantity of waste sent for disposal to 525 kg per capita[41]
Nova Scotia	No	50% waste diversion as well as a target for waste disposal of no more than 300 kg/person/year[42]
New Brunswick	No	Increase organic waste diversion[43]
Newfoundland and Labrador	No	Reduce waste going to landfills by 50% by 2010[44]
Prince Edward Island	No	Divert more waste per person from landfill than any other province[45]
Nunavut	No	None
Northwest Territories	No	None
Yukon	No	None

[41] Québec Government. Stratégie de valorisation de la matière organique, 2020. Available at http://www.environnement.gouv.qc.ca/matieres/organique/strategie-valorisation-matiere-organique.pdf.
[42] Nova Scotia Government. Renewal of Nova Scotia's Solid Waste Resource Management Strategy, 2009. Available at https://novascotia.ca/nse/waste/strategy.asp.
[43] New Brunswick. Waste Reduction and Diversion: An Action Plan, 2001. Available at https://www.bienvenuenb.ca/content/dam/gnb/Departments/env/pdf/LandWaste-TerreDechets/WasteReductionDiversion.pdf.
[44] Newfoundland and Labrador Government. Solid Waste management in Newfoundland and Labrador – Finishing what we started, December 2019. Available at https://www.gov.nl.ca/eccm/files/waste-management-terms-of-reference-review-pwms.pdf.
[45] Prince Edward Island Government. A Climate Change Action Plan for Prince Edward Island 2018-2023. Available at https://www.princeedwardisland.ca/sites/default/files/publications/climatechange2018_f8.pdf.

Table 4-2: Municipal Food and Organic Waste Commitments

Municipality	Specific to ICI Organic Waste	Goal / Commitment
City of Calgary	No	70% waste diversion by 2025 averaged across all four sectors – single and multi-family residential, business and organizations, and construction and demolition.
City of Guelph / Wellington County	Yes	Increase access to affordable, nutritious, local food by 50% by 2025; Create 50 new circular businesses and collaborations by 2025; Increase circular economic revenue by 50% by 2025 by recognizing the value of "waste"[46]
City of Saskatoon	No	70% waste diversion from the Saskatoon Regional Waste Management Centre (Landfill)[47]
City of Toronto	No	Achieve 70% diversion of materials collected (Green Bin, Blue Bin, waste disposed) from Industrial, Commercial & Institutional customers that receive City collection services by Year 10 of the Waste Strategy (2026); and, Overall diversion target of 200,000 tonnes by Year 10 of the Waste Strategy. This may be achieved through diversion of an additional 50,000 tonnes from sources currently not serviced by the City (through implementation of mandatory waste diversion by-laws for all multi-residential buildings, regardless of service provider, and additional service to small IC&I establishments).[48]
Metro Vancouver	No	Reduce food waste[49]
Region of York	No	Achieve 15 per cent reduction in food wastage by 2031 with an additional five per cent reduction achieved every five years thereafter.[50]
Ville de Montreal	No	A 10% reduction in the generation of waste during the life of the plan (20% in 2030); A 70% waste diversion rate by 2025 (85% in 2030)[51]

[46] Guelph-Wellington. Our Food Future, 2019. Available at https://foodfuture.ca.
[47] City of Saskatoon. 2019 Integrated Waste Management Report, 2019. Available at https://www.saskatoon.ca/sites/default/files/documents/2019_integrated_waste_management_report.pdf.
[48] City of Toronto. Long Term Waste Strategy, 2016. Available at https://www.toronto.ca/wp-content/uploads/2017/10/9803-Final-Long-Term-Waste-Management-Strategy.pdf.
[49] Metro Vancouver. Regional Food System Action Plan, 2016. Available at http://www.metrovancouver.org/services/regional-planning/PlanningPublications/RegionalFoodSystemActionPlan.pdf.
[50] Region of York. York Region's Integrated Waste Management Master Plan, 2016. Available at https://www.york.ca/wps/wcm/connect/yorkpublic/0512f3ae-7b62-40de-be92-a6de9aaa726d/Food+Waste+Reduction+Strategy.pdf?MOD=AJPERES.
[51] Ville de Montréal. Stratégie du Plan directeur de gestion des matières résiduelles de l'agglomération de Montréal, 2020. Available at https://ehq-production-canada.s3.ca-central-1.amazonaws.com/506d1813e780060c7eabf271332f0aa62f1d95e1/original/1598631939/PDGMR-Strategie_finale.pdf_986c40fc928b21545da8ecab354fbfc3?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-

Table 4-3: Company Organic Waste Commitments

Company	Goal / Commitment
Campbell Soup Company	Reduce the amount of waste sent to landfills by 25% on an absolute basis by FY2025, as compared to FY2017 Cut food waste in half by FY2030, as compared to FY2017[52]
ConAgra Brands	Reduce waste generated in facilities by one billion pounds by 2020 Committed to zero waste to landfill.[53]
General Mills	Invest in food recovery networks and platforms to empower 50,000 food retailers in surplus food rescue by 2030. (2020 baseline) Donate General Mills surplus food to enable 250 million meals for food-insecure people by 2030 (2020 baseline) Enable 25 communities across North America to expand their surplus food recovery capacity through innovative approaches by 2021[54]
IKEA	By 2020, goal to reduce food waste in all IKEA stores globally by 50%.[55]
Kellogg Company	By 2030, do our part to halve per capita global food waste at the retail and consumer level, and to reduce food losses along the production and supply chains including post-harvest losses[56]
Kraft Heinz Canada, Loblaw Companies Ltd, Maple Leaf Foods, Metro Inc, Save-On-	Prevent and reduce food waste in their own operations by 50% by 2025[57,58]

Credential=AKIAIBJCUKKD4ZO4WUUA%2F20210228%2Fca-central-1%2Fs3%2Faws4_request&X-Amz-Date=20210228T204700Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=4b5777799874af13cd2273382facdd4ece0f4ca7d22f39d067a84f827415eb06.

[52] Campbell Soup Company. 2020 Corporate Social Responsibility Report. Available at https://www.campbellcsr.com/_pdfs/2020_Campbells_CRR.pdf.

[53] ConAgra Brands. ConAgra Foods Announces Zero Waste Champions, 2014. Available at https://www.conagrabrands.com/news-room/news-conagra-foods-announces-zero-waste-champions-1989518.

[54] General Mills. Food Waste. Last retrieved Feb. 2021 at https://www.generalmills.com/en/Responsibility/Sustainability/food-waste.

[55] IKEA. Reducing Food Waste. Last retrieved Feb. 2021 at https://about.ikea.com/en/sustainability/healthy-and-sustainable-living/reducing-food-waste.

[56] Kellogg's. 2019/2020 Corporate Social Responsibility Report. Available at https://crreport.kelloggcompany.com/cr-report.

[57] Measured against a baseline of 2016.

[58] National Zero Waste Council. Food Industry Leaders Commit to Tackle Food Waste in Canada: Canadian Retailers and Product Manufacturers Announce 50% Reduction Target, January 17, 2019. Available at http://www.nzwc.ca/media/releases/MediaReleases/20190117-NZWCPCMediaRelease-IndustryFoodWasteCommitment.pdf.

Company	Goal / Commitment
Foods, Sobeys Inc, Unilever Canada and Walmart Canada	
McCain Foods Limited	Zero waste to landfill and 100% potato utilization by 2025[59]
Nestlé	As a member of Champions 12.3, accelerate progress toward halving food waste by 2030 Achieve zero waste for disposal in our sites Make date labels understandable to our consumers to reduce food waste at consumption stage
Sodexo	By 2025, halve food waste and food losses from its operations by the same year.[60]

There have been a number of collaborations between organizations that have been established to tackle issues related to food and organic waste including:

- The National Zero Waste Council's Food Working Group that includes provincial and local governments, various types of companies, and food rescue sector. The working group has developed resource materials to allow for more coordinated action across different sectors. They have established a national goal to reduce both food loss and waste by 50% by 2030 in alignment with Sustainable Development Goal 12.3 and the U.S. domestic target.[61]
- Pacific Coast Collaborative – includes Washington, Oregon, California, British Columbia, Seattle, Portland, San Francisco, Oakland and Vancouver, British Columbia. All of these jurisdictions have committed to a regional goal of halving food waste by 2030. The collaborative also includes a number of food retailers, brand manufacturers and non-profits.
- Recycling Council of Ontario formalized Waste Reduction Week is a year-round national program, focused on the principles of circular economy, resource efficiency, and waste reduction. It includes a focus on food waste reduction. Waste Reduction Week starts on the third Monday of October every year.
- ReFed, a US based non-profit that is dedicated to ending food loss and waste across the US food system by advancing data driven solutions.

4.3 Overview of Regulatory Approaches

The main regulatory mechanisms being taken to increase the amount of organic waste diverted from the ICI entities include:

- Source separation requirements / disposal bans,
- Disposal levies, and

[59] McCain Foods. 2019 Sustainability Report. Available at https://www.mccain.com/sustainability/reports-downloads/.
[60] Sodexo. Sodexo steps up fight against food waste, aims to deploy data-driven program at 3,000 sites within year, May 2019. Available at https://www.sodexo.com/en/media/sodexo-against-food-waste.html.
[61] National Zero Waste Council. A Food Loss and Waste Strategy for Canada, May 2018. Available at http://www.nzwc.ca/Documents/NZWC-FoodLossWasteStrategy.pdf.

- Waste audit requirements.

Table 4.4 provides a broad overview of regulatory approaches in place or proposed by various Canadian and US jurisdictions, including some local governments.

Table 4-4: Examples of Canadian and US Regulatory Approaches for ICI Organic Waste

Regulatory Approaches	Provincial / State Governments	Local Governments
Source Separation Requirements	Nova Scotia, Ontario, Prince Edward Island, California, Connecticut, Massachusetts, Rhode Island, Vermont Proposed: Québec, New York	Calgary, AB[62] Halifax, NS[63] Nanaimo, BC[64] Squamish, BC[65] Austin, TX[66] Boulder, CO[67] Hennepin County, MN[68] Metro, OR[69] New York City, NY[70] San Francisco, CA[71] Seattle, WA[72]
Disposal Bans	Nova Scotia, Prince Edward Island, California, Connecticut, Massachusetts, Rhode Island, Vermont Proposed: Manitoba, Ontario, Québec, New York	Capital Region District, BC Cowichan Valley Regional District, BC Metro Vancouver, BC[73] Nanaimo, BC[74] Squamish, BC[75] Considering:

[62] See Appendix A for Case Study.
[63] See Appendix A for Case Study.
[64] City of Nanaimo. *Bylaw Number 7128 – A Bylaw to Provide for the Collection and Disposal of Garbage, Food Waste, Recyclables and Other Solid Waste,* 2020. Available at https://www.nanaimo.ca/bylaws/ViewBylaw/7128.pdf.
[65] Regional District of North Okanagan. *Industrial, Commercial and Institutional Food Scraps Disposal Ban,* 2020. Available at http://www.rdno.ca/index.php/services/community/solid-waste/ici-disposal-ban.
[66] City of Austin. *City of Austin Code of Ordinances Chapter 15-6*, 2016. Available at https://www.austintexas.gov/sites/default/files/files/CHAPTER_15-6_-_Administrative_Rules__4-15-2016_.pdf.
[67] City of Boulder. Municipal Code 3-3-13, 2021. Available at https://library.municode.com/co/boulder/codes/municipal_code?nodeId=TIT6HESASA_CH3TRRECO_6-3-13PROWRERECOCO.
[68] Hennepin County. Ordinance 13 – Recycling for Hennepin County, 2018. Available at https://www.hennepin.us/your-government/ordinances/ordinance-13#Section7.
[69] Metro. Administrative Rule of Metro Code Chapter 5.10, 2021. Available at https://www.oregonmetro.gov/sites/default/files/2021/01/19/food-scraps-administrative-rules-second-implementation-date-change-effective-02012021.pdf.
[70] New York City. New York City Administrative Code Title 16-306.1, 2021. Available at https://codelibrary.amlegal.com/codes/newyorkcity/latest/NYCadmin/0-0-0-25974.
[71] City of San Francisco. Ordinance Number 100-09 Mandatory Recycling and Composting, 2009. Available at https://sfenvironment.org/sites/default/files/policy/sfe_zw_sf_mandatory_recycling_composting_ord_100-09.pdf.
[72] City of Seattle. Chapter 21.36 – Solid Waste Collection, 2016. Available at https://library.municode.com/wa/seattle/codes/municipal_code/281112?nodeId=TIT21UT_SUBTITLE_IIISOWA_CH21.36SOWACO.
[73] See Appendix for Case Study.
[74] City of Nanaimo. *Bylaw Number 7128 – A Bylaw to Provide for the Collection and Disposal of Garbage, Food Waste, Recyclables and Other Solid Waste,* 2020. Available at https://www.nanaimo.ca/bylaws/ViewBylaw/7128.pdf.
[75] Regional District of North Okanagan. *Industrial, Commercial and Institutional Food Scraps Disposal Ban,* 2020. Available at http://www.rdno.ca/index.php/services/community/solid-waste/ici-disposal-ban.

Regulatory Approaches	Provincial / State Governments	Local Governments
		Regional District of North Okanagan, BC (January 2022)
Disposal Levies	Manitoba, Québec, California, Michigan, Vermont Considering: Saskatchewan	Metro Vancouver, BC
Waste Audit Requirements	Ontario	Owen Sound, ON[76]

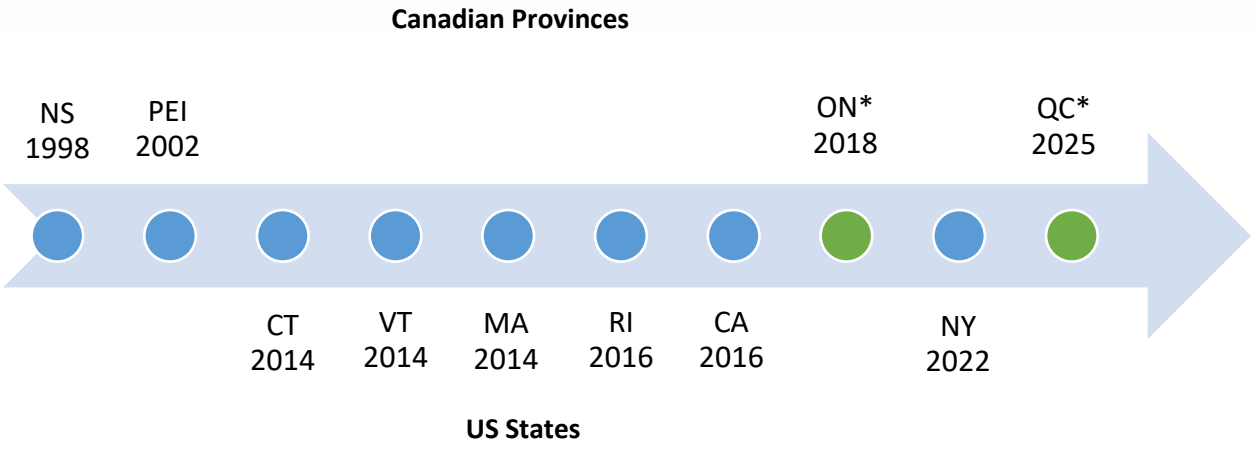
4.3.1 Source Separation or Mandatory Organics Recycling Requirements & Disposal Bans

One of the most common regulatory approaches to increasing the amount of organic waste diverted is the requirement for businesses to take specific actions to recycle their organic waste such as source separation, with subsequent off site or on-site processing.

At the provincial and state level, source separation requirements are sometimes combined with disposal bans. Disposal bans usually apply to transfer stations and disposal sites, however remedial actions are difficult, other than penalties (e.g., higher tipping fees, rejected loads, fines), once banned materials arrive in mixed loads at these sites. There is often not the space to deal with the materials at these sites and there are other issues like health and safety. As a result, regulators often focus on ensuring organic waste is being separated by the generator. Used in combination, these mechanisms allow regulators a means to ensure materials are separated as well as check to ensure they are being properly processed.

Over the past three decades, provincial and state level jurisdictions have been implementing organic waste bans and source separation requirements in combination (see Figure 4.1). It is important to note that Ontario has only implemented ICI source separation requirements. They have not implemented a disposal ban but are considering one. Québec is in the process of implementing source separation requirements to target ICI organic waste and like Ontario is also considering a disposal ban.

[76] City of Owen Sound. *By-law number 2006-001 – A By-law to Regulate the Collection, Handling and Recycling of Waste and Recyclable Materials in Certain Premises in The City of Owen Sound,* 2006. Available at https://www.owensound.ca/en/resourcesGeneral/Documents/2006-001-Mandatory-Recycling-By-law-CONSOLIDATED.pdf.



* Note Ontario and Québec have announced plans to introduce organic waste bans

Figure 4-1: Canadian Province and US State Implementation of ICI Organic Waste Bans and Source Separation Requirements

Source separation requirements and disposal bans for ICI organic waste that are implemented by jurisdictions tend to differ in four main ways:

1. Regulated entities targeted (e.g., types of operations or facilities) by the source separation requirements: in some cases, certain types of ICI facilities may be excluded from mandatory requirements, such as kindergarten to grade 12 schools, hospitals, nursing homes, and not-for-profit organizations (e.g., places of worship, charities).
2. Organic materials included: categories of organic materials targeted may include food waste, food preparation waste, soiled paper, yard waste or a combination of these waste types.
3. Regulatory thresholds: certain facilities may be excluded from mandatory requirements if they fall below certain de minimis rules that pertain to the amount of organic waste generated over time or size of an organization (e.g., number of employees, square footage of the building). These thresholds may be subject to phase in schedules and variations over time in some regulations.
4. exemptions by request or based on other factors: certain facilities may be eligible for exemption from mandatory requirements based on factors such as their proximity to an organic waste processing facility (e.g., composting or anaerobic digestion facility).

Table 4.5 provides a comparison of provincial and state level source separation requirements. There appears to be growing consistency in the approach been taken particularly amongst the Northeastern US states. While there is some variation, the general approach is similar:

- Provide ample time between when a ban is announced and when it is implemented to ensure generators have time to prepare (e.g., reduce organic waste generation, educate staff and ensure proper infrastructure is in place) and so that the waste management sector can properly collect and process it. This period of time is typically at least 3-5 years, to align bringing new processing capacity online.
- Apply source separation requirements to the largest generators first as they generally have greatest opportunity to reduce food and organic waste and can often save money in the process (e.g., surplus food rescue). It also allows for an opportunity for organic waste processing capacity to gradually come online.

- Allow for temporary exemptions where hardships may be caused by the implementation of the requirements (e.g., no processors within a reasonable transportation range).
- Need for compliance promotion (e.g., education, training, tools and resources) in advance of implementing mandatory requirements to reduce potential non-compliance issues (see Section 4.4 Non-Regulatory Mechanisms)

Table 4-5: Examples of Provincial and US State Level Source Separation Requirements for Organic Waste

Jurisdiction	Materials that need to be source separated	Sectors Included	Organic Waste Generation Thresholds	Exemptions
Nova Scotia Solid Waste Resource Management Regulations made under Section 102 of the Environment Act [77]	Food waste, food-soiled paper waste	Any business or public entity.	None	None
Ontario Food and Organic Waste Policy Statement[78]	Food waste, food-soiled paper waste	Any business or public entity.	All ICI buildings – 300 kg/wk Educational institutions and hospitals as described in O. Reg. 103/94[79] – 150 kg/wk	None
Prince Edward Island	Food waste, yard waste, food-soiled paper waste	Any business or public entity.	None	None
Québec	Not yet clarified.	Any business or public entity by 2025.	None	Not yet known.

[77] https://novascotia.ca/just/regulations/regs/envsolid.htm#TOC1_6
[78] https://www.ontario.ca/page/food-and-organic-waste-policy-statement
[79] https://www.ontario.ca/laws/regulation/940103

Jurisdiction	Materials that need to be source separated	Sectors Included	Organic Waste Generation Thresholds	Exemptions
California (Assembly Bill No. 1826)[80]	Food waste, yard waste, food-soiled paper waste	Any business or public entity.	2016 - 6.1 m^3/wk of organic waste. 2017 - 3.1 m^3/wk of organic waste. 2019 - 3.1 m^3/wk of solid waste. 2020 - additional entities if state-wide target not met.	Exemptions can be provided to rural areas (pop. <70,000) through resolution. Can also be approved by Director.
Connecticut (CGS Sec. 22a-226e)[81]	Food waste, food-soiled paper waste	Any commercial food wholesaler or distributor, industrial food manufacturer or processor, supermarket, resort or conference center.	2014 – 94 T/yr or 1,814 kg/wk 2020 – 47 T/yr or 907 kg/wk	Exempt if you are not within 32.2 km of a processor.
Massachusetts (Regulation 210 CMR 19.000)[82]	Food waste and vegetative material	Any business or public entity.	2014 - 907 kg/wk	None
New York (Proposed Part 350 Regulatory Text)[83]	Food waste, food-soiled paper waste	Any business or public entity but excludes hospitals, nursing homes, adult care facilities, kindergarten to grade 12 schools	2022 - 1,814 kg/wk	Exempt if you are not within 40.2 km of a processor.

[80] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB1826&search_keywords
[81] https://www.cga.ct.gov/current/pub/chap_446d.htm#sec_22a-226e
[82] https://www.mass.gov/doc/310-cmr-19000-solid-waste-management-facility-regulations/download
[83] https://www.dec.ny.gov/docs/materials_minerals_pdf/proposedpart350.pdf

Jurisdiction	Materials that need to be source separated	Sectors Included	Organic Waste Generation Thresholds	Exemptions
Rhode Island IRI Gen. Law 23-18.9-17)[84]	Food waste, food-soiled paper waste	Any business or public entity.	2016 – 94 T/yr or 1,814 kg/wk 2018 – 47 T/yr or 907 kg/wk for covered educational facilities	Within 24.1 km of a processor.
Vermont (Universal Recycling of Solid Waste Act)[85]	Food waste, yard waste, food-soiled paper waste	Any business or public entity.	2014 – 94.3 T/yr or 1,814kg/wk 2015 – 47.2T/yr or 907kg/wk 2016 – 23.6T/yr or 453 kg/w 2017 – 16.3 T/yr or 313 kg/w 2020 – no thresholds	Within 32.2 km of a processor (until 2020).

As noted in Table 4.4, there are also a considerable number of local governments that have moved forward with ICI organic waste bans, source separation goals or both. Local governments, while often having greater abilities to oversee source separation requirements in coordination with other bylaw inspections, often lack the ability to oversee waste processing facilities that they do not own or permit. The inability to inspect these facilities or require reporting becomes a challenge in understanding whether organic materials are being managed properly.

4.3.2 Disposal Levies

Disposal levies are widely administered by state / provincial or national governments as a financial incentive to reduce waste disposed and encourage reuse, recycling, or organics diversion.

Disposal levies are charges usually based on the type and weight of materials sent to disposal facilities (e.g., landfills, incinerators) and waste transfer stations when it may be transported out of jurisdiction for disposal. They can be specific to certain types of waste or applied more broadly, across various waste steams. They can also be applied to certain sectors such as commercial waste, while being exempt in others (e.g., residential waste).

Note a disposal levy is applied by law across an entire jurisdiction, as opposed to a differential disposal fee, which is charged at or one more sites operated by the same operator. Many local governments across Canada charge

[84] http://webserver.rilin.state.ri.us/Statutes/TITLE23/23-18.9/23-18.9-17.HTM
[85] https://dec.vermont.gov/waste-management/solid/universal-recycling

differential disposal fees at their waste management sites to encourage diversion. These differential fees are however not applied to private waste management sites. The implementation of differential fees in Metro Vancouver[86] and in Toronto[87] led to increasing amounts of waste exported to both private and public landfills in the United States.

Disposal levies are meant to ensure that negative social, environmental and economic externalities associated with waste disposal (e.g., release of greenhouse gases, consumed landfill space, lost opportunities to divert food) are better accounted for. They can also enhance diversion by increasing disposal costs, making composting and recycling more affordable alternatives to disposal. Disposal levies are common in the US and have been implemented to date in two Canadian provinces – Manitoba[88] and Québec[89]. Saskatchewan is also currently proposing to implement a disposal levy.

Table 4-6: Disposal Levies Implemented in Canada

Province	Rate	How are funds used	What does the levy apply to
Manitoba (implemented 2009)	$10/T[90]	Revenue sharing formula - 80% of the levy revenue is rebated to municipalities to promote diversion and the remaining 20% is used to support provincial initiatives such as the Manitoba Composts Program[91]	Exemptions apply to single-generator private/industrial landfills that do not accept waste from other generators or from municipal sources; First Nation waste disposal grounds that do not accept waste from other generators; Northern Affairs community landfills for waste disposed by First Nations. First Nations may voluntarily participate in the WRARS Program to receive the Recycling Rebate based on the same recycling tonnages reported to Multi-Material Stewardship Manitoba.
Québec (implemented in 2006)	Initially set at $10/T. Currently at $23.51/T and proposed to rise to $30/T with	Fees collected are redistributed back to municipalities based on formula that includes performance. Fees are also used to support other	All solid waste disposed in Québec landfills. Excludes incineration residue; materials used for landfill daily cover; residual materials that are sorted and recovered on the premises to be reclaimed; residual

[86] Maple Ridge-Pitt Meadows News. Garbage Flows Out of Metro Vancouver to Dodge High Tipping Fees, June 12, 2012. Available at https://www.mapleridgenews.com/news/garbage-flows-out-of-metro-vancouver-to-dodge-high-tipping-fees/.
[87] Detroit Free Press. Michigan sucks at recycling. Blame plentiful and cheap landfills, January 4, 2021. Available at https://www.freep.com/story/news/local/michigan/wayne/2021/01/04/michigan-recycling-landfills/4099956001/.
[88] Established through the Waste Reduction and Prevention Act. Available at https://web2.gov.mb.ca/laws/statutes/ccsm/w040ei.php.
[89] See case study in Appendix.
[90] Government of Manitoba. WasteWise. Last retrieved February 2021 at https://www.gov.mb.ca/sd/wastewise/wastereduction/index.html.
[91] https://www.gov.mb.ca/sd/wastewise/compost/program.html

Province	Rate	How are funds used	What does the levy apply to
	subsequent increases of $2/T per year.[92]	provincial initiatives like the Program for Processing Organic Matter Using Biomethanization and Composting[93]	materials recovered, after incineration; and mine tailings or residue generated by a mine tailings reclamation process.

The disposal levies in both Manitoba and Québec have been leveraged to support new or expanded organics processing capacity as well as to support local organics diversion programs and awareness.

4.3.3 Waste Audit Requirements

Ontario appears to be unique as it is the only jurisdiction in Canada or the United States (that requires ICI entities over a certain size to perform waste audits (i.e., amount, nature and composition of the waste; how it is produced; and how it is managed) and develop a waste reduction work plan. The requirements were implemented in 1994 under Ontario Regulation 102/94[94].

The regulation includes thresholds (i.e., that dictate when waste audits need to be completed) based on the square footage of the operation or in some cases based on other factors (e.g., hotels are based on number of guest rooms and educational institutions are based on students enrolled) and includes retail, construction, offices, restaurants, hotels and motels, hospitals, educational institutions and large manufacturers.

The Ontario government has announced[95] they will consult on ICI waste reform framework to improve the current waste diversion activities within this sector. Ontario Regulation 102/94) has been criticized by Ontario's Auditor General[96] due to lack of oversight and has been under review for a number of years.

While unique, this approach has been used in other areas to help organizations identify problems that might be unnecessarily costing them money and/or leading to environmental issues (e.g., toxic reduction plans).

4.4 Overview of Non-Regulatory Initiatives

There are also a substantial number of non-regulatory initiatives undertaken across Canada and the US to reduce food and organic waste and increase its diversion. Most jurisdictions moving forward with regulatory initiatives also have a keen focus on implementing complementary non-regulatory initiatives, such as:

- Financial investments in food waste reduction and organics diversion infrastructure;
- Environmental certification and labelling programs;
- Hauling and processing arrangements; and
- Education and outreach initiatives.

[92] Québec Government. Stratégie de valorisation de la matière organique, 2020. Available at http://www.environnement.gouv.qc.ca/matieres/organique/strategie-valorisation-matiere-organique.pdf.
[93] https://www.environnement.gouv.qc.ca/programmes/biomethanisation/
[94] https://www.ontario.ca/laws/regulation/940102
[95] Ontario government. *A Made-in-Ontario Environment Plan Progress Report*, November 2020. Available at https://www.ontario.ca/page/made-in-ontario-environment-plan.
[96] Ontario Auditor General. *4.09 Non-hazardous waste Disposal and Diversion - Follow-up to VFM Section 3.09, 2010 Annual Report*, 2012. Available at https://www.auditor.on.ca/en/content/annualreports/arreports/en12/409en12.pdf.

4.4.1 Financial investments in food waste reduction and organics diversion infrastructure

Governments are increasingly looking at funding programs that support food waste reduction and organics diversion infrastructure. Table 4.7 includes some examples of these programs.

Table 4-7: Financial Investments in Food Waste Reduction and Organics Diversion Infrastructure

Jurisdiction	Program
Food waste reduction	
Canada	The Surplus Food Rescue Program[97] is a $50 million initiative which will help to support Canada's food system, food processors, and food producers, and distributors to help ensure food availability for all Canadians. Funding will be used to help manage and redirect existing surplus food to organizations that address food insecurity and ensure that this surplus food is used to feed people. Agriculture and Agri-Food Canada (AAFC) launched a $20 million Food Waste Reduction Challenge.[98] Funding for waste audits was also available through AAFC's Growing Forward Fund.
Ontario	$5.25M of funding provided through the Surplus Food Redistribution Infrastructure Program Surplus Food Redistribution Infrastructure Program.[99] The funding supports food rescue organizations and indigenous communities and organizations to rescue and redistribute surplus food and assist with food insecurity.
Organics diversion	
Canada	Government has supported organic waste processing infrastructure through a number of infrastructure programs like the Low Carbon Economy Fund[100], Clean Energy Fund[101] and the Investing in Canada Infrastructure Program.[102]
Manitoba	The Manitoba Composts Program[103] provides incentive payments of $10.00 per tonne for food and organic waste processing facilities that process more than 2,500 tonnes/yr and $25.00/tonne, with a maximum of $25,000 annually, for those processing 2,500 tonnes or less.
Québec	The Program for Processing Organic Matter Using Biomethanization and Composting[104] provides financial support to municipalities and the private sector for the installation of infrastructure to treat organic waste. Québec has

[97] https://www.canada.ca/en/agriculture-agri-food/news/2020/08/surplus-food-rescue-program.html
[98] https://impact.canada.ca/en/challenges/food-waste-reduction-challenge
[99] https://www.ontario.ca/page/waste-management
[100] https://www.canada.ca/en/environment-climate-change/services/climate-change/low-carbon-economy-fund.html
[101] https://www.nrcan.gc.ca/science-data/funding-partnerships/funding-opportunities/current-investments/urban-waste-electricity-demonstration/4963
[102] https://www.canada.ca/en/office-infrastructure/news/2020/12/backgrounder-the-governments-of-canada-and-Québec-invest-in-renewable-energy-and-organic-residual-waste-management-in-varennes.html
[103] https://www.gov.mb.ca/sd/wastewise/compost/program.html
[104] https://www.environnement.gouv.qc.ca/programmes/biomethanisation/

Jurisdiction	Program
	allocated $1.2 billion over 10 years to better manage organic waste. This includes funds to support new compost and anaerobic digestion facilities as well as small-scale composting.
Vermont	Provided grants for municipalities to develop: - Composting Facilities – pads, aeration, buildings, processing equipment - Anaerobic Digestion Facilities – buildings, tanks, processing equipment - Organics Transfer Stations – pads, buildings, processing equipment They have also provided funds to purchase compost containers.

In some cases, government financial investments in waste diversion infrastructure may generate concerns, specifically related to competition with existing facilities that did not receive infrastructure funding, and if the grant funding is only directed towards one sector (e.g., local government) or one specific type of technology. Concerns have also been raised that the funding of organic waste processing infrastructure can pull materials away from higher value markets (e.g., animal feed, rendering or bioproducts).

Some companies are also playing a role. For example, the Walmart Foundation has offered nearly $2 million in funding to industry non-profits that are fighting to reduce food waste in Canada. The grants are part of the organization's commitment to award about $19 million to organizations that are innovating in food waste reduction and charitable food recovery.

4.4.2 Environmental Certification and Labelling Programs

There are a number of voluntary environmental certification and labelling programs that include provisions that support food waste reduction and enhanced organics diversion. Table 4.8 provides a number of examples of these programs.

Table 4-8: Environmental Certification and Labelling Programs that Support Food Waste Reduction and Organics Diversion

Program	Description	Includes Organics Diversion Criteria	Includes Food Waste Reduction Criteria	Third Party Audits
3RCertified (Canadian based)	3RCertified[105] recognizes organizations that take a leadership position in waste reduction and diversion. Properties are awarded certification on the basis of total points earned and verified through an onsite third-party evaluation. Organics	☑	☒	☑

[105] http://3rcertified.ca

Program	Description	Includes Organics Diversion Criteria	Includes Food Waste Reduction Criteria	Third Party Audits
BOMA Best	BOMA BEST Sustainable Buildings 3.0[106] provides a consistent framework for owners, managers and building operators to critically assess ten (10) key areas of environmental performance and management: energy, water, air, comfort, health and wellness, custodial, purchasing, waste, site, and stakeholder engagement.	☑	☒	☒
Global Green Key	Global Green Key[107] is an online self-assessment tool that allows hotels to evaluate themselves based on a number of key factors like energy, water and waste.	☑	☑	☒
Green Hospital Scorecard	The Green Hospital Scorecard (GHS)[108] provides a comprehensive health care benchmarking tool for Canada to measure energy conservation, water conservation, waste management and recycling, corporate commitment and pollution prevention. Participating hospitals report on their environmental and sustainability initiatives through a questionnaire and receive a Green Hospital Scorecard summarizing their environmental performance relative to their peers.	☑	☒	☒

[106] http://bomacanada.ca/bomabest/aboutbomabest/
[107] http://www.greenkeyglobal.com/home/aboutus/
[108] https://greenhealthcare.ca/ghs/

Program	Description	Includes Organics Diversion Criteria	Includes Food Waste Reduction Criteria	Third Party Audits
Leaders in Environmentally Accountable Foodservice	LEAF Certification[109] offers accreditation to restaurants demonstrating efforts in environmental and sustainable foodservice practices. Each restaurant must undergo an on-site review by a LEAF Accredited Consultant and meet minimum requirements in ten key areas of sustainability including: energy use, food purchasing and menu items, supplies, building and location, furnishing and decorative items, chemicals, waste and recycling, employees, policy and innovation, and water use.	☑	☑	☒

Note that these programs do vary significantly as some measure environmental performance in multiple areas and the rigour related to each varies significantly (e.g., some require third-party audits while others involve selfdeclarations). All of these have a component that have a component that would address food and organic waste management, but this is not the only evaluation factor.

4.4.3 Hauling & Processing arrangements

Municipal waste management systems in Canada have the ability to leverage waste management collection and processing efficiencies. Collection routes, public education campaigns, and processing all benefit from economies of scale for delivery. Some municipal governments also leverage this economy of scale to help service small businesses and organizations along residential routes, and in some cases more broadly. Organic waste collection is generally an optional service that is provided either at cost or a part of property taxes.

In 2018 over a four-month period, the Recycling Council of Ontario (RCO) piloted a similar waste collection approach to a municipal waste management system in the Region of Durham to bring together non-residential generators under a regionally based service model to leverage collection and processing efficiencies in a manner similar to standardized waste collection services provided to the residential sector.

The initial pilot provided notable findings and offered important data points including generation tonnages and costing structures.[110] Participation was offered to all ICI generators in a 150 km catchment area irrespective of

[109] https://www.leafme.org/home
[110] Recycling Council of Ontario. *Improving Food and Food Waste Recovery in the Non-Residential Sector Through a Co-Operative Collection*. Last retrieved February 2021. Available at https://rco.on.ca/Our-Work/foodwastepilot/?portfolioCats=39.

their size or type. Participate rates were very high at 98 per cent with a wide range of generator type including shopping malls, daycares, restaurants and golf courses. Over the pilot's operation period the average recovery rates (tonnage available for collection) was 97% with a contamination rate of less than 5%. The regionalized service model reduced service cost by as much as 60 per cent. In addition, the equivalent of 2,000 meals were rescued and distributed to local food banks.

A similar but larger scale pilot (9 months service period) is expected to be trialed by the RCO in partnership with Wellington County and the City of Guelph in spring/summer of 2021.

Metro Vancouver is also seeking to develop a Food Recovery Network, supported by a technology platform, that can be integrated with other food recovery initiatives already in place or under development in Metro Vancouver and neighboring regions, to divert surplus food to the highest value end-use, create secondary markets and reduce avoidable food waste.

4.4.4 Education and Outreach

Education and outreach efforts to support food waste reduction and/or organics diversion are common in many jurisdictions across Canada and the United States. All of the jurisdictions reviewed with regulatory approaches that target organic waste placed a strong focus in this area. It was seen as a means to:

- Raise awareness on how organizations could reduce food waste, recover and redistribute surplus food, and enhance organic waste diversion.
- Improve awareness regarding the problems posed by disposed organic waste and get gain buy-in from the regulated community.
- Share and communicate best practices aimed at reducing generation of food waste (which can save money) and diverting organics from final disposal.

Some jurisdictions have leveraged or partnered with separate organizations to help them in this area (see Table 4.9).

There are also companies providing direct support to help organizations in food waste reduction. By way of example, the Provision Coalition assists Canadian food processing companies with various environmental initiatives, including food loss and waste reduction. They have developed, tested and refined a web-based tool[111, 112] that helps these companies estimate how much food they waste and where along their process it is wasted. From there this tool sets up a process to identify, cost, evaluate and select potential solutions to better manage food and reduce food losses and waste. They recently completed a study of 50 food processing companies and their tool helped identify an average of $228,000 in savings with an average payback period (i.e., for any capital upgrades) of 12 months.

[111] https://provisioncoalition.com/whatwedo/foodlosswaste
[112] https://provisioncoalition.com/toolsandresources/foodlosswastetoolkit

Table 4-9: Examples of Non-governmental Organizations that Assist with Jurisdictional Education and Outreach

Organization (e.g., participating governments)	Description
Divert NS[113] (e.g., Nova Scotia, Halifax)	Divert NS is a not-for-profit corporation funded by the provincial government that champions recycling in Nova Scotia. They provide a number of materials that can be used by the ICI sector to build a culture of diversion (e.g., bin signage, event planning guidance, explanation of the importance of organics diversion).
Love Food Hate Waste Canada[114] (e.g., Metro Vancouver, City of Vancouver, City of Victoria, Guelph-Wellington, Québec, Capital Regional District, British Columbia)	Modelled on the Love Food Hate Waste[115] campaign in the UK – a proven behaviour change campaign that, in its first five years, helped cut avoidable food waste by 21%. Funded by private and public sector partners. They work with businesses, governments and community groups across Canada, to inspire and empower people to make their food go further and waste less. There are numerous guides on how different types of businesses can reduce food loss, support donation, and increase organic waste diversion.
Recycling Works (Massachusetts) [116]	RecyclingWorks in Massachusetts is a recycling assistance program funded by the Massachusetts Department of Environmental Protection. It helps businesses and institutions reduce waste and maximize recycling, reuse, and food recovery opportunities. They include a number of documents to help businesses comply with the food waste ban and improve economic outcomes.

Many municipalities, provinces and territories also provide education and outreach to support compliance and or promotion of ICI organic waste diversion. Examples of educational materials include:

- Vermont has developed a hauler list[117], map of facilities[118] and information on generators[119] to ensure market participants have information available to make informed decisions about servicing.

[113] https://divertns.ca
[114] https://lovefoodhatewaste.ca
[115] https://www.lovefoodhatewaste.com
[116] https://recyclingworksma.com/how-to/materials-guidance/food-waste-2/
[117] https://dec.vermont.gov/sites/dec/files/wmp/SolidWaste/Documents/FoodScrapHaulersSTATEWIDELIST.pdf
[118] http://anrmaps.vermont.gov/websites/Organics/default.html
[119] http://anrmaps.vermont.gov/websites/Organics/documents/FoodScrapGeneration_Calculations-Final.pdf

- Massachusetts has developed similar materials to Vermont.[120]
- The National Zero Waste Council a number of materials to assist with food waste reduction by providing guidance on food donation and better understanding of date labelling (e.g., best before).[121]
- Specific guidance has also been developed for certain sectors as the zero-waste toolkit for event coordinators (Recycling Council Ontario)[122], restaurants[123] (Metro Vancouver), and Grocery stores and Healthcare sector[124] (New York State).
- British Columbia has developed a series of Food Waste Prevention Guides for Businesses in British Columbia[125]

4.5 Analysis

There is a growing action by local and provincial / US state level governments to implement policies to increase the reduction and diversion of ICI food and organic waste. As can be seen in Figure 4-2 this regulatory action is not unique to one province in Canada but happening across the country, with similar activity in the US. The predominance of this regulatory activity is to take targeted action focusing on the largest ICI generators by banning generators from disposing food and organic waste or requiring them to source separate organics. As these practices are normalized, and organic waste collection and processing infrastructure is built, some of these jurisdictions have begun to require more organic waste generators to participate in these activities (i.e., lowered thresholds).

[120] https://www.mass.gov/lists/commercial-institutional-agricultural-composting-organics
[121] http://www.nzwc.ca/focus-areas/food/resources/Pages/default.aspx
[122] https://rco.on.ca/Our-Work/zero-waste-toolkit-for-event-coordinators/
[123] http://www.metrovancouver.org/services/solid-waste/recycling-programs/food-scraps-recycling/restaurants/tools-resources/Pages/default.aspx
[124] https://www.rit.edu/affiliate/nysp2i/resources?resources%5B21036%5D=21036&keys=&sort_bef_combine=field_publication_date_value_DESC
[125] https://www2.gov.bc.ca/gov/content/environment/waste-management/food-and-organic-waste/prevent-food-waste/prevent-business-food-waste

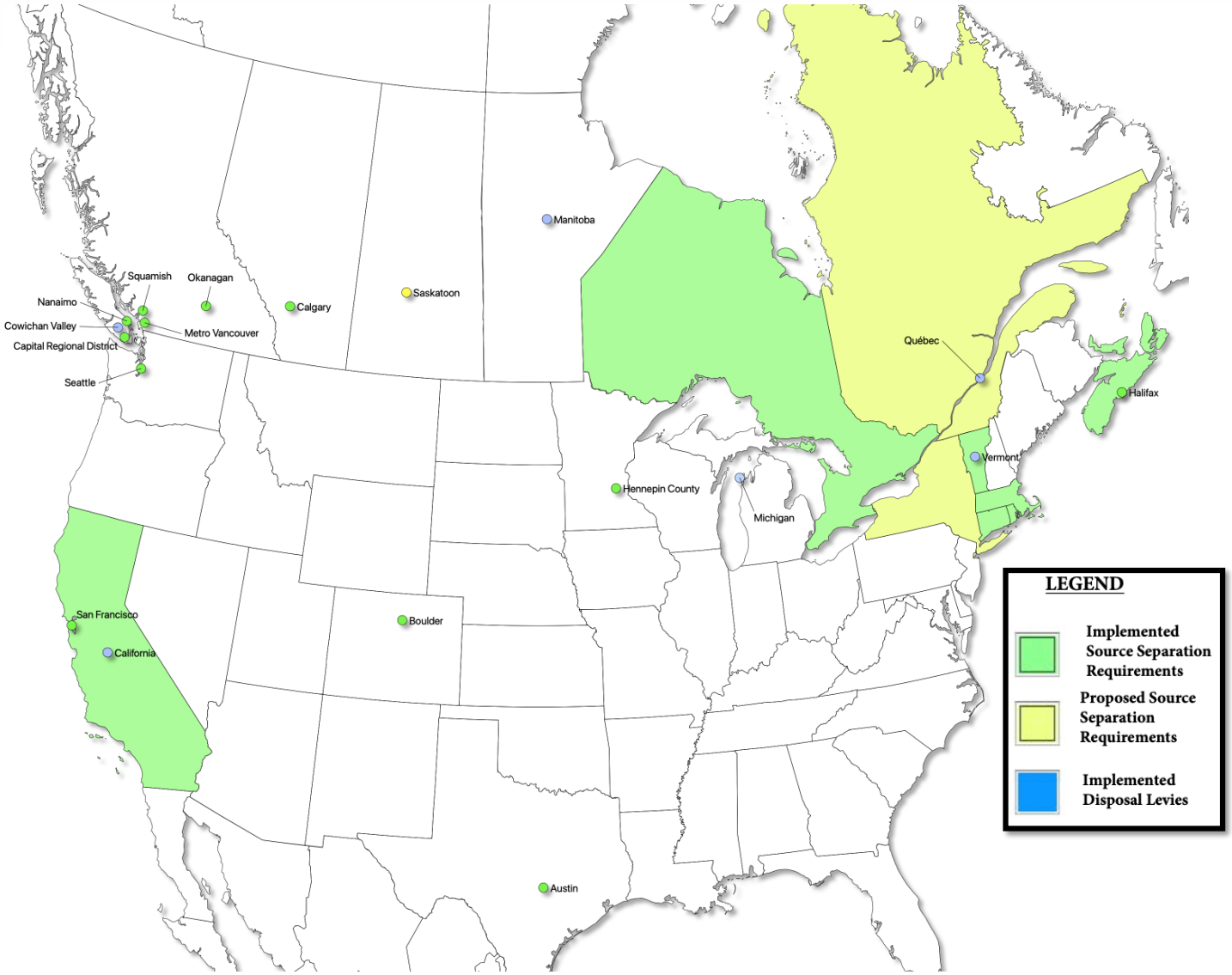


Figure 4-2: Snapshot of Canadian and US Jurisdictions with ICI Organic Waste Policies (2021)

The approach has been replicated across the northeast United States and has been adopted by the two largest provinces in Canada - Ontario and Québec.

The gradual implementation of food and organic waste disposal bans, and source separation requirements offers a tremendous opportunity across the country to achieve greater food and organic waste diversion, in a manner that allows for the development of the appropriate infrastructure over time. The predominant advice in implementing these requirements was to:

- Allow for adequate time for generators and service providers to properly plan and develop infrastructure (e.g., at least two years);
- Start with the largest generators who have greater abilities to reduce organic waste generation and economies of scale to manage materials efficiently;

- Ensure ongoing consultation and resources to allow generators to adapt (e.g., reduce organic waste generation); and
- Consider additional incentives for infrastructure for areas with lower population densities that may not have access to organic waste diversion infrastructure;

There also appears to be a growing trend towards implementing disposal levies. Although landfill levies in the many US states tend to be minor, Québec and Manitoba have implemented more substantial disposal levies. These levies act as a broad influence on diversion activities and the revenues generated in both Québec and Manitoba are being used to support diversion activities particularly related organic waste diversion.

For disposal levies, the predominant advice was to ensure:

- A gradual increase in disposal levies;
- all similar waste materials are captured, including those being exported for disposal outside the jurisdiction; and
- funds raised are used in a manner that does not hinder already functioning markets.

Local governments are also active in supporting policies that support greater organic waste diversion and reduction. They do however have more difficulties in implementing policies given their limited jurisdiction (e.g., the movement of waste tends to extend past municipal boundaries and municipalities tend to have more limited powers over waste management operations). As a result, source separation requirements and disposal levies are more effective if implemented at the provincial / state level.

There is also a great deal of voluntary activity happening through collaboratives and directly by individual businesses. The work by these organizations as early adopters is helpful to establish the base for regulatory action by governments. While these voluntary actions are important, they are not enough on their own to drive wholesale change. Each of the jurisdictions that were implementing regulatory requirements, emphasized the importance of fostering these voluntary efforts.

5.0 ON-SITE COMPOSTING TECHNOLOGIES

5.1 Introduction

On-site organic waste management technologies offer the opportunity for some ICI generators to manage their own food and organic wastes. These technologies have the potential to reduce organic waste management costs and may confer some additional environmental benefit (e.g., avoided hauling and processing GHG emissions). There is a not a well-defined threshold for these on-site technologies, but they are generally found at larger generators that have space (e.g., shopping malls, arenas, schools), rather smaller generators (e.g., a single restaurant).

5.2 Methodology

The purpose of this section is to provide a summary of new and emerging on-site diversion technologies for the collection, processing and final end use of ICI food and organic waste. This task was intended to showcase the variety of different types of on-site OW processing technologies currently used by ICI, with an emphasis those currently used in Canadian facilities. As such the technologies presented are not an exhaustive list.

Data collection included a desktop internet search (Canada and US) and interviews. Five technology providers and one technology distributor provided information and were interviewed to gather additional information about the various technologies, their applicability, product end-use and their potential positive environmental impact (i.e., diversion, GHG reduction, compost product).

Data for all technologies is summarized in the sub-sections below and in Appendix B.

5.3 Results

5.3.1 Brome Composting Inc.

Brome Composting Inc. (Brome) is a Québec company that manufactures industrial scale composters for ICI entities and other uses.

Food waste is directly loaded into a single-stage continuous flow unit by staff, or via conveyors and/or screw feeders (depending on the unit size). The units can accommodate all types of food waste. Wood shavings or a similar amendment are added to inbound food waste to optimize the composting recipe. Amendments can include cardboard or paper, generated at these ICI locations. The blended materials are turned and composted in the rotating drum. Temperatures are monitored and supplemental air is provided, as required. After 5-30 days the materials are removed for curing. This curing can take place on-site or removed from the site and taken to another location.

They manufacture 14 different models of their composter (Figure 5.1). Rotating composter drum sizes range from 1.5m^3 to 18 m^3. These units can accommodate 40 kg-1,000 kg/day of waste. Brome has models that can be installed at ICI operations and larger models that are applicable as a stand-alone industrial composting facility (i.e., municipal, agricultural).

Figure 5-1: Example of a Brome Composter (used for ICIC)

The Brome units range in cost from $35,000-130,000. Brome can also include other pieces of equipment (e.g., mixer), at an additional cost. The Brome units can be purchased outright or leased.

There are currently 100 Brome units in operation with approximately 30 Brome units located at ICI locations in Canada, including universities, shopping malls, arenas and mining operations. They are distributed across the provinces and northern territories.

5.3.2 ORCA Digesters

ORCA Digesters is a Canadian owned and operated company that has been developing and manufacturing North American made aerobic digesters, since 2012. The ORCA technology is most applicable for settings that generate large amounts of organic waste such as restaurants, hotels, and grocery stores.

Food waste is loaded into the ORCA by facility staff on a continuous flow basis (i.e., as opposed to a batch). A mix of proprietary microorganisms is added to aid the digestion. Within 24 hours the food waste is microbially processed and is discharged into the facility plumbing/sewer system. Part of the utility of this technology is that it size reduces and liquifies food waste so it can flow to municipal wastewater treatment plants for subsequent processing. The facility plumbing/sewer system should have a grease interceptor prior to discharging into the sewer. Facilities must also meet any municipal requirements (i.e., in terms of effluent quality) before discharging into the sewer.

There are five sizes of ORCA units with processing capacities ranging from 165 kg-1,100 kg/day. Figure 5.2 depicts an ORCA OG50 model (5'9" length x 2'11" width x 4'1"height) and shows where food waste is loaded into the unit.

Figure 5-2: Example of an ORCA Unit (OG50)

The ORCA technology is set on load cells which measure the inbound weight of food waste, along with other basic telemetry. These measurements are collected and tracked using proprietary software. Clients can sign into the online portal to access their unit's information, track waste diversion in real-time, as well as use this information to make operational decisions in an effort to reduce waste.

ORCA Digesters offers its technology to be purchased outright or leased on a Technology as a Service model. The price to purchase an ORCA ranges from $15,000-$40,000 with the option to add a service plan. Leasing an ORCA costs between $500-$1,100/month and includes regular service. There are currently 2,000 ORCA units in operation, with 250 of these in Canada (e.g., at hospitals, grocery stores, stadiums).

5.3.3 Walker Grease Trap Service

Walker Grease Trap Service is an Ontario company that manufactures an industrial scale and patented Organic Resource Recovery System (ORRS), for use in grocery stores.

Food waste is collected and loaded into a hopper (approximately 50 litres) by staff (Figure 5.3). The size of this unit is approximately 6'l x 4'w x 5'h. The units can accommodate all types of grocery store food waste. Typically, food wastes include fruit and vegetables, dairy, prepared foods and bread. This system includes a grinder to size reduce food waste and holding tank to store these materials. The food waste is collected using a vacuum truck, dewatered at a transfer facility and then transferred to anaerobic digestion facilities for processing.

They manufacture 1 model of ORRS (storage tank sizes can vary). A grocery store that actively uses the system places a range of 650-800 litres/day of food waste (this would equal about the same in kg/day as a small amount water is added to food waste as part of the process) in the unit.

There are currently 45 Walker ORRS units in operation, almost all in southwestern Ontario with a few in Ottawa. The Walker ORRS units are used exclusively at grocery stores. It is more cost effective to incorporate this system when building a grocery store than after store construction.

Figure 5-3: Example of a Walker ORRS

5.3.4 Joracan Composters

Joracan is a Québec-based Canadian company that manufactures commercial composters. Their commercial composter (Joracan NE20T) is applicable primarily for restaurants, institutions (e.g., schools, long-term care / retirement homes), condominiums and corporate offices.

Food waste is loaded by facility staff or residents into a two-stage batch unit. The units can accommodate all food waste, except for raw meat and large bones. Wood pellets are added to inbound food waste to optimize the composting recipe (i.e., carbon to nitrogen ratio). There is a built-in shredding/mixing unit at the start of the

process to blend food waste with wood pellets. In the stage 1 chamber the blended materials are turned and composted. Temperatures are monitored and supplemental air is provided as required. After two weeks the materials are automatically moved to the stage 2 chamber for curing. Here the materials are turned and cured for a further two weeks. After curing the compost is discharged from the system and can be ready for use.

Joracan has one commercial unit model (Joracan NE20T) (Figure 5.4), which can accommodate 50 kg/day or about 20 tonnes/year. The size of the unit is approximately (12'*4'*5'). The Jorcan NE20T unit costs $54,000. There are currently 13 Joracan NE20T units in operation in Canada, in Québec and British Columbia.

Figure 5-4: Example of an Joracan Composter

5.3.5 Oklin Composting Technology

Oklin Composting Technology (Oklin) is a Chinese company that have developed and manufactured more than 400 composters worldwide, primarily for large food serving venues (e.g., shopping malls, arenas, airports, food processing facilities).

Materials (i.e., primarily food waste but also some paper products, such as napkins) are loaded by facility staff into a unit. A mix of proprietary microorganisms is added (annually) to facilitate decomposition. No carbon source is added to the materials. The units can accommodate all pre- and post-consumer food waste and some compostable packaging. Facility staff can load fresh materials each day. Materials are composted for 24 hours, during which time there is a reported 80-90% weight reduction. The materials in the unit are also mechanically heated (up to 50°C generally and for 1 hour greater than 70°C, to inactivate any pathogens) and turned by internal rotating arms. A given unit has sufficient capacity (i.e., batch) for one week's worth of materials (i.e., the size of the unit is dictated by the amount of food waste generated). Any moisture is evaporated and vented from the system. Thereafter the unit is opened, and a discharge motor helps to empty out the unit (i.e., batch). The material will have resided for 1-7 days in the unit. The immature compost produced requires 21-24 days of curing. This can occur on or off-site.

There are 7 sizes of Oklin commercial units ranging from 25-1,350 kg/day. Figure 4.5 depicts an Oklin unit. They range in size from (4'l*2'w*3.5h to 16'l*6'w*10'h).

Figure 5-5: Example of an Oklin Composter

The Oklin units range in cost from $24,000-$300,000 and it is estimated that operating costs are up to $1,200/month.

There are currently more than 400 Oklin units in operation, with 15 of these in Canada (e.g., Cadillac Fairview shopping centres, Vancouver International Airport, Vancouver Convention Centre, restaurants, residential buildings).

5.3.6 Recycling Alternative

Recycling Alternative is a Vancouver based company that offers a variety of waste management services, including waste and recyclables collection and the on-site management and recovery of food waste at ICI generators. They are a distributor for Oklin Composting Technology composters (as described in Section 4.3.5 and Appendix B). To Recycling Alternatives the Oklin units' function like a "bioreactor" and "compactor for food waste". Its primary benefit is that it reduces the volume/weight of these materials.

Recycling Alternative adds after-market customization to the Oklin Composters to enhance them. This includes adding sensors to measure process parameters and the development of software to track these measurements. The units are connected to a cloud-based server. Their goal is to apply 'machine learning' to these units that tracks how and when materials are added as well as processing parameters (e.g., temperature) that ultimately works towards the optimization of the process.

The material (food waste, paper towels, compostable plastics, etc.) placed in the units are aerobically composted and is discharged as an immature compost. Air flows into the unit (for aeration purposes) and is discharged via a pipe leaving the unit. The air is deodorized prior to discharge into existing venting or an outdoor space. Newer units are using UV technology to eliminate odours. To date, no permitting has been required for venting. There is no leachate and water is not normally added to the unit.

After discharge from the units they have installed, immature compost is collected by a waste hauler and taken to a permitted composting facility for curing. It is blended with other inbound materials at these facilities.

To date, they have had success installing these units in larger ICI generators such as shopping malls and supermarkets but also in residential towers. Currently, their focus is on shopping malls. They started with installing units in British Columbia shopping malls and are now starting to install them in Ontario shopping malls. Figure 4.6 depicts a unit in a waste room.

Figure 5-6: Oklin Composter in a Waste Room

Recycling Alternatives works with clients to improve the quality of wastes that will be put into the units. Figure 5.7 depicts a "tray station", at Vancouver Airport, where staff sort the materials on the tray to the appropriate waste container.

Figure 5-7: Tray station

5.4 Summary

Of the five on-site ICI organic processing technologies reviewed three are composters (Brome Composters, Joracan Composters, Oklin Composters), one an aerobic digester (i.e., digestion in the presence of oxygen) (Orca Digesters) and one that facilitates size reduction storage (Walker ORRS).

Brome Composters, Orca Digesters, Joracan Composters, and Oklin Composters all facilitate some level of microbial decomposition, the extent of which will be commensurate with their residence time, which ranges from 1 day to 4 weeks.

Brome Composters, Joracan Composters, and Oklin Composters require removal of uncured or partially cured compost from the unit and various levels of additional compost curing, which can take place on-site or at an off-site location.

The Orca Digester and Organic Resource Recovery System (ORRS) rely largely on post unit processing to produce products.

Presently all of these technologies are used in larger ICI facilities, that generate large amounts (i.e., 25kg/day) of food and organic waste, such as shopping malls, hotels, schools and arenas. Some of the technology providers are actively working to develop smaller scale units for smaller ICI facilities such as individual restaurants.

A critical issue with these systems is that they cannot tolerate much, if any contamination (e.g., plastic, metal, glass). This means that the inbound food and organic waste must be uncontaminated. This requires setting up systems to ensure that food waste generators (e.g., customers) properly sort their wastes into the correct container and/or facility staff facilitate this process.

It is unclear but seems unlikely that these technologies confer any economic savings relative to conventional waste management systems, given the upfront capital costs and operating (i.e., staff and utilities) costs. Most ICI facilities that use these technologies because they want to be able to better manage the generation of processing of their food and organic waste. This is often driven by environmental goals (e.g., reduced GHG emissions) but also from the better on-site management of food and organic waste and avoiding some or all of the nuisances that can be associated with conventional on-site waste management of food (i.e., in bins and compactors).

Advantages

These technologies often and at minimum serve a useful intermediate step for ICI food and organic waste management. They can be used to replace bins and compactors often used to store food and organic waste, which can result in discharge of liquid, odours and attract vermin. A key benefit is that if managed properly they can avoid these nuisances.

A key advantage of these technologies is that some of them (e.g., Brome Composters, Joracan Composters) can be used in remote locations (e.g., mines) where there are no other waste management services and/or locations with land (e.g., some universities) where the compost can be viably used.

The environmental benefits include reduced transportation impacts, diversion of food waste from landfill, avoided GHG from disposal and in some cases compost product that can be used in gardens.

Disadvantages

All of these technologies incur a considerable cost, mostly for the piece of equipment itself and to a lesser extent operating cost (e.g., electricity, water consumption, wood pellets). All of these technologies discharge their products well before they would at industrial scale composting facilities and require either full processing or additional curing elsewhere. These technologies require considerable space within the waste rooms in which they are typically located, although they can replace other containers.

Some technology providers alluded to environmental permitting as a potential issue although none were able to provide specific examples. If outputs are discharged to the sewer they will need to comply with any local sewer use by-laws.

Potential

There is great potential for on-site technologies to help manage food and organic waste generated at ICI facilities. In practice and as noted, they are currently most practical for large generators of food waste that have sufficient space for the equipment and/or to store/cure any compost produced. As previously noted, most ICI facilities that do adopt these technologies do so to help meet their environmental goals and reduce nuisances that can be associated with conventional on-site waste management of food.

6.0 CONCLUSIONS

This study was able to considerably advance the understanding of ICI food organic waste disposal and diversion in Canada; how this is material is managed; regulations and policies that impact how it is managed and examples of how this could be diverted on-site. It provides comprehensive data and analysis to aid both the public and private sector, for ICI waste management planning purposes.

Not surprisingly, food intensive ICI facilities such as manufacturers (food processing), grocery stores, restaurants and hotels are the largest food and organic waste generators and also represent the greatest opportunity to reduce food and organic waste generation and increase diversion.

The key drivers of ICI food and organic waste management continue to be cost and convenience. In most cases, disposal is currently simply cheaper and more convenient than diversion. As a result, in most provinces and territories disposal continues to be the main endpoint for this waste stream. Further, most jurisdictions do not have sufficient organic waste diversion infrastructure in place to manage significant volume increases.

This is not to say that efforts are not being taken to overcome these challenges. A growing number of companies have corporate social responsibility and other programs and are, in some cases, willing to pay the premium to divert food and organic waste. These companies are often voluntarily working together and aided by the efforts of government investments, programs and policies.

As well, there are growing governmental efforts, across the country, to drive food and organic waste diversion reduction and diversion. While the current regulatory/policy framework, across different provinces and territories, is a patchwork, there does appear to be a greater alignment in the tools being used including strong early efforts to support food and organic waste reduction, followed by regulatory mechanisms like source separation requirements and disposal levies. A similar trend can also be observed in the US northeast. There is substantial opportunity for these jurisdictions to learn from each other as they implement or revise policies and programs.

While a considerable amount of data was collected for this study, the availability of ICI food and organic waste data, in particular for disposal and diversion, remain a challenge across the country. There are opportunities to build on the data collected for this report, to further improve both public and private sector understanding of ICI food and organic waste and how it is managed. A solid data driven understanding of ICI food and organic waste can ultimately be used to further inform comprehensive and effective provincial / territorial policy and regulation development for this waste stream, with an end goal of reducing the amount of ICI food waste that is produced and increasing ICI food and organic waste diversion.

APPENDIX A

Case Studies for Regulatory Approaches to Address ICI Organic Waste

(i.e., source separation requirements and landfill bans)

Case Studies for Regulatory Approaches to Address ICI Organic Waste (i.e., source Separation Requirements and Landfill Bans)

The following case studies provide additional details for regulatory approaches to address ICI organic waste (i.e., source separation requirements and landfill bans) adopted by various jurisdictions in Canada and the United States. These case studies are intended to illustrate variations in approaches, and do not comprise an exhaustive list of approaches by jurisdiction.

Canadian Provinces

Nova Scotia	
Mechanisms	Source Separation Requirements / Disposal Ban
Context	Nova Scotia was the first province in Canada to implement a disposal on organic waste. The ban was initially introduced to reduce the environmental impact of disposal sites and then to cut the waste landfilled by 50% by 2000. The goal was to stop disposing of materials that had potential for reclamation.
Regulated Approach	The ban on compostable organic material (industrial, commercial, institutional and residential) became effective in 1998. The Environment Act, 1995 provides legislative authority for the government to ban certain materials from landfill or other disposal areas. Section 20 of the Solid Waste-Resource Management Regulations require that a person: must not destroy or dispose of a designated material in a landfill, incinerator or thermal treatment facility; must not accept a designated material for destruction or disposal in a landfill, incinerator or thermal treatment facility; and that each municipality shall provide a plan to the Administrator to ensure that the bans are implemented.
Organic Waste Targeted	Compostable organic material which includes food waste, yard waste and soiled paper
Regulated Entities	All generators.
Implementation	Municipalities are required to present a waste management plan setting out the measures being taken to comply with the bans. Many municipalities have implemented clear bag programs that allow for inspection at the time of collection. The transfer or landfill site operator is responsible for conducting an inspection. Compliance efforts mainly based on warning and awareness letters, although loads may be rejected or subject to penalties. ICI sector required to institute source separation programs in order to be compliant.
Relative Success	Nova Scotia achieved its goal of reducing the amount of waste going to landfill sites by 50% by 2000. The regulations have led to significant investments and infrastructure growth for processing organics in the province.
Lessons Learned	Allowed for adequate time for infrastructure investments to be made. The provincial government did run into some initial issues with compliance issues with compost facilities (e.g., odour management) but these were resolved.
Other Resources	DivertNS, a not-for-profit corporation, was established to promote waste diversion in Nova Scotia, including enhanced organics diversion. Divert NS delivers education and awareness programs, works collaboratively to develop and implement stewardship agreements, funds research and development initiatives, and promotes innovation through the development of value-added manufacturing.

Ontario	
Mechanisms	Source Separation Requirements
Context	The Food and Organic Waste Policy Statement supports the provincial vision of a *circular economy* and is meant to move towards the province's visionary goals of zero waste and zero greenhouse gas emissions from the waste sector. The Policy Statement focuses on *waste reduction and resource recovery* through preventing and reducing *food waste*, effectively and efficiently collecting and processing *food and organic waste* and reintegrating recovered resources back into the economy.

Ontario	
	The Policy Statement provides policy direction to further the provincial interest related to *waste reduction* and *resource recovery of food and organic waste*.
Regulated Approach	The Food and Organic Waste Policy Statement (Policy Statement) was established in 2018 pursuant to Section 11 of the Resource Productivity and Recovery Act. Policy Statements provide policy direction to the various parties including the provincial government, municipal governments, waste generators, and service providers. The Policy Statement provides various levels of direction (e.g., shall, should and encourage). The Policy Statement specific to ICI establishments includes source separation and reduction / diversion goals. It also includes direction on food waste reduction, surplus food rescue, promotion and education to reduce waste, increase diversion and promote compost.
Organic Waste Targeted	Food waste, and organic waste resulting from food preparation and soiled paper and leaf and yard waste (current consultation may lead to some amendments)

Regulated Entities	• All commercial, institutional, and industrial buildings subject to O.Reg. 103/94 that generate more than 300/kg week of food and organic waste
	  ○ 70% reduction / diversion by 2025 through source separation or equivalent.
	• All ICI buildings not subject to O.Reg. 103/94 that generate more than 300/kg week
	  ○ 50% reduction / diversion by 2025 through source separation or equivalent.
	• All ICI buildings subject to O.Reg. 103/94 that generate less than 300/kg week
	  ○ 50% reduction / diversion by 2025 through source separation or equivalent.
	• Educational institutions and hospitals subject to O.Reg. 103/94 that generate more than 150 kg/week
	  ○ 70% reduction / diversion by 2025 through source separation or equivalent.

Implementation	Extensive consultation was held with stakeholders over several years before the Policy Statement was released. The requirements for ICI establishments are also phased in over a seven-year period.
Relative Success	n/a
Lessons Learned	Too early to properly assess.
Other Resources	• The province is currently working on releasing guidance to help municipalities and businesses meet their targets and obligations under the Policy Statement. The guidance is expected to be released by Spring 2021. • In October 2020, the Ontario Ministry of Environment, Conservation and Parks has provided $5.25M in funding through the Surplus Food Redistribution Infrastructure Program. The funding will support food rescue organizations and indigenous communities and organizations to rescue and redistribute surplus food and assist with food insecurity. • The Province has also committed to developing a proposal to phase-out food and organic waste from landfills by 2030.

Québec	
Mechanisms	Source Separation Requirements / Disposal Levies
Context	Québec is addressing organic waste to: • Improve the environment; • Reduce GHG emissions; • Maintain its leadership role in production renewable energy; • Build a green economy; and • Support the health and fertility of agricultural land. As part of their strategy (i.e, Strategie de Valorisation de la Matiere Organique), they have established the following targets: • Offer the collection of organic waste to all citizens of Québec by 2025. • Manage organic waste in all industries, businesses and institutions by 2025. • Recycle or recover 70% of the organic matter targeted by 2030. • Reduce 270,000 tonnes of CO_2 equivalent per year in GHG emissions by 2030.
Regulated Approach	As part of their strategy, Québec is considering penalties and then compelling source separation of food and organics residues and the collection of paper and cardboard in ICI. They are also considering a minimum standard for diversion of paper biosolids.

Québec	
	Québec's disposal levy was established in 2006 under the Regulation Respecting the Charges Payable For the Disposal of Residual Materials. The levy was initially established at $10.00 per tonne but is now set at $23.51 per tonne. The government is considering increasing the disposal price to $30 per tonne over the next few years and subsequent annual increase of $2 per tonne per year. Funds gained from the levy are used to improve municipal waste management practices based on a funding formula.
Organic Waste Targeted	Consultations on the source separation requirements are yet to occur. The disposal levy applies to all waste disposed except incineration residue; materials used for landfill daily cover; residual materials that are sorted and recovered on the premises to be reclaimed; residual materials recovered, after incineration; and mine tailings or residue generated by a mine tailings reclamation process.
Regulated Entities	It is proposed that all industries, businesses and institutions will be required to properly manage their organic waste by 2025.
Implementation	Consultations are yet to occur.
Relative Success	Regulations do not yet exist but are anticipated by 2023.
Lessons Learned	There were some initial issues with waste being exported outside of Québec to avoid the disposal levy but this loophole is being addressed by applying the disposal levy to waste transfer sites as well.
Other Resources	Provincial government allocated $1.2 billion over 10 years to better manage organic waste includes funds to support new compost and anaerobic digestion facilities as well as small-scale composting.

Canadian Municipalities

City of Calgary	
Mechanisms	Source Separation Requirement
Context	Part of the City of Calgary's previous goal was to send 80 per cent less waste to Calgary landfills in 2020 than in 2007.[1] Calgary wanted to target the most common materials and the largest generators in the waste stream to maximize diversion. Their most recent goal is 70% diversion by 2025 and includes all waste generating sectors, not just residential.
Regulated Approach	Since 2017, the City requires all non-residential properties to source separate and divert food and yard waste to a food and yard waste material recovery facility through Bylaw Number 4M2020 – Being a Bylaw of the City of Calgary to Regulate and Manage Waste. The Bylaw also includes requirements for clear signage, adequate containers and communication to tenants.
Organic Waste Targeted	Food waste, food soiled paper and yard waste.
Regulated Entities	Includes all non-residential entities. Non-residential entities can seek to be excluded by the Director if they do not generate food and yard waste on the non-residential property.
Implementation	Broad spectrum of stakeholders engaged as part of the consultation. A long lead time was provided to implement the bylaw and there was a grace period to allow non-residential entities time to comply. The bylaw was enacted in November 2017. While Calgary has the ability through Bylaw 4M2020 to ensure businesses are complying with the requirements, they do not have the ability to oversee private sector service providers who are collecting the materials. Bylaw officers enforce the bylaw based on complaints that are filed and perform proactive checks as part of regular inspections.
Relative Success	The regulatory approach is generally seen as successful; it resulted in an increase in the number of businesses collecting and managing these materials over time. The City does not however regulate the waste management

City of Calgary	
	sector so does not have direct access to data related to the amount of organic waste being composted/processed from the ICI sector.
Lessons Learned	Importance noted of engaging stakeholder and ensuring adequate time is provided for business and other organizations to be ready. Bylaw 4M2020 is only applicable to the owner of a non-residential parcel and does not extend to the Hauler or Processors of the materials. The City does not have the powers to ensure the materials collected and processed by the private sector are being managed according to the intent of the bylaw.
Other Resources	The City of Calgary provides a number of educational resources to assist businesses on their website. The municipality also established an ICI Working Group and a Post-Secondary Institution Community of Practice that focuses on waste diversion issues. These working groups provide input to the City, provide knowledge back to the regulated community, and provide an opportunity for the private sector to contribute to collaborative waste management solutions.

City of Saskatoon	
Mechanisms	Source Separation Requirements / Disposal Ban
Context	The Industrial, Commercial, and Institutional (ICI) Waste Diversion Strategy is part of the City of Saskatoon's (City) Waste Reduction and Diversion Plan and identifies ways to help achieve the City's 70% Waste Diversion Target. This includes mandatory ICI recycling and organics diversion programs and policies; determining the role of City-delivered services for ICI waste management and diversion; and establishing a working group with representatives to support strategic implementation.
Regulated Approach	Saskatoon City Council approved the regulatory approach in January 2020. Businesses and organizations will be required to: • Have separate and labelled containers for garbage and recycling; • Provide education to employees and tenants on how to properly sort waste; and • Ensure removal and proper disposal of waste. If food or yard waste is generated as part of operations, a separate and labelled container for organics will also be required.
Organic Waste Targeted	Food waste, food soiled paper and yard waste.
Regulated Entities	The organics regulation will only apply to businesses and organizations that generate organics waste as a part of their operation (ex. supermarkets and grocery stores, accommodation and food services, etc.) An exemption criterion is being developed and will be applied on a case-by-case basis. The onus will be on the business to apply for exemption.
Implementation	The City will use a phased approach that will see education and assistance with early compliance for recycling starting in January 2022 and organics July 2023 with enforcement one year later respectively. Enforcement of the ICI regulation will occur at the generator with a heavy focus on education. Options for banning recycling and organics from the landfill will be assessed in 2023 once these diversion services are established.
Relative Success	n/a
Lessons Learned	The regulation approved by City Council closely models those used in Calgary and Halifax. Engagement with the ICI sector during the development of options helped identify some key insights. For example: • Most businesses (>70%) currently have recycling services or drop off material at a City depot. • Less than 10% of businesses currently have an organics service so this will be a greater learning curve.

City of Saskatoon	
	• Many businesses expressed concern with a mandatory organics service since they did not produce organics waste; the recommendation to Council reflected this. • Awareness and education are key barriers to adoption. We heard this from the City of Calgary and our own business community.
Other Resources	Educational resources currently being developed and will be refined based on feedback from the ICI working group. At a minimum, the following will be provided: • Dedicated ICI webpage, • Templates for container labels and posters, • Fact sheets, • A How-To Guide, and • Examples of successful businesses and organization in our community

Metro Vancouver	
Mechanism/s	Disposal Ban
Context	The Disposal Ban Program was a key waste reduction strategy identified in the *Integrated Solid Waste and Resource Management Plan*.
Regulated Approach	Implemented through the *Greater Vancouver Sewerage and Drainage District Tipping Fee and Solid Waste Disposal Regulation Bylaw*. The Organics Disposal Ban is enforced in the same as most of the Region's other disposal bans. Waste is inspected when it is delivered to a regional disposal facility. If a waste load contains excessive amounts of food scraps, the hauler pays a surcharge of 50% on the cost of disposal. Over 50 materials are included in the program with inspections occurring regularly at all Metro Vancouver and City of Vancouver facilities. Metro Vancouver reports annually on program results by inspection rates, surcharged materials, surcharge rates by company/municipality and other program information. Note that some of the member municipalities in Metro Vancouver have moved forward with complementary measures such as the City of Vancouver which requires every owner or occupier of a non-residential property where food waste is produced to have a food waste diversion plan (i.e., By-law number 11092 – a By-law to amend Solid Waste By-law No. 8417 regarding organic waste).
Organic Waste Targeted	• Leaf and yard waste, • All food, including bones, eggshells and sauces, • Coffee grounds/filters and tea bags, • Wooden utensils, chopsticks and toothpicks, • Napkins, pizza boxes and uncoated paper plates, • Small amounts of grease, and • Paper bags or newspaper used to collect food scraps.
Regulated Entities	Applies to all residential and non-residential.
Implementation	The organic waste disposal ban was implemented in January 2015 for the Metro Vancouver Region. Metro Vancouver started planning for the organic disposal ban in 2011 when it was identified as a key part of their waste management strategy. There are more than a dozen materials from the disposal, including clean wood, electronics, mattresses, common recyclable paper and containers (e.g., cardboard, newspaper, aluminum cans, etc.), yard trimmings, appliances and paint. Significant work was undertaken between the years it was announced to when it was finally implemented to consult with the stakeholders and assist with preparations (e.g., food waste reduction). For the first six months of the ban efforts were focused on education and outreach and no surcharges were issued during this period. After the grace period, a 50% higher rate was applied to any service provider disposing of waste garbage at Metro Vancouver facilities that contained more than 25% visible food scraps. There is no direct enforcement of the ban on generators as the Region does not have jurisdiction in this area.
Relative Success	The non-compliance rate is 2%. There has been an increase in organic processing capacity in the area and an increase in the amount of materials being diverted. While only anecdotal, there also appears to be an increase in food donations (although this may or may not be directly attributed to the landfill ban).

Metro Vancouver	
Lessons Learned	Regulator indicated the need for focus to be on ensuring organizations are prepared in advance which includes ensuring they have tools to help them reduce the amount of organic waste they are generating (e.g., food donation). Without these tools, a ban may only be seen as penalty to certain organizations without actually addressing the core issues. Metro Vancouver has placed a strong focus on food waste prevention and reduction through direct outreach, on-going consultations, and partnerships like Love Food Hate Waste Canada, and the National Zero Waste Council. Metro Vancouver is also seeking to develop a Food Recovery Network, supported by a technology platform, that can be integrated with other food recovery initiatives already in place or under development in Metro Vancouver and neighboring regions, to divert surplus food to the highest value end-use, create secondary markets and reduce avoidable food waste. As the ban is applied only at facilities owned by Metro Vancouver, there have been some issues related to waste materials being exported into neighbouring jurisdictions that are not impacted by the ban. Metro Vancouver has taken steps to address this through changes to its transfer and disposal fee structure, but it does remain a challenge. Over time, disruptions to the operation of some organic processing facilities occurred (e.g., due to environmental orders for non-compliance issues or other issues), which in some cases required Metro Vancouver to issue temporarily exemptions to the organics ban until sufficient processing capacity was restored.
Other Resources	Metro Vancouver has provides organizations with a number of educational tools and resources to assist them with regulatory compliance as well as information on Food Scrap Haulers and operational considerations. Through the National Zero Waste Council, resources have also been created to assist organizations with measurement of food loss and waste, understanding requirements related to food donation and date labelling for food.

United States Jurisdictions

Massachusetts	
Mechanisms	Source Separation Requirements / Disposal Ban
Context	The overarching objective was to "prevent pollution, maximize materials reuse, and conserve both natural resources and energy by ensuring the proper handling, transfer, processing and disposal of solid waste." Beside this, Massachusetts is bound by law to reduce greenhouse gas emission by 25% by 2020 below 1990 levels and 80% by 2050. The state also sought to address issues related to limited in-state landfill capacity.
Regulated Approach	Established under Regulation 310 CMR 19.000, the regulation establish bans on the disposal or incineration or transfer of disposal at solid waste facilities. Bans include a wide range of materials including leaves, yard waste and commercial organic materials.
Organic Waste Targeted	Commercial organic material which includes: • Food material (i.e., material produced from human or animal food production, preparation and consumption activities and which consists of, but is not limited to, fruits, vegetables, grains, and fish and animal products and by-products) and • vegetative material (i.e., plant material)
Regulated Entities	Any entity that generates more than 907 kg per week of commercial organic waste but excludes materials from residences. Massachusetts DEP provided guidance material related to the size of businesses and institutions that would likely be captured. They are considering lowering the requirements to any entity that generates more than 453 kg per per week of commercial organic waste.
Implementation	Provided a long lead time to implement for commercial organic materials ban. Extensive consultation was undertaken with stakeholders. Leaf and yard waste were banned December 31, 1991 and December 31, 1992 respectively. Bans at transfer station were implemented April 1, 2000 for both. The ban for commercial organic material was implemented for landfills, combustion facilities and transfer facilities on October 1, 2014. Massachusetts DEP at the onset mainly focused on education but as of the fall of 2019 has issued 82 notices of non-compliance and 8 penalties. Focus is on addressing compliance through the generators but they also have ability to enforce if there are issues with service providers.
Relative Success	Substantial increases in the amount of food donation (30% since 2014), food sent to animal feed, and organic waste processed (more than doubled since). There has been a drop in the amount of compost processed as

Massachusetts	
	some material is being processed in neighbouring states. There has been substantial investments in anaerobic digestion capacity and de-packaging operations.
Lessons Learned	Did not anticipate the amount of packaged food waste and at the beginning needed to provide a number of exceptions as there was not the infrastructure in place to de-pack these materials. State funding has helped to ensure these materials can be processed. Stressed the importance of on-going outreach to the various impacted sectors.
Other Resources	Massachusetts DEP has: • Provided 6 grants for $1 million (USD) for addressing food waste processing issues • Awarded 20 loans for $5.28 million (USD) for organic waste processing projects • Developed a map of facilities and information on generators • Allowed for on-going educational support to be provided through RecyclingWorks, which is a recycling assistance program funded by the Massachusetts DEP.

New York	
Mechanism/s	Source Separation Requirements / Disposal Ban
Context	Strong focus on the environmental benefits, including creating useful compost and decreasing the amount of materials that would otherwise be sent to a landfill, and in turn reducing greenhouse gas emissions. Also a focus on food insecurity and has a stronger focus on support for food donation.
Regulated Approach	In 2019, NYS passed the Food Donation and Food Scraps Recycling law. Effective January 1, 2022, businesses that generate an annual average of 1,814 kg of wasted food per week or more must: 1. donate excess edible food; and 2. recycle all remaining food scraps if they are within 40 km of an organics recycler (composting facility, anaerobic digester, etc.) – as the crow flies.
Organic Waste Targeted	The proposed regulation includes inedible food, trimmings from the preparation of food, food-soiled paper, edible food that is not donated, and food processing waste. Food scraps does not include used cooking oil, yellow grease, or any food which is subject to a recall or seizure due to the presence of pathogens.
Regulated Entities	Any non-residential entity that generates more than 1,814 kg per week of commercial organic waste but excludes hospitals, nursing homes, adult care facilities, kindergarten to 12 schools. Includes a provision so it does not overlap with New York City's food waste ordnance. Large generators of food scraps may petition the Department for a one-year waiver due to undue hardship.
Implementation	The plan for implementation is the following: • The Food Donation and Food Scraps Recycling law passed in April 2019. • Draft Regulation will be regulations will be released for consultation in Spring/Summer 2021. • Regulations will be promulgated in the Summer/Fall of 2021. • Large generators will be notified of their requirements in June 2021. • Designated food scrap generators can submit a waiver from part or all of the requirements of the law between June and September 2021. • Department plans to maintain a list of all designated food scraps generators transporters that handle source separated food scraps, and organics recyclers (e.g., rendering, animal feed producers, composting, digestion, fermentation). It will make the list available on or before June 1 of each year, beginning in 2021. • Effective date of the law is January 1, 2022. • All designated food scraps generators must submit an annual report to the department on or before March 1 of each year, beginning in 2023, in an electronic format acceptable to the department. The annual report must include, at a minimum, the following information: o the amount of edible food donated; o the amount of food scraps recycled; o the name of any transporter used for food scraps; o the name of the organics recycler(s) where the food scraps were processed; and o a description of any implementation issues (e.g, contamination in food scraps, inconsistent pick-ups, odors.) and actions taken to address those issues. • Focus is on generators but transporters, transfer stations, processing facilities all have responsibility to ensure materials are properly managed. • Compliance will focus on education to begin with.

New York	
Relative Success	• The ban is expected to be in place by 2022.
Lessons Learned	• Followed similar approach to neighbouring states. • There have been some concerns about the ability of the State to identify all the large generators. • Given short timelines there may be some concerns about the ability to evaluate those seeking waivers for part or all of the requirements.
Other Resources	• Will be establishing a working group to advise • Educational materials and funding - https://www.dec.ny.gov/chemical/96166.html • Guidance materials for various stakeholders - https://www.dec.ny.gov/chemical/114499.html

Vermont	
Mechanisms	Source Separation Requirements / Disposal Ban
Context	Diminishing landfill capacity in the State. Regulators saw it as an opportunity to increase waste diversion, reduce GHG emissions, stimulate economic growth associated with resource recovery, conserve landfill capacity, and standardize waste management across the State.
Regulated Approach	Vermont State Law through the Universal Recycling of Solid Waste Act (Act 148 of 2012) banned the disposal of food waste in trash/landfill/incinerators in phases culminating with a full ban July 1, 2020. The ban was phased in from 2014 through 2020 with the hope that this phased rollout would incentivize the hauling and processing capacity to grow. The law also requires facilities that accept trash to also offer collection of food scraps separate from trash and for haulers to of trash to offer food scrap collection to non-residential customers and apartments of 4 or more units unless another hauler is willing to offer that service.
Organic Waste Targeted	Food residuals (i.e., source separated, and uncontaminated material is derived from processing or discarding of food that is recyclable) and leaf and yard residual (i.e., source separated, compostable untreated vegetative matter).
Regulated Entities	Any non-residential entity that generates food residuals or leaf and yard residuals and located within 32 kilometers of a certified organic waste management facility that has available capacity is required to separate and dispose of them. Requires all facilities and haulers that collect garbage to offer organic waste collection.
Implementation	Requirements were phased in: • July 1, 2014 – generators of more than 94.3 tonnes per year of food residuals (1,814 kg per week) and located within 32 kilometers of a certified organic waste management facility that had available capacity. • July 1, 2015 – generators of more than 47.2 tonnes per year of food residuals (907 kg per week) and located within 32 kilometers of a certified organic waste management facility that had available capacity. Transfer facilities and bag-drop haulers must accept leaf and yard debris. • July 1, 2016 – generators of more than 23.6 tonnes per year of food residuals (454 kg per week) and located within 32 kilometers of a certified organic waste management facility that had available capacity. Leaf and yard waste banned from landfill. • July 1, 2017 – generators of more than 16.3 tonnes per year of food residuals (314 kg per week) and located within 32 kilometers of a certified organic waste management facility that had available capacity. Transfer facilities & bag-drop haulers must accept food scraps. • July 1, 2020 – Food residuals are banned from landfill & haulers must offer food residual collection. Compliance work is ongoing but to date no one has been fined. The focus has been on voluntary compliance starting with the largest generators first. They also have ability to enforce if there are issues with service providers.
Relative Success	Generally seen as a success: • Nearly quadrupled the amount of food scrap haulers (12 in 2012 to over 45 in 2021). • Food donation has nearly tripled since the ban was established. • Food scraps send to compost, anaerobic digestion and animal feed have grown year over year. Difficult to measure exactly as some materials are being shipped outside Vermont for processing. • Substantial increase in organic processing capacity. • Substantial increase in access to facilities that collect food scraps and leaf and yard debris. • Most controversial elements were the hauler requirements and full ban but generally.

Vermont	
Lessons Learned	• Importance of the need to talk with stakeholders and decision makers (legislators often and consistently and to keep the process moving forward. Waste is subject to apathy and needs explaining and assistance. • Phase-in dates allow to allow for requirements to be understood and proper planning. • Some strategic funding may be helpful in certain areas but not major factor.
Other Resources	Vermont Department of Environmental Conservation has: • Done extensive outreach and education about the new law with key stakeholder groups, including: grocers/restaurant associations, haulers, solid waste operators/managers, hospitals, schools, nursing homes, food manufacturing producers, food rescue organizations, and much more. • Given grants to municipal entities to support food scrap collection and management infrastructure. • Conducted more than 200 direct business/institution visits to discuss recycling and food scraps. Most were in compliance or getting in compliance. • Developed substantial resources for businesses to implement programs and reduce waste. • Developed a hauler list, map of facilities and information on generators.

APPENDIX B

On Site Technology Summary Table

On Site Technology Summary Table

Technology	Brome Compost	ORCA Digesters	Walker Grease Trap Service	Joracan	Oklin International	Recycling Alternative
Country of origin	Canada	Canada	Canada	Canada	China	Canada
Aerobic/ Anaerobic	Aerobic In-vessel composter	Aerobic digester	Neither. The Organic Resource Recovery System (ORRS) size reduces and stores food waste before directing to anaerobic digestion.	Aerobic In-vessel composter	Aerobic In-vessel composter	Aerobic In-vessel composter. They distribute Oklin International composters and modify them.
Batch or Continuous Flow	Batch	Continuous flow	Batch	Continuous flow	Batch	Batch
Retention time	5-30 days	24 hours	7-14 days in a holding tank	2-4 weeks	24-hour food waste to compost; 80-90% weight-based reduction rate.	24-hour food waste to compost; 80-90% weight-based reduction rate.
Products produced	Compost (after further maturation)	None	None on-site. Biogas and digestate off site.	Compost, which can be further cured, as required	Compost (after a further 21-24 days maturation). On-site or off-site.	Compost (after a further 21-24 days maturation). On-site or off-site.
ICI Food waste types	All types of food waste	Food preparation waste and food waste from meals	All types of food waste from grocery stores	Food preparation waste and food waste from meals	All types of food waste including meat, dairy, pre- and post- consumer food waste. Some compostable packaging materials Some green waste	All types of food waste including meat, dairy, pre- and post- consumer food waste. Some compostable packaging materials Some green waste
Applications	Large scale industrial applications (e.g., mines), grocery stores,	Hotels, grocery stores, arenas, cafeterias restaurants, schools,	Large scale grocery stores	Restaurants, institutions (e.g., schools, seniors homes),	Arenas, restaurants, schools, cafeterias, hotels, shopping centres, grocery stores, airports,	Arenas, restaurants, schools, cafeterias, hotels, shopping centres,

Technology	Brome Compost	ORCA Digesters	Walker Grease Trap Service	Joracan	Oklin International	Recycling Alternative
	schools, food processing, produce growers	shopping centres		condominiums and corporate offices	food processing facilities	grocery stores, airports, food processing facilities
Food waste quantities (in kg or litres/day)	40-1,000 kg/day	165-1,090 kg/day	650-800 litres/day	50 kg/day	25-1,350 kg/day commercial units.	25-1,350 kg/day commercial units.
What are the costs associated with the technology?	**Capital costs** $35,000-$130,000 **Operating costs** Not available	**Capital costs** $15,000-$40,000 **Operating costs** Utilities (electricity and water) ($110/month average)	**Capital costs** Not provided **Operating costs** Low. Requires small amounts of electricity and water to operate.	**Capital costs** $54,000 for unit **Operating costs** Low. Small amount of electricity (980 kw/year) and wood pellets	**Capital costs** $24,000-$300,000 **Operating costs** Utilities, Quarterly and annual maintenance (microbe replacement, parts replacement). (up to $1,200/month)	See Oklin International
Where is your technology in use in Canada?	Approximately 100 total units operating in Canada, of which 30 are at ICI locations, including mining operations, large scale hydro operations, and universities	250 units with 80% in Ontario (e.g., hospitals, grocery stores, stadiums)	45 ICI units operating in Canada. Located at grocery stores	13 ICI units operating in Canada.	15 units with most in British Columbia and Alberta. Ontario is a developing market. Units are installed in Cadillac Fairview shopping centres, Vancouver International Airport, Portage College in Alberta, Vancouver Convention Centre (2021) and private installations in restaurants and residential buildings.	See Oklin International

Technology	Brome Compost	ORCA Digesters	Walker Grease Trap Service	Joracan	Oklin International	Recycling Alternative
Where is your technology in use in North America? (beyond Canada)	Small number of units in the USA. Locations include a large stadium.	2,000 units, most in North America	Not applicable	Not applicable	5 units in the USA. (10-35 kg/day units) They more than 400 units installed globally including in Europe, Asia, Australia and New Zealand	See Oklin International
Website	https://www.bromecompost.com/en/	https://www.feedtheorca.com	https://www.walkergts.com	http://joracanada.ca/en/	http://oklininternational.com/commercial/	https://recyclingalternative.com/what-we-recycle/composters/
Other resources	Landrienne, Québec: https://www.youtube.com/watch?v=eKBiAscvekE Pikogan, Québec: https://www.youtube.com/watch?v=HtwtjbpbRI8 Defland Farm : https://www.youtube.com/watch?v=CZloHfAGIfo		https://www.walkergts.com/case-studies/how-longos-in-east-gwillimbury-reduced-its-organic-waste-volume-by-65-using-walkers-patented-orrs-solution	ICI model https://www.youtube.com/watch?v=TvL0w0AS38w	http://oklininternational.com/technology/	https://youtu.be/saqAjC3sX1Q
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