Solid Waste Master Plan | Plan directeur des déchets solides

High Level Long List of Options

June 2021

Solid Waste Master Plan

Plan directeur des déchets solides

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Disclaimer:

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This technical memorandum was prepared by HDR Corporation and Dillon Consulting Limited.

This Project has been delivered with the assistance of Resource Productivity and Recovery Authority's Continuous Improvement Fund, a fund financed by Ontario municipalities and stewards of Blue Box waste in Ontario. Notwithstanding this support, the views expressed are the views of the author(s), and Resource Productivity and Recovery Authority and Stewardship Ontario accept no responsibility for these views.

1 Introduction

The City of Ottawa (City) is developing a 30-year Solid Waste Master Plan (SWMP) that includes consideration of the successes and failures of the past and present, and defines a vision for the future that will ensure its long term viability and sustainability, while ensuring flexibility to respond to an ever changing industry over the next 30 years. Some of the key questions the City will be seeking answers to through the development of the SWMP include:

- How can wastes from the City's customer base be better managed (residential, public and park spaces, City facilities, non-City waste)?
- What role will the existing systems, programs and facilities play in meeting the future needs of the City?
- What new technologies may be available to better manage waste materials?
- What role can the City play to further reduce the materials that will eventually become waste and support a circular economy framework?

The purpose of this technical memorandum is to identify options that will address the future needs of the City, identified in technical memorandum #7 - Long-Term Waste Management Needs.

2 Methodology

Options were identified to address each of the specific needs identified in the Task 7 Long-Term Waste Management Needs technical memorandum and built off of the work done in Phase 1 of the project, including extensive consultations with the public, staff, key stakeholders, City Councillors, and based on experience or recommendations from the consulting team.

Options have been identified for the SWMP's areas of focus, which include curbside residential, multi-residential, parks and other public spaces, City facilities and operations and current partner programs. They consider emerging policy and program trends, and current and emerging technologies; both large-scale and smaller scale.

Options have been categorized as either:

- Implementation tool – tactics and tools that will support the solid waste management system (e.g. a targeted outreach campaign);
- Program – waste management programs that aim to reduce and/or divert waste from disposal (e.g. a repair cafe);
- Policy – regulations, policies or by-laws or amendments to support waste management programs (e.g. disposal ban for different materials); or
- Facility/Infrastructure – waste management infrastructure that manages or processes waste collected (e.g. an anaerobic digestion facility for organics).

Options were grouped into one of ten categories:

1. Promotion and Education
2. Regulations, Policies, By-laws
3. Waste Avoidance, Reduction and Reuse
4. Recycling
5. Collection and Drop-off
6. Organics Management
7. Waste and Energy Recovery
8. Residual Management
9. Innovation
10. Other

A description for each option was developed with supporting text for the following:

- **Overview** – a short description of the proposed option and whether the option is proven or emerging (i.e. implemented by other municipalities).
- **Source of option** – whether the option was identified by the consultant as part of the Phase 1 work or through professional judgment, identified by staff or City Councilors, or through consultation undertaken by the City as part of Phase 1.

- **Proposed strategic alignment** – identification of the SWMP's guiding principles and/or goals that are applicable to the option.
- **Needs assessment alignment** – identification of the alignment with the future needs described in the technical memorandum #7 Long-Term Waste Management Needs.
- **Individual Producer Responsibility (IPR) Impact** – whether or not the upcoming transition to IPR is expected to have an impact on the implementation of the option.
- **System consideration** – whether an option is a core system component (i.e. integral to the City's waste management system) or a secondary system component that would be implemented as part of the core system.
- **Sector applicability** – what sector the option would be applicable to (Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF) and/or Partner Programs (PP)).
- **Environmental considerations** – estimates of the anticipated impact on waste diversion, greenhouse gas (GHG) emissions and/or potential impacts to air or water quality.
- **Social considerations** – the anticipated level of resident effort and behaviour change required, potential to impact public health, public safety, community interruption, accessibility, equity and/or inclusion.
- **Technical/operational considerations** – includes the need for siting, ease of implementation, integration with existing systems and/or level of effort required by the City to implement the option.
- **Regulatory considerations** – anticipated approvals required, timing of permitting/approval process and estimated costs.
- **Financial considerations** - estimated capital and operating costs, additional staffing requirements and/or cost savings. The cost estimates included are high level planning estimates to show order of magnitude costs.
- **Unknowns/assumptions** – made in the absence of information or data.
- **Supporting system requirements for success –** system interdependencies such as additional infrastructure etc. that would be needed for a successful outcome.
- **Potential Outcomes** – anticipated results from implementation of the option (e.g., impact on remaining life of the Trail Waste Facility landfill).
- **Measurement** – if/how the option can be measured when implemented (i.e. quantitative measures such as tonnes disposed or diverted).
- **Case studies/ evidence of results** – descriptions of other jurisdictions who have implemented similar options.
- **Recommendation** – whether the option should proceed to the evaluation stage or be held until further information is available (particularly for those options impacted by IPR).

It should be noted that it is very difficult to estimate City of Ottawa-specific costs at this time. Generally, at this stage of a planning process, high level indicative estimates of capital and operating costs are provided. The cost estimates provided are based on information that is publicly available or based on the City's current or prior experience with similar options. Publicly available costs are typically based on the specific needs of a particular jurisdiction, which may be impacted by other supporting policies, programs and infrastructure, and may not be reflective of Ottawa's particular needs. For this reason, costs are indicative only at this point and have not yet been developed to reflect the entire system, where interdependencies and efficiencies may exist. This work will be undertaken as part of the development of the business case for the recommended options that will form the recommended integrated waste management system.

Estimated costs were grouped as either low, medium/low, medium, medium/high and high for program/policy/implementation tools and for facility/infrastructure. Two different ranges were developed to account for the wide range in costs related to these two different categories. The cost ranges are presented in Table 1.

Table 1: Cost Ranges Used for Options Descriptions

Program/Policy/Implementation Tools Costs

Costs	Low	Medium/Low	Medium	Medium/High	High
Capital Costs	<$500,000	$500,000-$1 million	$1-$3 million	$3-$5 million	>$5 million
Operating Costs	<$100,000	$100,000 - $500,000	$500,000 - $1 million	$1 - $3 million	>$3 million

Facility/ Infrastructure Costs

Costs	Low	Medium/Low	Medium	Medium/High	High
Capital Costs	<10 million	$10-50 million	$50-$100 million	$100-$200 million	>$200 million
Operating Costs	<$1 million	$1-3 million	$3-$6 million	$6-$10 million	>$10 million

It should also be noted that it is difficult to estimate costs and timing for permitting and approvals. For some options (e.g. related to organics management, waste or energy recovery and residual facilities) there are either no examples of facilities being developed in Ontario, or very limited experience in developing such facilities. It is very difficult to

predict how regulations may change in the future and therefore the timing or costing of permitting and approvals. Estimates developed for the option descriptions are based on facilities developed in other jurisdictions and the project team's professional judgement and are meant to be indicative only.

The cost estimates identified will be used for comparative purposes during the evaluation process.

3 List of High Level Options to Meet Future Needs

The following tables present a list of e high-level options identified to meet the City's future waste management needs, a brief description of each and whether the option proceeded to the evaluation stage or not. Detailed descriptions of each option can be found in Appendix A.

1. Promotion & Education

Option	Option Description	Outcome
1A1 – Develop and Implement New/Expanded Outreach Initiatives	This option would see the City develop new outreach initiatives and expand existing outreach programs to support Solid Waste Master Plan goals and programs. The outreach initiatives would go beyond providing program information and target specific actions and behaviours that are necessary for optimal waste avoidance, program performance and waste diversion.	Proceeded to the evaluation stage.
1A2 – Develop and Maintain Dedicated Waste Portal	This option involves the development and implementation of a dedicated waste portal on the City's website. The portal would be an interactive and informative space where residents and stakeholders (e.g. school board etc.) could access a wide range of solid waste-related information.	Proceeded to the evaluation stage.
1A3 – Develop and Implement Call-Click-Visit Campaign	This option involves developing and implementing a Call-Click-Visit Campaign. This multi-faceted campaign would provide the opportunity to target larger audiences by providing different options on how residents can obtain information to participate and engage in waste management programs.	Proceeded to the evaluation stage.
1A4 – Develop and Implement Food Waste Reduction Education Initiatives	This option involves developing and implementing food waste reduction initiatives to educate residents and build awareness of food waste and its impact.	Proceeded to the evaluation stage.

Option	Option Description	Outcome
1A5 – Behavioural Change Management Strategy	The City would develop an overarching Behavioural Change Management Strategy to achieve waste avoidance, reduction and diversion goals and objectives. The strategy would facilitate change by understanding the habits and behaviours behind current waste management and disposal practices and leveraging behavioural science to identify approaches for adapting these behaviours or creating new ones that will improve waste avoidance, reduction and diversion.	Proceeded to the evaluation stage.
1B1 – Develop and Implement Educational Initiatives	This option would see the City develop and implement new educational initiatives aimed at educating residents on the importance of and how to avoid, reduce and divert waste. The educational initiatives would go beyond providing program information and target specific actions and behaviours that are necessary for optimal waste avoidance, program performance and waste diversion.	Proceeded to the evaluation stage.
1C1 – Develop and Implement Marketing & Communication Tools	This option would see the City develop and deploy new marketing and communication tools. This could include scheduled newsletters or blogs, a TV/video series (including on YouTube), displays in public spaces, print materials, direct mail, targeted campaigns, collection staff appreciation programs, etc.	Proceeded to the evaluation stage.

2. Regulations, Policies, By-laws

Option	Option Description	Outcome
2A1 – Disposal Bans	Disposal bans are a policy mechanism that prohibit certain materials or items from being disposed of in a landfill and require alternative disposal or recycling options are in place before being implemented.	Proceeded to the evaluation stage.
2A2 – Single-Use Item Reduction Strategy	This option involves the development of a single-use item reduction strategy to address single use items, including plastic and expanded polystyrene (EPS), as well as and other materials, such as paper-based items. The strategy would encompass City facilities and operations.	Proceeded to the evaluation stage.
2B1 – Enforce Set-out Limits for Garbage and Reduce Container Limit	The intent of implementing limits on the number of garbage bags, containers or items set out at the curb is to increase participation in the City's waste diversion programs and reduce the amount of garbage sent to the Trail Waste Facility landfill. The equivalent reduction in the curbside set-out limit would also be applied to the multi-residential garbage allocation for each building.	Proceeded to the evaluation stage.
2B2 – Mandatory Waste Diversion in all City Facilities	This option would see the City implementing mandatory waste diversion in all City facilities. This could include diversion of any or all of the following: blue and black box recyclables; green bin organics; electronics; hazardous waste (e.g. batteries, hazardous waste from City operations); and other materials (e.g. textiles (sheets, towels, uniforms), construction and demolition materials).	Proceeded to the evaluation stage.
2B3 – Enforce Source Separation Requirements for Recycling and Organics	This option looks at enforcing the current source separation provisions contained within the Solid Waste by-law requiring garbage be separated from recycling and/or green bin material. It would apply to all sectors receiving the City's waste collection service.	Proceeded to the evaluation stage.

Option	Option Description	Outcome
2B4 – Mandatory C&D Waste Diversion	In support of this option, the City could extend its curbside collection ban to include C&D waste to include renovation waste, which is currently collected at the curb, pending viable recycling options or end markets.	Proceeded to the evaluation stage.
2B6 – Making Green Bin a Prerequisite to Receive City Waste Management Services	This option would see the City implement requirements for all multi-residential properties to implement and participate in the City's Green Bin program in order to receive City waste management services	Proceeded to the evaluation stage.
2C1 – Develop a Circular Economy Strategy	This option would involve the development of a dedicated cross-departmental Circular Economy Committee, with support from external stakeholders and industry experts that would work to develop a community and organization Circular Economy Strategy and action plan and work collectively to implement it.	Proceeded to the evaluation stage.
2C2 – Supporting Waste Minimization and Diversion at Special Events	This option would see the City develop a plan to phase-in additional waste management requirements at small and large events over the short, medium and long term.	Proceeded to the evaluation stage.
2C3 – Multi-residential Building Development Standards	The City would enhance the Multi-residential Building Development Standards to support waste diversion and reuse and sharing of resources under the City's development review process. The City would review and update the Development Standards to incorporate more recent better practices that support increased resident participation in waste diversion programs and reuse activities.	Proceeded to the evaluation stage.
2C4 – Chute Closure Program at Multi-residential Buildings	The City would implement a chute closure program at Multi-residential buildings that have single chutes for garbage to facilitate waste diversion.	Proceeded to the evaluation stage.

Option	Option Description	Outcome
2C5 – Pay-As-You-Throw (PAYT)	In this option the City would undertake a financial analysis of its waste management system costs to assign costs based on the services provided and review ways to recover some or all of those costs from the various users (e.g., collection, multi-residential) beyond the current fees in place at the Trail Waste Facility and the Yellow Bag Program for small businesses.	Proceeded to the evaluation stage.
2D1 – Waste Diversion Infrastructure Fee for New Development	The City would implement a Waste Diversion Infrastructure Fee for developers. This policy would require developers of new single-family and multi-residential homes to pay for and/or distribute Green Bins and educational materials to new homes as part of the subdivision/site plan approval process.	Proceeded to the evaluation stage.
2D2 – Development Charges for Waste Diversion Growth	Development charges are one-time fees paid to the City to offset the growth-related capital costs required to provide additional municipal services arising from new development and redevelopment. The City would use development charges to fund growth related waste diversion and collection.	Proceeded to the evaluation stage.
2D3 – Bonds for Green Building	The City would implement a financial mechanism to ensure waste reduction/diversion or waste-related green building standards (Option 2C3) are incorporated into new development and are performing as planned by requiring developers to provide a financial security.	Proceeded to the evaluation stage.
2D4 – Tipping Fee Strategy for Trail Waste Facility	This option would involve the City exploring a tipping fee strategy for the Trail Waste Facility (TWF) that would create an incentive to reduce waste disposal of difficult to manage items at the TWF.	Proceeded to the evaluation stage.

Option 2B5 – Mandatory IC&I Diversion By-law was removed as the industrial, commercial and institutional (IC&I) sector is regulated by the Province, therefore is not in the scope of the solid waste master plan. Only those locations that are currently serviced by the City are considered in scope i.e. multi-residential properties (technically considered part of the IC&I sector under provincial regulations), City-owned facilities, small businesses (through the

Yellow Bag program) and to schools (Green Bin only). These locations are captured under options 2B2 - Mandatory Waste Diversion in all City Facilities and 2B3 - Enforce Source Separation Requirements for Recycling and Organics.

3. Waste Avoidance, Reduction and Reuse

Option	Option Description	Outcome
3A1 – Sharing Space/Swaps/ Sharing Library/Repair Cafes (for various materials)	This option would see the City develop one or more temporary/event based or permanent sharing spaces, swaps, sharing library or repair cafes or partner with community/charitable organizations for materials that can be shared, reused or repaired rather than recycled or disposed of in landfill.	Proceeded to the evaluation stage.
3A2 – Community Reuse Events	This option would see the City develop one or more temporary drop-off events or partner with community/charitable organizations for personal and household goods that can be reused rather than recycled or disposed of in landfill. Items could be dropped off at designated City facilities or other locations. The City could also explore increasing the number of Give Away days from two per year.	Proceeded to the evaluation stage.
3A3 – Develop Specialized Reuse Centre(s)	City would develop one or more permanent reuse centre(s) or partner with community and /or charitable reuse organizations for personal and household goods that can be reused rather than disposed of in landfill. Examples of items include art and craft supplies, office supplies, building materials, furniture, etc.	Proceeded to the evaluation stage.
3A4 – Develop Community Strategies, Opportunities and Partnerships to Increase Reuse and Recycling and Avoid Waste	This option involves the City supporting community-based initiatives that increase reuse and recycling and avoid waste. Some examples include creating a dedicated Team/Group/Committee to implement waste avoidance, reduction and reuse options in the community or supporting for local waste avoidance, reuse, reduction and recycling initiatives.	Proceeded to the evaluation stage.

Option	Option Description	Outcome
3A5 – Develop Corporate Strategy to Increase Waste Avoidance, Reduction, Reuse and Recycling	This option involves the City developing a Corporate Waste Avoidance, Reduction, Reuse and Diversion Strategy to identify how the City as a Corporation will reduce the amount of waste it generates, reuses and recycles at its facilities and in its operations, including single-use items and how to support circular economy principles and zero waste opportunities.	Proceeded to the evaluation stage.
3A6 – Implement a Food Waste Reduction Strategy	This option involves the City implementing a food waste reduction strategy, either by licensing a program such as Love Food Hate Waste or developing its own program to educate residents about food waste reduction.	Proceeded to the evaluation stage.
3A7 - Expand and Improve the Take It Back! Program	This option would see the City work with partners to increase the number of Take It Back! Options for residents. The Program encourages local businesses to “take back” some of the materials (e.g., automotive products, medical supplies, electronics) they sell from residents for reuse, recycling or disposal. This option would also include improvements to the current program.	Proceeded to the evaluation stage.
3B1 – Subsidies, Rebates, Grants for Options that Avoid, Reduce or Reuse Waste	As a way to incentivize waste avoidance, reduction and reuse, the City could award a subsidy, rebate or grant to local residents, resident groups or non-profit organizations for options, ideas or programs that avoid, reduce or reuse waste.	Proceeded to the evaluation stage.

4. Recycling

Option	Option Description	Outcome
4A1 – Textile Waste Diversion Enhancement	The purpose of this option is to look at ways to enhance the current textile waste diversion options that are available through P&E aimed at promoting these different options, allowing more convenient placement of bins throughout the City, subject to regulatory requirements pertaining to public health and safety, property maintenance, and nuisance control and to implement mechanisms to track program performance.	Proceeded to the evaluation stage.
4B1 – Mobile Municipal Hazardous Special Waste Home Collection	This option looks at expanding the City's current Municipal Hazardous or Special Waste (MHSW) program to include more convenient and fully accessible home collection of materials. Residents would call to schedule a collection for which there may be a fee.	Put on hold until the impact of IPR for the MHSW program is better known.
4B2 – Expand Number of Existing Mobile One Day Depots for Municipal Hazardous Special Waste	This option would expand the MHSW collection program to provide additional one day events to increase diversion of MHSW.	Put on hold until the impact of IPR for the MHSW program is better known.
4C1 – Separate Bulky Waste Collection and Recycling	This option explores collecting bulky waste separately from garbage. This may facilitate the separation of some items for recycling (e.g., mattresses, scrap metal, furniture, bulky plastics, clean wood, window glass, etc.) or reuse/upcycling, if possible.	Proceeded to the evaluation stage.
4D1 – Temporary Neighbourhood Drop-off Depots for Divertible Materials	This option involves hosting temporary neighborhood public drop-off depots for divertible materials to make waste diversion more accessible and convenient by accepting several types of divertable materials. Types of material accepted may include electronics, textiles, MHSW, blue box materials and more with the potential for expansion based on disposal waste characterization audit results over time and availability of end markets.	Proceeded to the evaluation stage.

Option	Option Description	Outcome
4D2 – Permanent Neighbourhood Drop-off Depots for Some or All Materials	This option involves establishing permanent neighborhood public drop-off depot(s) to collect materials for reuse, recycling and/or disposal and to make waste diversion/disposal more accessible at convenient locations closer to residential areas.	Proceeded to the evaluation stage.
4D3 – Expanded Drop-off Areas for Divertible Materials at Trail Waste Facility	This option considers providing additional drop-off bays for divertible materials at the TWF, focusing on expanding the Small Loads Facility once it is relocated from the proposed Stage 5 footprint.	Proceeded to the evaluation stage.

5. Collection and Drop-off

Option	Option Description	Outcome
5A1 – Collection of More Materials at the Curb	This option includes having the City offer curbside collection of additional materials such as batteries and electronics, light bulbs (some may be considered hazardous waste), wood pallets, textiles, Styrofoam and construction and demolition (C&D) materials such as wood, drywall and asphalt shingles. Collections would be offered periodically throughout the year or could be by appointment.	Proceeded to the evaluation stage.
5A2 – Expanded Diversion Program at City Facilities and Operations	This option reviews the opportunity for the City to implement a standardized recycling and green bin program across all of its facilities and operations. It also reviews the possibility for the City to roll out other waste diversion programs for batteries, cartridges/toners, electronics, office furniture, needle collection and scrap metal in its facilities and operations.	Proceeded to the evaluation stage.
5B1 – In-Ground Collection Containers	N/A	Was consolidated with Option 5C2 - Use of Alternate Collection Containers in Parks, Public Spaces and Multi-residential Properties.

Option	Option Description	Outcome
5B2 – Optibags	This collection system would require the use of colour coded plastic film collection bags for selected waste streams such as garbage, recycling and source separated organic waste to enable collection of the bags together, in a single truck or receptacle to reduce collection costs and contamination. Customers would sort their waste streams into different coloured bags and place all the bags in a single waste collection receptacle such as a bin or cart. An optical sorting facility that has camera/software technology to recognize the different bag colours and materials would sort the waste into different streams for processing.	Proceeded to the evaluation stage.
5B3 – Vacuum Collection System	This option may require the City to work with developers to implement vacuum collection as part of new multi-residential or IC&I developments. It may also be relevant to City revitalization or renewal projects. Additional consideration will need to be given to couple the system with the Optibag.	Proceeded to the evaluation stage.
5B4 – Automated Cart Collection for Curbside Garbage	This option would require the City to switch to cart-based curbside collection of garbage using carts.	Proceeded to the evaluation stage.
5B5 – Clear Bags for Curbside Garbage	This collection option requires residents to place garbage in clear/transparent bags at the curb for collection. Typically, one or more smaller opaque bags are allowed to be placed in the clear bags for privacy or a separate black garbage bag is permitted in addition to the clear bags.	Proceeded to the evaluation stage.

Option	Option Description	Outcome
5B6 – Single Stream Collection of Recycling	This option would see the City switch to single stream (SS) recycling for the remaining customers it services after the Blue Box recycling program is transitioned under Individual Producer Responsibility (IPR). Customers would be able to place recyclable materials into one bin/carts without separating them into fibres or containers (i.e. Blue or Black Bin materials).	Put on hold for consideration until final Blue Box regulations are released by the province and the City has clear direction on which programs it will continue to manage versus which programs producers will become 100% responsible for managing.
5C1 – Waste Diversion Program in Parks and Other Public Spaces	This option considers implementing a broad-scale, comprehensive waste diversion program, with recycling and/or organics bins in parks and public spaces across the City. This option has incorporated the former Option 5B1 – In-Ground Collection Containers.	Proceeded to the evaluation stage.
5C2 – Use of Alternate Collection Containers in Parks, Public Spaces and Multi-residential Properties	The option reviews the use of alternative waste collection containers in parks and public spaces across the City.	Proceeded to the evaluation stage.
5D1 – RFID Technology on Waste Collection Containers	Implementation of this option will require the City to equip containers with radio-frequency identification (RFID) capabilities to gain information about collection services and performance and ensure systems are in place to capture the information on vehicles or programs.	Proceeded to the evaluation stage.

Option	Option Description	Outcome
5D2 – Undertake a Review of the Yellow Bag Program	In this option, the City would undertake a review of the Yellow Bag program, including eligibility requirements and impacts on Individual Producer Responsibility (IPR) for the recycling portion of the program.	Proceeded to the evaluation stage.
5D3 – Identify Curbside Collection Efficiencies	The City would undertake a curbside collection efficiency study, including a business case review, to determine contract requirements in advance of the 2030 curbside collection contract being awarded. The study would consider costs, servicing the collection needs of a growing City and how to reduce GHG emissions related to collection of waste.	Proceeded to the evaluation stage.

6. Organics Management

Option	Option Description	Outcome
6A1 – Aerobic Composting	This option explores the development of an aerobic composting facility to process household organics (e.g., food waste, soiled paper products, diapers, pet waste).	Proceeded to the evaluation stage.
6A2 – Anaerobic Digestion (AD)	This option explores the use of AD technology to process household organics (e.g., food waste, soiled paper products, pet waste), as well as diapers and sanitary products. This option could produce a renewable source of energy to achieve the City's Energy Evolution Strategy Renewable Natural Gas Strategy project objectives and 100% GHG reduction target in the City's Climate Change Master Plan.	Proceeded to the evaluation stage.
6A3 – Animal Feed Production	This option involves processing food waste into animal feed or other feed by-products. Food waste would be heat treated, dehydrated, and either mixed with dry feed or fed directly to animals. Insects can also be used to process food waste into animal feed or other products, such as black soldier flies.	Proceeded to the evaluation stage.
6A4 – Co-digestion of Sewage and Organics at ROPEC or Co-location of Anaerobic Processing Facility for Organics at ROPEC	This option explores the co-digestion/co-location of a new anaerobic digester to process household organics at the Robert O. Pickard Environmental Centre (ROPEC) wastewater treatment facility which currently uses anerobic digestion (AD) to process sewage sludge.	Proceeded to the evaluation stage.
6A5 – On-Site Organics Management	The City would support on-site management of organic waste by residents to help reduce the amount of material collected and managed by the City through its waste management programs.	Proceeded to the evaluation stage.
6B1 – Separate Composting of LYW	Under this option, LYW would be collected and processed separately from Green Bin organics.	Proceeded to the evaluation stage.

Option	Option Description	Outcome
6B2 – Gasification of LYW	This option reviews the City developing a gasification facility to process LYW either prior to or when its existing processing contract ends in 2030.	Proceeded to the evaluation stage.

7. Waste and Energy Recovery

Option	Option Description	Outcome
7A1 – Mixed Waste Processing (Mechanical Pre-sort Only)	This option would involve the development of a mechanical pre-sort facility to recover some recyclables and organic materials and does not include facilities to process recyclables, organics or other materials (including into refuse derived fuel (RDF)).	Proceeded to the evaluation stage.
7A2 – Mechanical Biological Treatment (MBT)	This option involves the development of a MBT facility to recover recyclables and organics from the City's garbage. It would include a pre-sort facility, an organics treatment facility and could include a facility to create refuse derived fuel (RDF) from the residue.	Proceeded to the evaluation stage.
7A3 – Mass Burn Incineration (Direct Combustion)	This option examines the possibility of the City developing a mass burn incineration facility to manage post-diversion residual waste.	Proceeded to the evaluation stage.
7A4 – Emerging Technologies (Gasification, Pyrolysis, Hydrolysis, Chemical Recycling)	This option includes the development of a facility that would employ an emerging technology to manage some portion of the City's waste stream (e.g. garbage, organics, and plastics).	Proceeded to the evaluation stage.
7A5 – Landfill Mining at Trail Waste Facility landfill	This option could involve removing materials to recover a combustible fraction, recyclables, metals, construction & demolition materials (C&D), soil, and/or hazardous waste (to be treated). This option looks at the requirements and implications of mining the Trail Waste Facility landfill, specifically to gain landfill space.	Proceeded to the evaluation stage.

Option	Option Description	Outcome
7A6 – Landfill Gas Management Strategy	Under this option, the City would develop a Landfill Gas Management Strategy that considers the City's current commitment through the PowerTrail agreement and the Climate Change Master Plan greenhouse gas (GHG) reduction targets. The strategy would also consider the Renewable Natural Gas Strategy project identified in the City's Energy Evolution Strategy.	Proceeded to the evaluation stage.

8. Residual Management

Option	Option Description	Outcome
8A1 – Purchase an Existing Landfill	This option looks at the requirements and implications of purchasing an existing landfill with sufficient remaining approved capacity (i.e. > 10 years) to serve the City's future needs, to supplement current disposal capacity at TWF or be subsequent to the TWF closure.	Proceeded to the evaluation stage.
8A2 – Use of a Private Landfill	This option looks at the requirements and implications of using an existing landfill to supplement current disposal capacity at TWF or be subsequent to the TWF closure via contract with a private owner and/or operator of a landfill facility.	Proceeded to the evaluation stage.
8A3 – Develop a New Landfill	This option looks at the requirements and implications of siting and developing a new landfill to supplement current disposal capacity at TWF and/or be subsequent to the TWF closure. The City could develop a new landfill located inside City limits or outside City limits, in another municipality.	Proceeded to the evaluation stage.
8A4 – Trail Waste Facility Landfill Expansion	This option examines the possibility of expanding the approved capacity of TWF.	Proceeded to the evaluation stage.
8A5 – Trail Waste Facility Optimization Strategy	The Trail Landfill Optimization Strategy considers optimizing landfill operations over and above what is currently done to continually optimize landfill operations in order to increase the remaining capacity and extend the site life of the landfill.	Proceeded to the evaluation stage.

9. Innovation

Option	Option Description	Outcome
9A1 – Innovation and Technology Strategy	The City would develop a strategy to integrate innovation into solid waste technologies and approaches. The Solid Waste Innovation and Technology Strategy would help the City proactively match it's short, medium and long-term waste management needs with innovation and technology solutions that will help address key challenges and drive the City towards its Zero Waste, Circular Economy and Climate Change Master Plan Goals.	Proceeded to the evaluation stage.

10. Other

Option	Option Description	Outcome
10A1 – Future Use of Bufferlands Around Trail Waste Facility and Nepean Landfill	The City owns a number of properties abutting or in the vicinity of the Trail Waste Facility (TWF), which are commonly referred to as the 'bufferland properties'. This option is to complete the review of potential alternate and additional uses for these lands.	Did not proceed to the evaluation stage.
10A2 – Working Towards a Zero Emissions Solid Waste Fleet	This option builds on the City's past and future Green Fleet related work and the Energy Evolution Strategy. It would consider opportunities such as different fuel types, including Renewable Natural Gas (RNG) and hybrid or electric vehicles for the solid waste fleet, which includes residential waste collection trucks, landfill equipment, trucks used to collect waste from parks and other public spaces such as transit stops, as well as other vehicles used by solid waste staff to carry out their work.	Proceeded to the evaluation stage.

4 Next Steps

Options that are recommended to proceed to the evaluation stage will be evaluated using the triple bottom line methodology developed in consultation with the City and stakeholders. This process will identify a short-list of the highest-ranking options that are in alignment with the City's future needs, vision, guiding principles and goals, and will be used to develop two integrated waste management systems; a moderate and aggressive system, that the City will seek resident and stakeholder feedback on as part of Engagement Series 2.

Following Engagement Series 2, feedback from residents, stakeholders and members of Council will be used to develop the City's SWMP. This would include the core system components for waste recovery, processing and disposal, with secondary considerations (e.g., implementation tools, programs, policies) layered on for the various sectors to which the City provides service.

Appendix A

Memo

1. Promotion and Education

1A1 – Develop and Implement New/Expanded Outreach Initiatives

Category:	Implementation Tool
System Overview:	• This option would see the City develop new outreach initiatives and expand existing outreach programs to support Solid Waste Master Plan goals and programs. The outreach initiatives would go beyond providing program information and target specific actions and behaviours that are necessary for optimal waste avoidance, waste diversion and program performance. Specific initiatives would be tailored using an evidence-based approach, for example, using waste audit data and would be informed by the market research been done on resident's behaviour and attitudes towards waste. • Initiatives would typically be characterized as direct interactions with people (either in person or virtually) that engage participants and can be targeted towards specific materials, behaviours, programs or sectors (e.g. the multi-residential sector). • This option could include undertaking engagement initiatives such as waste awareness and reduction campaigns, promotion of nationally or internationally recognized certification programs (e.g. 3R Certified Program), waste awareness events, appreciation events, promotion of waste reduction and diversion competitions and challenges, ambassador programs, community breakfasts (e.g. Metro Vancouver sustainability issues) and public art projects. • The initiatives could be developed and delivered by the City themselves or in partnerships with local organizations, for example, groups that offer programs and events to newcomers to Ottawa. The City may wish to consider partnering with faith-based or new Canadian organizations to expand the reach to new residents to Ottawa and/or minority groups. The City could also partner with educational institutions to develop new initiatives to effect behaviour change based on research. • Building on the work that the City has done on identifying different audiences and their attitudes and behaviours related to solid waste, the City will need to find new and different ways from the traditional P&E approaches to engage people who are not participating in the City's programs, and to educate them about new programs and initiatives. The City will need to continually look for ways to reach and engage people through the use of social marketing tactics, relatable terminology, understandable measures of success, simplified explanations of environmental impacts, more information on what happens to garbage, recycling and organics in the City, etc., in order to overcome barriers for change to desired behaviours to reduce and divert waste.

Category:	Implementation Tool
Status:	• Proven • All municipalities utilize outreach programs to educate residents and businesses and raise awareness of waste avoidance, reduction, reuse and recycling.
Source of Option:	• Consultant, Staff, Consultations, City Councillors
Proposed Strategic Alignment:	Goals: • 2. Reduce waste generation. • 3. Maximize the reuse of waste. • 4. Maximize the recycling of waste. • 6. Aspire to achieve 100% GHG emission reductions. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles • Change community values. • Protect the environment.
Needs Assessment Alignment:	• Aligned with the need to expand and/or modify technologies and approaches used to reach the City's diverse customer base, to create the desired behavioural changes and to support program priorities.
Individual Producer Responsibility (IPR) Impact:	• Partial impact - unknown what role City will have in educating about recycling and Municipal Hazardous Special Waste (MHSW) programs.
System Consideration:	• Core system requirement.
Sector Applicability:	• Applicable to all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Environmental benefits of outreach efforts will vary, depending on the initiative and desired behaviour changes. Benefits could include improved waste avoidance, increased waste diversion and reduced GHG emissions through individual behavioral changes and actions resulting in waste reduction. • No direct impacts on air/water quality.

Category:	Implementation Tool
Social Considerations:	• Change requires residents to move away from consumption lifestyle to conservation lifestyle, which is not easy nor desirable for some. • Residents need to change their behaviour and participate in programs to effect change. • New programs or initiatives may increase accessibility, equity and inclusion through hosting in-person events, however, events held virtually would only cater to those with internet access.
Technical/ Operational Considerations:	• Minor operational considerations. City will need to develop and execute additional outreach initiatives and programs, retain external resources to assist or find a partner to assist with development and delivery of programs. • Leverage the market research undertaken and waste audit data to inform development of initiatives.
Regulatory Considerations:	• No approvals required.

Category:	Implementation Tool
Financial Considerations:	• Capital costs for new or major solid waste program changes should include costs for an education and outreach campaign to support users in adapting to changes necessary for the program to be successful. Costs could be in the order of $1.00 to $2.50 per household for a multi-media campaign and up to $5.00 per household when individual engagement is required for major change initiatives. • Operating costs to support ongoing initiatives are anticipated to be medium/low ($100,000 to $500,000) and a portion of the annual budget can be allocated to support targeted campaigns (e.g. material or sector) based on waste diversion and operational priorities, noting that the City spent $163,000 in 2019 for promotion and education on changes to the Green Bin program. • There will be additional staffing requirements for new and ongoing initiatives over and above current outreach activities. An additional one to two staff may be required for future program changes that require engagement and follow up. These costs are anticipated to be medium/low ($100,000 to $500,000). May be costs associated with any pre- and post- performance monitoring to determine the success of specific campaigns (e.g. waste audits), anticipated to be medium/low ($100,000 to $500,000) • May be costs associated with market research, such as conducting focus groups, user testing and more in-depth social marketing studies to understand barriers for behaviour change in order to develop appropriate promotion and education (P&E) materials that support outreach initiatives. These costs are anticipated to be medium ($500,000 to $1 million). • P&E initiatives will require coordination and will be designed based on the waste management program design/objectives and desired user behaviour of the target audience. The resulting P&E program plan will include the use of a combination of tactics including, but not limited to, market research, focus groups, use of waste audit and program performance data, outreach, education, marketing and multi-media communications (in person, phone, web-based, social media, radio, direct mail, print, radio, video, apps, etc.). As a result, costs identified for this option may be lower once a coordinated plan is developed that considers what components can be used across multiple options.
Unknowns/ Assumptions:	• Assume a variety of tools and techniques are utilized to cover various needs and demographics. • Unknown if City would develop and deliver initiatives or partner with another organization. • Unknown what tools producers will use for P&E regarding new Blue Box and MHSW programs and what level of City P&E would be required once these programs transition to IPR.

Category:	Implementation Tool
Supporting System Requirements for Success:	• Tools and programs are required when implementing new programs or services, and on an on-going basis to continue to promote and educate residents on existing programs and services. • May require the assistance of City's Public Information and Media Relations Department. • Regular and detailed waste audits are required to track program performance and to inform future outreach initiatives.
Potential Outcomes:	• Potential to indirectly increase waste diversion, waste reduction and waste avoidance. • Potential to increase the life of Trail Waste Facility landfill.
Measurement:	• Program specific measures can be identified (e.g. number of participants, desired behaviour change, etc.) Reach of social media campaigns can be measured by number of views and time spent viewing information. • Waste audits can be used to identify materials for targeted campaigns and follow up audits can identify if the P&E campaign successfully changed behaviour.
Case Study #1:	• Simcoe County utilizes a 35' trailer as a mobile education unit (MEU) with a variety of interactive stations, primarily aimed at school children. It serves as a travelling classroom and can visit schools (suspended due to COVID-19). • There are four different interactive stations to engage and educate students on waste reduction and diversion programs in a fun and engaging manner. The stations are laid out in a streetscape, following the lifecycle of a product starting at the purchase of the product, educating users on the best way to shop at the grocery store. The stations also engage users on how to properly sort and divert products and what happens to products for final processing and disposal. • The mobile concept was developed as Simcoe County encompasses a large geographic area. The MEU has been operating since 2011 and at that time, had an initial set-up cost of $196,300 with annual operating costs of $65,000. • Simcoe County tracks program results by number of public/outreach events, feedback forms at events, surveys and participation studies.1 During the first five years (2011 to 2016), the MEU was used at more than 120 events and has reached more than 29,000 participants.

[1] CIF Project 276 and Mobile Education Unit (MEU) - Solid Waste Management (simcoe.ca)

Category:	Implementation Tool
Case Study #2:	• In 2017, Peel Region undertook a campaign to reduce contamination in their recycling stream. The approach was to test out a digital-only marketing approach, focusing on one contamination issue at a time over two phases. • In 2017, the campaign used the slogans “Let them Loose!” and “Set Them Free” and aimed to educate residents about the impacts of placing recyclables inside plastic shopping bags, tying them shut and placed into the carts. Tactics used included a video, website, social media (Google, Twitter, Facebook) and email. The video showed what happens to recyclables placed in small shopping bags at the Materials Recovery Facility (MRF) and how the bags can end up in landfills and had 1.9 million views. This campaign resulted in decreased bagged recyclables entering the MRF (50% reduction) and the associated savings from avoided residue costs and revenue from the sale of materials (estimated at $55,000 in avoided residue costs and $57,000 in added revenue). • The second phase of the campaign took place in 2018 and focused on cleaning out food from recyclable containers prior to placement in recycling carts. The slogans “sticky situations” and “Too much on your plate” were used with the same tools and tactics as the first phase, including a video that got almost 1.2 million views. The Region did not observe any significant changes in the amount of food contamination entering the MRF[2].
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[2] Continuous Improvement fund: digital media

1A2 – Develop and Maintain Dedicated Waste Portal

Category:	Implementation Tool
System Overview:	• This option involves the development and implementation of a dedicated waste portal on the City's website. The portal would be an interactive and informative space where residents and stakeholders (e.g. school board etc.) could access a wide range of solid waste-related information and be optimized for use with mobile phones. • The portal could include providing links to local resources, podcasts, virtual presentations, tutorials and workshops, as well as virtual tours of the recycling, organics processing and landfill facilities, advertising/promoting waste related events and social media contests, highlighting local success stories and donation opportunities, providing fund and interesting facts on waste reduction and diversion, TV and radio interviews, and best practices from other jurisdictions. It could also serve as a medium for an exchange of knowledge between senior and youth citizen groups. • The portal could also consider the use of artificial intelligence to help residents obtain information on the City's waste programs. • This option could be developed and delivered by the City themselves or in collaboration with an IT provider.
Status:	• Proven • Municipalities utilize waste portals to educate residents and businesses and raise awareness of waste reduction, reuse and recycling.
Source of Option:	• Staff
Proposed Strategic Alignment:	Goals: • 1. Reduce waste generation. • 3. Maximize the reuse of waste. • 4. Maximize the recycling of waste. Guiding Principles: • Change community values. • Protect the environment.
Needs Assessment Alignment:	• Supports the need to expand and/or modify technologies and approaches used to reach the City's diverse customer base, to create the desired behavioural changes and to support program priorities. • Tied to supporting increased curbside and multi-residential waste diversion performance by increasing participation in the City's residential waste diversion programs. • Also tied to increasing participation and the waste diversion rate in the multi-residential sector.

Category:	Implementation Tool
Individual Producer Responsibility (IPR) Impact:	• Partial – unknown if recycling or Municipal Hazardous Special Waste would be included.
System Consideration:	• Secondary – will be an implementation tool to overlay onto core system.
Sector Applicability:	• Applicable to several sectors: Single Family (SF), Multi-residential (MR) and Partner Programs (PP).
Environmental Considerations:	• P&E activities support improved waste avoidance, reduction and diversion. • No direct impact on greenhouse (GHG) emissions. • No direct impacts on air/water quality. • Impacts may be indirect as a result of changes to behavior.
Social Considerations:	• Waste portal may increase accessibility, equity and inclusion but, caters to those who have access to the internet. • Residents need to change their behavior and participate in programs to effect change.
Technical/ Operational Considerations:	• Minor operational considerations. • City will need to develop and deploy the waste portal, which can take significant staff time. It will also need to be updated regularly. • City will need to ensure portal meets current architectural design, Accessibility for Ontarians with Disabilities Act (AODA) requirements and is bilingual.
Regulatory Considerations:	• No approvals required.
Financial Considerations:	• The capital cost to develop the portal is estimated to be medium low ($100,000 to $500,000). There are no annual operating costs. Existing staff would do any updates to the portal once it is developed.
Unknowns/ Assumptions:	• Unknown if City would develop and deploy waste portal themselves or contract the service out.
Supporting System Requirements for Success:	• Web portal would need to be updated on an on-going basis to continue to promote, advertise and engage with residents about programs, services, events and information. • May require the assistance of City IT support.
Potential Outcomes:	• Potential to indirectly increase waste diversion, waste reduction and waste avoidance. • Providing more information in a clear manner could increase participation in City diversion programs and reduce waste, which could potentially increase the life of the Trail Waste Facility landfill.

Category:	Implementation Tool
Measurement:	• Reach of web portal can be measured by number of views and time spent viewing information. • Tonnages of waste could be tracked over time.
Case Study #1:	• In addition to the operational information posted on the Metro Vancouver region's website, this federation 21 B.C. municipalities has developed separate waste related websites, each one with a less formal, more visually appealing look and feel (i.e. lots of images, funny videos etc.). The website "Create memories, not garbage" offers tips for a waste-free holiday season, from decorating to eating, gifting and wrapping presents. "Think thrice about your clothes" encourages people to reduce textile waste by shopping sustainably, by repairing, altering or repurposing the clothes residents already own or donating or recycling what they no longer wear. It also has a community forum for people to post their own tips and tricks. A third website is entirely dedicated to Metro Vancouver's annual Zero Waste Conference.
Case Study #2:	• Extensive waste information can be found in the Home and Property section on the Halifax Regional Municipality's website. It contains a news portal and links to a number of electronic tools, e.g. a Facebook page called "Halifax Recycles", featuring initiatives like "Wasteless Wednesdays"; a YouTube video on how to get a collection calendar app; waste reduction YouTube tutorials; instructions on how to book a wide range of free waste-related workshops; downloadable PDF files of garbage, organics and recycling signs and posters for use at home, school or business; an anti-litter campaign; hazardous household waste information; and a search engine for disposal questions,
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

1A3 – Develop and Implement Call-Click-Visit Campaign

Category:	Implementation Tool

System Overview:	• This option involves developing and implementing a Call-Click-Visit Campaign. This multi-faceted campaign would provide the opportunity to target larger audiences by providing different options on how residents can obtain information to participate and engage in waste management programs.
	• There are three aspects to this campaign:
	  ○ The “Call” tactic would allow residents to listen to prerecorded robo calls.
	  ○ The “Click” tactic would be an online platform with a blog, videos, games and contests.
	  ○ The “Visit” tactic would be in-person events to educate and engage residents which could include mall kiosks, visual displays, Ambassador Program, speakers series, refurbished food truck/trailer to be used as a mobile education booth etc.
	• Topics for each tactic could focus on reuse, repurpose/refurbish, reduce, refuse/rethink, reclaim, renew and/or redesign.
	• This option could also consider the use of artificial intelligence to help residents obtain information on the City’s waste programs.
	• The online portion of the campaign would be optimized for use with mobile phones.
	• This option could be developed and delivered by the City themselves or in collaboration with an IT provider.

Status:	• Proven • Many municipalities utilize different aspects of Call-Click-Visit campaigns to educate residents and businesses and raise awareness of waste reduction, reuse and recycling.
Source of Option:	• Staff

Category:	Implementation Tool
Proposed Strategic Alignment:	Goals: • 1. Reduce waste generation. • 3. Maximize the reuse of waste. • 4. Maximize the recycling of waste. • 7.Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 8.Maximize participation by enhancing the accessibility, convenience, consistency and affordability of waste management programs and services. Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Protect the environment.
Needs Assessment Alignment:	• Supports the need to expand and/or modify technologies and approaches used to reach the City's diverse customer base, to create the desired behavioural changes and to support program priorities. • Tied to supporting increased curbside waste diversion performance by increasing participation in the City's residential waste diversion programs. • Also tied to increasing participation and the waste diversion rate in the multi-residential sector.
Individual Producer Responsibility (IPR) Impact:	• Partial – unknown if recycling or Municipal Hazardous Special Waste would be included.
System Consideration:	• Secondary – will be an implementation tool to overlay onto core system.
Sector Applicability:	• Applicable to most sectors: Single Family (SF), Multi-residential (MR), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• P&E activities support improved waste avoidance, reduction and diversion. • No direct impact on greenhouse gas (GHG) emissions. • No direct impacts on air/water quality. • Impacts may be indirect as a result of changes to behavior and increase waste avoidance, reduction, reuse and recycling.
Social Considerations:	• The various campaign tactics may increase accessibility, equity and inclusion, especially since three options to obtain information are provided (phone, internet, in-person). • Residents need to change their behavior and participate in programs to effect change.

Category:	Implementation Tool
Technical/ Operational Considerations:	• Minor operational considerations. • City will need to develop and execute campaign tactics or find a partner to assist with development and delivery. • Will require significant staff time to develop and execute the campaign.
Regulatory Considerations:	• No approvals required.
Financial Considerations:	• Capital cost for the development and implementation is estimated to be low (<$500,000) at $500,000. • There would be low annual operating costs associated, as existing staff would be used to create and update content, update website and attend events.
Unknowns/ Assumptions:	• Assume a variety of tools and techniques are utilized to cover various needs and demographics. • Unknown if the City would develop and deliver campaign or partner with a third party.
Supporting System Requirements for Success:	• Campaign tactics would need to be updated on an on-going basis to continue to promote, advertise and engage with residents about programs, services, events and information. • May require the assistance of City's Public Information and Media Relations (PIMR) Department.
Potential Outcomes:	• Potential to indirectly increase waste diversion, waste reduction and waste avoidance. • Providing more information in a clear manner could increase participation in City diversion programs and reduce waste which could potentially increase the life of the Trail Waste Facility landfill.
Measurement:	• Reach of "Call" tactic can be measured by numbers of calls and time spent on the call. • Reach of "Click" tactic can be measured by number of views and time spent viewing information. • Reach of "Visit" tactic can be measured by number of participants or number of events. • Tonnages of waste could be tracked over time.
Case Study #1:	• Different levels of governments, including municipalities, develop specific campaigns to inform people of the different ways that they are able to obtain information on a range of different programs, services and initiatives. Increasingly, municipalities have recognized that residents like to receive information on City programs and services in different formats and have adapted to suit these needs. Approximately 10 years ago, Service Canada implemented a Call-Click-Visit campaign, which enabled residents of Canada to either call for information, access it online or visit in-person.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

1A4 – Develop and Implement Food Waste Reduction Education Initiatives

Category:	Implementation Tool
System Overview:	• This option involves developing and implementing food waste reduction initiatives to educate residents and build awareness of food waste and its impact. • This could include initiatives such as virtual or in-person waste-free cooking classes or events, rapid messaging about food waste and Green Bin use at events such as Farmers' Markets, expanding existing P&E campaigns and materials, and creating educational material regarding meal planning, how to tailor grocery shopping to avoid impulse buys, and proper transport and storage of perishable food. • Messaging could be done in collaboration with Ottawa Public Health and could leverage initiatives such as the "Love Food, Hate Waste" materials. • An initiative could also include promoting or developing apps, in collaboration with local restaurants, to offer meals at a reduced cost shortly before closure. • The City would ensure that the online initiatives are optimized for use with mobile phones. • This option could be developed and delivered by the City themselves or in partnerships with a third party. • Based on Ottawa's 2018/2019 curbside waste audits, over 46,000 tonnes of food waste was placed in the garbage and over 30,000 tonnes of food waste was placed in the Green Bin. At 50% avoidable food waste3, it is estimated that Ottawa residents are throwing away about 38,000 tonnes of avoidable food waste annually in the garbage and Green Bin. • This option is tied to option 3A6 - Implement a Food Waste Reduction Strategy.
Status:	• Proven • Many municipalities are focusing on the avoidable versus unavoidable food waste and finding ways to communicate approaches to reduce food waste generation.
Source of Option:	• Staff

[3] In Toronto, waste audits have shown that the average single-family household throws away over 200 kg of avoidable and unavoidable food waste annually and avoidable food waste represents over 50% of all food waste generated.

Category:	Implementation Tool
Proposed Strategic Alignment:	Goals: • 1. Reduce waste generation. • 6. Aspire to achieve 100% GHG emission reductions. Guiding Principles: • Change community values. • Protect the environment.
Needs Assessment Alignment:	• Supports the need to expand and/or modify technologies and approaches used to reach the City's diverse customer base, to create the desired behavioural changes and to support program priorities. • Tied to supporting increased curbside waste diversion performance by increasing participation in the City's residential waste diversion programs. • Also tied to increasing participation and the waste diversion rate in the multi-residential sector.
Individual Producer Responsibility (IPR) Impact:	• No impact.
System Consideration:	• Secondary – will be an implementation tool to overlay onto core system.
Sector Applicability:	• Applicable to most sectors: Single Family (SF), Multi-residential (MR), City Facilities/Operations (CF), Programs (PP).
Environmental Considerations:	• P&E activities support improved waste avoidance and reduction. • No direct impact on waste diversion. • Potential to reduce greenhouse gas (GHG) emissions from landfill if food waste is diverted/avoided/reduced. • No direct impacts on air/water quality. • Impacts may be indirect as a result of changes to behaviour.
Social Considerations:	• Residents need to change their behavior and participate in programs to effect change. • The various initiatives may increase accessibility, equity and inclusion.
Technical/ Operational Considerations:	• Minor operational considerations. • City will need to develop and execute initiatives or find a partner to assist with development and delivery. • May require significant staff time to develop, maintain and execute initiative. • Waste audits should be conducted in advance and after each campaign to determine the amount of avoidable versus non-avoidable food waste that is being generated.

Category:	Implementation Tool
Regulatory Considerations:	• No approvals required.
Financial Considerations:	• The capital cost is estimated to be low (<$500,000) at approximately $150,000 to $250,000 to develop and rollout the initial initiative, specific to Ottawa. Alternatively, the City could leverage the Love Food, Hate Waste campaign material and pay the annual licensing fee, which is around $40,000. • Waste audits costs would be medium/low ($100,000 to $500,000). • Annual operating costs are expected to be low (<$100,000) in the order of $50,000 for on-going P&E related specifically to food waste reduction. • Promotion and education initiatives will require coordination and will be designed based on the waste management program design/objectives and desired user behaviour of the target audience. The resulting P&E program plan will include the use of a combination of tactics including, but not limited to, market research, focus groups, use of waste audit and program performance data, outreach, education, marketing and multi-media communications (in person, phone, web-based, social media, radio, direct mail, print, radio, video, apps, etc.). As a result, costs identified for this option may be lower once a coordinated plan is developed that considers what components can be used across multiple options.
Unknowns/ Assumptions:	• Assume a variety of tools and techniques are utilized to cover various needs and demographics. • Unknown if the City would develop and deliver initiatives or partner with another organization.
Supporting System Requirements for Success:	• May require the assistance of the City's Public Information and Media Relations (PIMR) Department. • Tied to option 3A6 - Implement a Food Waste Reduction Strategy.
Potential Outcomes:	• At 50% reduction of avoidable food waste, there may be the potential to divert 23,000 tonnes of food waste from garbage, and approximately 15,000 tonnes of food waste from the Green Bin program every year. • Potential to extend the life of the Trail Waste Facility landfill by approximately one year, depending on waste composition and waste density factor.
Measurement:	• Reach of initiatives can be measured by number of participants or number of events. • May be measured through audits of food waste in the Green Bin and garbage. • May be measured in reduced tonnages of Green Bin food waste being collected.

Category:	Implementation Tool
Case Study #1:	• Love Food Hate Waste4 (LFHW) campaigns engage Canadians to think about how households generate food waste and how by making different decisions when it comes to buying, storing and preparing meals, they can reduce food waste. • The National Zero Waste Council (NZWC), an initiative of Metro Vancouver, launched the LFHW Canada campaign in 2018 as a key deliverable of its strategy to reduce food waste across Canada. At campaign launch, NZWC had several partners including Metro Vancouver, the Capital Regional District and the cities of Toronto, Vancouver and Victoria. • The multi-media campaign provides consumers across Canada tips and ideas to effectively prevent food waste. This national campaign has a common message with a range of partners from local and provincial governments to food retailers and other stakeholders using multiple platforms (e.g. website, social media, in-store promotions, bus shelters, etc.). Materials are developed in both English and French languages. • The LFHW campaign originally started by the Waste and Resources Action Program (WRAP) in the United Kingdom in 2007. It is a proven behavior change campaign that, in its first five years, helped cut avoidable food waste by 21%.
Case Study #2:	• The food recovery initiative, Squatch Food Waste5, was launched in 2018 by Sustainable Connections as part of their Toward Zero Waste Program. The campaign has several business and government partners within Whatcom County, Washington, including the City of Bellingham. • Squatch Food Waste helps educate individuals and business owners on how to “squatch” the amount of wasted food they create. The initiative follows the food reduction hierarchy (reduce, feed others, feed animals, compost, landfill) and provides tips and ideas for each step such as smart shopping, meal prepping and composting. The initiative also connects individuals to local businesses, organizations and farmers to donate surplus food. • The campaign utilizing an animated “Squatch” character and promotes its message via its website, social media, drives and workshops.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[4] Love food hate waste website

[5] Meet Squatch: food waste at home

1A5 – Behavioural Change Management Strategy

Category:	Programs/ Implementation Tools/Strategy
System Overview:	• The City would develop an overarching Behavioural Change Management Strategy to achieve waste avoidance, reduction and diversion goals and objectives. The strategy would facilitate change by understanding the habits and behaviours behind current waste management and disposal practices and leveraging behavioural science to identify approaches for adapting these behaviours or creating new ones that will improve waste avoidance, reduction and diversion. • The strategy would explore how the City's various ongoing and future initiatives could work together to achieve waste management goals. It could guide the development and implementation of campaigns and programs. The strategy could initially focus on opportunities that have been identified through previous green bin market research, the Green Bins in Schools program, the Multi-Residential Diversion Strategy and waste audit studies. • Behaviour change is at the heart of many waste reduction and diversion efforts and it will be critical to their success. Behaviours need to shift away from waste creation and disposal to waste avoidance, reduction, reuse and recycling. Making this change requires a shift in the capabilities, motivations and opportunities for residents to reduce and divert their waste. It's about changing individuals' habits and scaling up to entire communities and cities. This is needed because waste reduction and diversion are big challenges that require collective changes. • Behaviour change starts with a good diagnosis of the behaviour and what needs to change, before coming up with a strategy or solutions. This establishes a framework for moving from understanding to action. Changing behaviour is a complex process. Multiple levels of intervention strategies (e.g. education, incentives, restrictions, training) and policies (e.g. fiscal measures, regulation, service provision, and marketing) are often needed to implement and sustain the desired changes over time. • Behaviour science can help us understand how to best put policy into practice. For example, a plastic bag tax is an example of a transparent nudge that has been introduced by some governments. The cost is usually low enough that it shouldn't have an impact on behaviour, but even a low bag tax can be surprisingly effective. Behaviour scientists suggest that the tax achieves this by sending a signal that it isn't good to use plastic bags. • A conventional approach might only look at ways to raise awareness. A behaviour insights approach is more systematic, trying to understand the drivers and opportunities for change. This supports the development of communications and outreach plans and campaigns to address each of the issues and barriers, while also making it convenient and cost effective to change behaviour. • Some behaviour changes can be simple, yet effective. For example, studies have shown that an impactful way of reducing food waste from a cafeteria is to remove the tray, so it's a little more difficult for people to carry their food, and they end up taking less. Other changes can be on a much larger scale, such as the research and rollout for the green bin program change that introduced the use of plastic bags to encourage more residents to participate in the City's green bin program.

Category:	Programs/ Implementation Tools/Strategy
System Overview:	• Some behaviour changes can be simple, yet effective. For example, studies have shown that an impactful way of reducing food waste from a cafeteria is to remove the tray, so it's a little more difficult for people to carry their food, and they end up taking less. Other changes can be on a much larger scale, such as the research and rollout for the green bin program change that introduced the use of plastic bags to encourage more residents to participate in the City's green bin program.
Status:	Emerging • Some municipal solid waste initiatives such as education campaigns leverage behavioural science and insights. However, behavioural change management strategies for waste avoidance, reduction and diversion at the municipal level are not common.
Source of Option	• Consultations, Staff
Proposed Strategic Alignment:	Goals: • 1.Extend the life of the Trail Road Landfill. • 2.Reduce the amount of waste generated. • 3.Maximize the reuse of waste. • 4.Maximize the recycling of waste. • 7. Support, influence and partner with the Industrial, Commercial and Institutional sector, including multi-residential, small businesses, and the agriculture sector, the Construction & Demolition sector, to reduce, reuse and divert waste in the broader community. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Changing community values. • Adopt circular economy principles. • Embrace innovation. • Use the triple bottom line.

Category:	Programs/ Implementation Tools/Strategy
Needs Assessment Alignment:	• Supports the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. • Aligned with the need to focus on the value of food to increase the prevention of food waste, which is higher in the waste hierarchy. • Aligned with the need to identify an approach to support increased curbside waste diversion performance by increasing participation in the City's residential waste diversion programs. • Also aligned with the need to actively work with stakeholders in the multi-residential sector to improve multi-residential waste diversion performance.
Individual Producer Responsibility (IPR) Impact:	• Partial – unknown how recycling would be impacted.
System Consideration:	• Secondary – would be an implementation tool to overlay onto core system.
Sector Applicability:	• Applicable to several sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), Partner Programs (PP).
Environmental Considerations:	• Behaviour change management supports improved waste avoidance, reduction and diversion. • No direct impact on greenhouse gas (GHG) emissions. • No direct impacts on air/water quality. • Impacts may be indirect as a result of changes to behavior.
Social Considerations:	• More residents need to reduce waste and participate in waste diversion programs. Behaviour change is required to successfully implement this option. • Level of effort required will vary. For example, inconsistent and aspirational resident groups as identified in the green bin market research will need to make modest changes, while disconnected residents will need to make significant changes. No change is needed for superstars who are already doing all they can to reduce and divert their waste. • Accessibility needs and challenges for equity and inclusion groups will need to be considered and addressed through the Behaviour Change Management Strategy.

Category:	Programs/ Implementation Tools/Strategy
Technical/ Operational Considerations:	• Strategy will need to be developed in-house by City staff or contracted to a third-party. • Contents of the strategy will determine level of ambition and the corresponding effort and timelines required to achieve it. • Minor operational considerations to develop the strategy, however implementation of the outcomes of the strategy may require significant staff effort and resources. • Staff support on the strategy and implementation could involve advice, oversight and delivery of initiatives such the green bin market research and the resulting green bin communications and engagement plan that was carried out by staff in Public Information and Media Relations with Public Works and Environmental Services. • Waste audits should be undertaken to determine impact over time.
Regulatory Considerations:	• The strategy would likely require Council direction and approval. • No other approvals required.
Financial Considerations:	• The one-off cost to develop a Behaviour Change Management Strategy is estimated to be low (<$500,000). • On-going market research costs could exceed $120,000 for larger scale studies. Smaller projects or follow-up studies could cost about $60,000. • Waste audits costs are in the range of $100,000 to $500,000.
Unknowns/ Assumptions:	• Assume the City will enter into community partnerships that will help facilitate behaviour change needed to achieve waste avoidance, reduction and diversion goals. • Unknown whether the City will initiate work on the strategy prior to the completion and approval of the Solid Waste Master Plan. • The level of avoidance, reduction and diversion achieved as a result of the implementation of the strategy is not known.
Supporting System Requirements for Success:	• Coordination with promotion and education will be needed. • Assistance from the City's Public Information and Media Relations (PIMR) Department.
Potential Outcomes:	• Potential to indirectly increase waste diversion, waste reduction and waste avoidance. • Potential to increase the life of Trail Waste Facility landfill, however it is difficult to quantify by how much.

Category:	Programs/ Implementation Tools/Strategy
Measurement:	• Implementation of this option could be measured through market research and waste audit data. • Conducting market research before and after an intervention such as a promotion and education campaign can reveal impacts on public awareness and opinions. • Collecting tonnage data on garbage, recyclables and organics before and after an intervention can indicate whether waste avoidance and diversion rates have increased, decreased or remained constant. • Waste audits can be used to gather detailed waste data, such participation rates, waste stream composition or contamination of recycling streams to assess the impact of an initiative on behaviour.

Case Studies/ Evidence of Results	• Multi-residential waste diversion at a large, 25-year old Toronto condominium shows how changes to waste collection practices can be introduced to shift behaviour[6].
	  ○ Organics collection was introduced in 2015 and the garbage chute became an organics chute. Transparent recycling bags are distributed to residents each week. Between 2014 and 2016, residents decreased the volume of garbage by 83% and increased the volume of recyclables collected by 48%.
	  ○ Empty containers are provided to residents to collect their used cooking oil. Residents are encouraged to separate hazardous waste, electronic waste and scrap metal for collection in dedicated areas. A sharing shelf is available to residents for reusable items, and those not taken by residents are donated at the end of each month.
	  ○ New residents are given a welcome package that explains the waste diversion programs in the building. The City of Toronto provides free educational tools and signage in multiple languages and these materials are used in this building to inform residents.
	  ○ Overall, this initiative has reduced the number of garbage bins required from 20 to less than one bin per month, and lowered waste costs from $20K to $5K per year. This case study is regarded as a success story and an example for multi-residential waste diversion.

[6] Mayfair on the Green: A zero waste success story

Category:	Programs/ Implementation Tools/Strategy
Case Studies/ Evidence of Results	• A local government in the United Kingdom (New Forest District) used behaviour insights to develop an evidence-based approach to reduce littering in the area[7]. ○ Insights from surveys, focus groups and interviews were used to develop a campaign that aimed to motivate positive behaviours through local pride and identity, while deterring littering with a constant reminder of the surveillance and penalties in place. ○ The campaign featured a wide-eyed owl on billboard displays and refuse bag dispensers next to the displays to make it easier for visitors to take their waste home. ○ The original scope of the project in 2019 was to address littering from vehicles, which costs around $190,000 a year. Increased visitors to the area during the pandemic in 2020 resulted in huge litter increases plus overflowing bins, despite added collections. ○ The one month campaign achieved a 29% reduction of coastal littering from the previous month, 10.8 tonnes less litter, and saved $15,000 in clean-up costs. They distributed a total of 6,750 free litter bags to visitors during the month. • The City of Philadelphia used behavioural science studies to understand what motivates actions to identify ways minimize waste and tackle litter[8].
Recommendation	• It is recommended that the option proceed to the evaluation stage.

[7] How behavioural insight helped reduce littering by 29% | Local Government Chronicle (LGC) (lgcplus.com)

[8] GovLabPHL Releases Behavioral Science Studies on Litter Reduction | Office of the Mayor | City of Philadelphia

1B1 - Develop and Implement Educational Initiatives

Category:	Implementation Tool
System Overview:	• This option would see the City develop and implement new educational initiatives aimed at educating residents on the importance of and how to avoid, reduce and divert waste. The educational initiatives would go beyond providing program information and target specific actions and behaviours that are necessary for optimal waste avoidance, waste diversion and program performance. Specific initiatives would be tailored using an evidence-based approach, for example, using waste audit data and would be informed by market research done on resident's behaviour and attitudes towards waste. • The initiatives may be media-oriented and could include initiatives such as a zero waste or circular economy education centre at an existing or new waste facility, or online tools and mobile applications such as online waste sorting games. They could also include tailored presentations, workshops, courses and tours of waste management facilities for City staff, schools, the public and the IC&I sector. • These could be developed and delivered by the City themselves or in partnership with local organizations.
Status:	• Proven • All municipalities utilize educational initiatives to educate residents and businesses and raise awareness of waste avoidance, reduction, reuse and recycling.
Source of Option:	• Consultant, Staff, Consultations, City Councillors
Proposed Strategic Alignment:	Goals: • 2.Reduce waste generation. • 3.Maximize the reuse of waste. • 4.Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. Guiding Principles: • Change community values. • Protect the environment.
Needs Assessment Alignment:	• Aligned with the need to expand and/or modify technologies and approaches used to reach the City's diverse customer base, to create the desired behavioural changes and to support
Individual Producer Responsibility (IPR) Impact:	• Partial impact - unknown what role City will have in educating about recycling and Municipal Hazardous Special Waste (MHSW) programs.
System Consideration:	• Secondary - will be an implementation tool to overlay onto core system.

Category:	Implementation Tool
Sector Applicability:	• Applicable to all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Benefits of educational initiatives will vary, depending on the initiative and desired behaviour changes. Benefits could include improved waste avoidance, increased waste diversion and reduced greenhouse gas (GHG) emissions through behavioral changes and actions resulting in waste reduction. • No direct impacts on air/water quality.
Social Considerations:	• Change requires residents to move away from consumption lifestyle to conservation lifestyle which is easy nor desirable by some. • Residents need to change their behaviour and participate in programs to effect change. • New programs or initiatives may increase accessibility, equity and inclusion by providing in-person and virtual avenues to participate. Virtual events would cater to those with internet access.
Technical/ Operational Considerations:	• City will need to develop and execute new educational initiatives or find a partner to assist with development and delivery of programs. • City would need to find a suitable location and available space for initiatives that require physical space, such as a waste diversion/circular economy education centre. • Leverage the market research undertaken to inform development of initiatives.
Regulatory Considerations:	• No approvals required.

Category:	Implementation Tool
Financial Considerations:	• Most initiatives would not require capital funding, but may have some capital costs depending on the initiative (e.g. an education centre). Costs are anticipated to be low (<$500,000). • Operating costs are anticipated to be medium/low ($100,000 to $500,000) for a targeted initiative, including development of materials and staff time. Additional staff time may be required if an education centre was operated on a full-time basis and to develop and deliver talks or workshops, etc. Costs are anticipated to be medium/low ($100,000 to $500,000) for dedicated staffing and levels would depend on demand/uptake of in-person initiatives. • If the City partners with another organization (e.g. a non-profit environmental group) to deliver waste education, there may be some funding requirements. • Educational initiatives will require coordination and will be designed based on the waste management program design/objectives and desired user behaviour of the target audience. The resulting P&E program plan will include the use of a combination of tactics including, but not limited to, market research, focus groups, use of waste audit and program performance data, outreach, education, marketing and multi-media communications (in person, phone, web-based, social media, radio, direct mail, print, radio, video, apps, etc.). As a result, costs identified for this option may be lower once a coordinated plan is developed that considers what components can be used across multiple options.
Unknowns/ Assumptions:	• Assume a variety of tools and techniques are utilized to cover various needs and demographics. • Unknown if City would develop and deliver initiatives or partner with another organization. • Unknown what tools producers will use for P&E regarding new Blue Box and MHSW programs and what level of City P&E would be required once these programs transition to IPR.
Supporting System Requirements for Success:	• Educational initiatives are required on an on-going basis to continue to promote and educate residents on solid waste programs, initiatives and services. • May require some accessible, physical space at a City facility (for an educational centre). • May require the assistance of City's Public Information and Media Relations Department. • May require collaboration and coordination with local school boards to deliver education initiatives such as tailored presentations or workshops within schools. • May require development of partnerships with organizations such as Business Improvement Areas, faith-based organizations, cultural groups, environmental not for profit groups such etc. to develop and deliver educational initiatives.
Potential Outcomes:	• Potential to indirectly increase waste diversion, waste reduction and waste avoidance. • Potential to increase the life of Trail Waste Facility landfill.

Category:	Implementation Tool
Measurement:	• Program specific measures can be identified (e.g. number of participants, number of educational kits borrowed, number of talks/presentations, number of tours etc.)
Case Study #1:	• The City of Hamilton provides a number of educational initiatives including: • A fieldtrip to the Central Composting (CCF) facility at the specifically designed Learning Room. The fieldtrip provides curriculum connections specific to Grade 5. Round-trip transportation is provided at no charge. Space for the learning room was incorporated into the CCF design. • A waste education kit has been developed in partnership with a local environmental organization targeting Grades 1-5. The kit can be reserved online and can be borrowed for two weeks. The kit includes videos of all the waste facilities in action. • Speakers can be provided for community events to discuss the City's waste programs. • The initiatives are provided as part of the waste management program outreach activities, which include education, promotion and marketing. Outreach staff provide presentations and Learning Room visits based on requests and are not dedicated to the educational initiatives.
Case Study #2:	• The Region of Halton provides youth-oriented education and outreach programs for schools and community groups with a dedicated staff resource that delivers presentations, workshops and activities. Tours of the Halton Waste Management Site (drop of depot and landfill) are also available for students and community groups. In 2018, they delivered 148 presentations. • Age specific content has been developed for schools and presentations are typically provided to multiple-grades or assemblies. Content for younger children includes the 3Rs, giving students a sense of how much waste they generate each day, litterless lunches and increasing recycling at home and at school. High school content includes issues in waste management and how recycling, composting and landfills operate. • Community group workshops are offered to youth groups and include waste reduction-themed recreational activities. • Activities are also conducted at day camps in the summer and to youth groups (e.g., Scouts, Girl Guides) in the evenings. • There is a back-up staff member trained in the event the dedicated staff person is unable to attend. • Materials that are developed are coordinated with the Region's Communications Department.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

1C1 - Develop and Implement Marketing and Communication Tools

Category:	Implementation Tool
System Overview:	• This option would see the City develop and deploy new marketing and communication tools. This could include scheduled newsletters or blogs, a TV/video series (including on YouTube), displays in public spaces, print materials, direct mail, targeted campaigns, collection staff appreciation programs, etc. These tools would be informed by the market research that has been done on resident's behaviour and attitudes towards waste. • This option could also include exploring behaviour related to waste as part of workshops, design sprints, focus groups, etc., in order to tailor tools to issues relevant to the Ottawa context. The Waste Explorer app could be enhanced through integrating mapping of locations for reuse, recycling or disposal into the app (i.e. integrating retailers and charitable organizations participating in the City's, "Take it Back!" Program). • The City would ensure that all tools and outreach materials are optimized for use with mobile phones. • This option could also explore leveraging different technologies such as artificial intelligence, augmented reality and locating software and could include partnering with local universities to develop specific tools. • These tools could be developed and delivered by the City themselves, by an external provider or in partnerships with local organizations.
Status:	• Proven • All municipalities utilize marketing and communication tools to educate residents and businesses and raise awareness of waste reduction, reuse and recycling.
Source of Option:	• Consultant, Staff, Consultations, City Councillors
Proposed Strategic Alignment:	Goals: • 2. Reduce waste generation. • 3. Maximize the reuse of waste. • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. Guiding Principles: • Change community values. • Protect the environment.

Category:	Implementation Tool
Needs Assessment Alignment:	• Aligned with the need to expand and/or modify technologies and approaches used to reach the City's diverse customer base, to create the desired behavioural changes and to support program priorities.
Individual Producer Responsibility (IPR) Impact:	• Partial impact - unknown what role City will have in educating about recycling and Municipal Hazardous Special Waste (MHSW) programs.
System Consideration:	• Secondary - will be an implementation tool to overlay onto core system.
Sector Applicability:	• Applicable to all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Environmental benefits of the application of the tools will vary, depending on the tool, initiative and any desired behaviour changes. Benefits could include improved waste avoidance, increased waste diversion and reduced greenhouse (GHG) emissions through behavioral changes and actions resulting in waste reduction. • No direct impacts on air/water quality.
Social Considerations:	• Change requires residents to move away from consumption lifestyle to conservation lifestyle which is not easy nor desirable by some. • Residents need to change their behaviour and participate in programs to effect change. • New tools may increase accessibility, equity and inclusion through using both in-person and virtual tools. Virtual information and events would cater to those with internet access.
Technical/ Operational Considerations:	• Minor operational considerations. • City will need to develop and deploy marketing and communication tools, which can take significant staff time. • A continual understanding of the different target audiences, and their attitudes, values and behaviours towards waste will be required. • Leverage the market research undertaken to inform selection and development of tools.
Regulatory Considerations:	• No approvals required.

Category:	Implementation Tool
Financial Considerations:	• No capital costs anticipated unless the City develops or purchases an app. This cost is estimated to be low (<$500,000). • Operating costs anticipated to be medium/low ($100,000 to $500,000), depending on the tools used. TV, radio and newspaper ads can be costly. • Depending on the tool implemented, staffing requirements could range from low (<$100,000) to medium/low ($100,000 to $500,000). • Promotion and education initiatives will require coordination and will be designed based on the waste management program design/objectives and desired user behaviour of the target audience. The resulting P&E program plan will include the use of a combination of tactics including, but not limited to, market research, focus groups, use of waste audit and program performance data, outreach, education, marketing and multi-media communication tools (in person, phone, web-based, social media, radio, direct mail, print, radio, video, apps, etc.). As a result, costs identified for this option may be lower once a coordinated plan is developed that considers what components can be used across multiple options.
Unknowns/ Assumptions:	• Assume a variety of tools and techniques are utilized to cover various needs and demographics. • Unknown if City would develop and deploy tools themselves, contract out portions of work or partner with another organization. • Unknown what tools producers will use for P&E regarding new Blue Box and programs and what level of City P&E would be required once these programs transition to IPR.
Supporting System Requirements for Success:	• Marketing and communication tools are important when implementing new solid waste programs or services, and on an on-going basis, to continue to engage with residents about the City's programs and services. • May require the assistance of City Public Information and Media Relations Department. • Would require ongoing research into new forms of marketing and communication and periodic refresh of tools.
Potential Outcomes:	• Potential to indirectly increase waste diversion, waste reduction and waste avoidance. • Potential to increase the life of Trail Waste Facility landfill.
Measurement:	• Implementation of this option is not easily measurable, and measures of success would likely be qualitative.

Category:	Implementation Tool
Case Study #1:	• A study in the United Kingdom (UK) was conducted in 2016 to see if social media could change consumer behaviour. A major retailer in the UK undertook a campaign to reduce food waste and provided information on reducing food waste in a monthly magazine, a bi-weekly newsletter, and Facebook postings. Online questionnaires were used to gauge changes in behaviour related to food waste. All forms of communication resulted in self-reported reduction in food waste and social media (Facebook) did not outperform the other means of communication.[9]
Case Study #2:	• Quinte Waste Solutions developed a P&E campaign with the goal of decreasing placement of black plastics and coffee/hot beverage/disposable cups in its Blue Box Program. The campaign was aimed at the multi-residential sector and provided seven sets of door hangers with simple messages to residents, each with slightly different wording, and information for superintendents and property managers. A small amount of social media was also undertaken. A series of five waste audits were undertaken throughout the year and it was found that compared to the control group: • Residents placed more black plastics and coffee cups in the garbage (increased capture rate in garbage); and • Residents placed fewer black plastic items and coffee cups in recycling and overall waste (kg/unit/wk). • The cost for each door hanger was $1.68, which included the cost to oversee the project but not for the waste audits. • The success of this campaign was attributed to the length of the campaign (i.e. one year), simple, consistent messaging, regular communication, and having a tactile piece of messaging which residents had to touch (which increases the chance of them reading the message).[10]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[9] How behavioural insight helped reduce littering by 29% | Local Government Chronicle (LGC) (lgcplus.com)

[10] CIF project 1055

2. Regulations, Policies, By-laws

2A1 – Disposal Bans

Category:	Program/Policy

System Overview:	• Material disposal bans are a policy mechanism that prohibit certain materials or items from being disposed of in a landfill. They require alternative disposal or recycling options for the banned material to be in place prior to being implemented.
	• The City currently prohibits a range of materials from being placed in the waste stream including household hazardous waste, Phase 1 electronics and electrical waste, sharps, tires, batteries, Compact Fluorescent Lightbulbs (CFL), asphalt and concrete, soil/firewood/brush >10 cm in diameter, large quantities of construction, demolition and renovation materials, white goods and wooden pallets.
	• The City bans hazardous waste, recyclable material and yard waste, among other materials not typically generated by residents from disposal at the Trail Waste Facility landfill.
	• In addition to these materials, the City could implement and enforce material disposal bans at the Trail Waste Facility (TWF). The ban could be enforced curbside, at the point of collection for multi-residential buildings, at a transfer station and/or at the Trail Waste Facility itself.
	• Disposal bans on specific types of materials, such as organics or bulky items can form part of an effective waste reduction and diversion strategy. When combined with other measures, material bans can help to remove toxic and hazardous materials from the solid waste stream and support the diversion of recyclables and products collected under industry stewardship programs for proper diversion and processing.
	• This option could include any or all of the following:
	  ○ Ban Green Bin Organics in the garbage, including food waste, leaf and yard waste and/or grass. These materials would not be collected at the point of collection in the garbage stream by the City under its collection contracts for any customer.
	  ○ Ban Industrial, Commercial and Institutional (IC&I) waste.
	  ○ Ban Construction & Demolition (C&D) waste or specific C&D materials, for example, drywall.
	  ○ Ban other divertible materials, for example, metals, bulky items such as mattresses, fibres not covered under individual producer responsibility programs, textiles, electronics not currently banned in the Solid Waste By-law.

Category:	Program/Policy
Status:	• Proven • Other municipalities in Canada have banned specific materials from landfill disposal (e.g. Capital Region District, BC – corrugated cardboard, concrete, clean soil, drywall, hazardous wastes, kitchen scraps, mixed paper, newspapers, scrap metal, leaf and yard waste).
Source of Option:	• Consultant, Staff, Consultations
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. Guiding Principles: • Change community values. • Protect the environment. • Lead by example.
Needs Assessment Alignment:	• Being a key City asset, determine ways to extend the life of the Trail Waste Facility landfill to maximize the life of the asset and plan for new disposal capacity, when required. • Aligns with the need for the City to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system.

Category:	Program/Policy
Individual Producer Responsibility (IPR) Impact:	• Partial. • Unknown at this time what recovery rates will be achieved, what items will be designated and how recycling will be collected at the curb. • May position the City to support the diversion of designated materials from the curbside garbage stream to the appropriate producer-managed waste collection programs.
System Consideration:	• Secondary - will be a policy to overlay onto core system.
Sector Applicability:	• Applicable to waste collected from all sectors - Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP). • This option is most suited to the Single Family (SF) sector but could be applied to City facilities and Partner Programs, such as the Yellow Bag program. Would be more difficult to apply to Multi-residential (MR) given the anonymity of individual MR units in disposing of their waste and how waste is collected in this sector. • Would also be applicable to other waste managed at TWF from other sectors (i.e. IC&I, C&D).
Environmental Considerations:	• Depending upon the selected program for curbside collection, annual reduction of approximately 1 to 15%[11] of tonnes of garbage being disposed of at TWF landfill annually. • C&D waste and/or IC&I waste managed by the private sector could be diverted from TWF to private sector disposal facilities. • Reduced greenhouse gas (GHG) emissions anticipated by diverting these materials from landfill (organics specifically).

[11] GovLabPHL Releases Behavioral Science Studies on Litter Reduction

Category:	Program/Policy
Social Considerations:	• Will require significant behaviour change by some residents to use the appropriate programs to manage these materials instead of putting them in the garbage stream for collection. • Banning certain materials residents are used to being able to place in the garbage for disposal and requiring them to divert through a program that may be less accessible may be seen as a reduction in service. • Some potential for illegal dumping if residents cannot dispose of these materials in the garbage stream. Also, there is the potential to "hide" materials in opaque garbage bags or in the middle of garbage containers, making it challenging to enforce at the point of collection without supporting policies (e.g., clear bags). This is particularly true for the multi-residential sector, as waste diversion is already a challenge with common area collection points or chutes for garbage. • Some impact on accessibility, equity and inclusion if residents have to find alternate ways to dispose of materials. Some materials, like C&D waste may require residents to transport materials themselves to an acceptable facility.

Category:	Program/Policy
Technical/ Operational Considerations:	• City would need established and easily accessible waste diversion programs in place for residents to properly divert the banned materials. • City would need additional enforcement and customer service staff and potentially staff at TWF at the outset of the program. A material ban in the MR sector and at City facilities with front-end load (FEL) collection bins may be more difficult to implement and enforce than at the curb. • Enforcement of any ban would need to be integrated into future collection contracts and the City would need to ensure collection contractors are enforcing material bans at point of collection. • City may consider creating drop-off depots for some materials that can be recycled and/or have stable markets. • City may consider partnering with or promoting community organizations that have established collection, processing, or re-use programs for banned materials. • City will need to consider monitoring and enforcement approaches to garbage collected in FEL bins at MR properties. • Could divert more materials through existing Green Bin program, increasing the tonnes managed in this program. • Would require a significant P&E campaign to launch program and maintain information on what material are banned and where they may be disposed. • The bans could be phased-in as alternate disposal facilities and locations are identified or alternate means of managing (e.g. recycling) are identified.
Regulatory Considerations:	• Will require an amendment to the Solid Waste By-law which would require municipal approval. Some materials are already in the By-law; however are not currently enforced.

Category:	Program/Policy
Financial Considerations:	• Ongoing P&E to support participation in the program and one-time costs in the order of $1 to $2.50 per household for a multi-media campaign to launch the initiative. • May be an increase in annual operating costs related to additional tonnes of organics. • May reduce revenue from tipping fees, however would result in cost deferral due to extended life of TWF landfill. • Additional staff and/or technology may be required to enforce the ban, including completing inspections at TWF or at the point of collection. • Additionally, more staffing resources may be required to clean up illegal dumping, which may occur with ban implementation.
Unknowns/ Assumptions:	• It is unknown if or when the Province will implement a ban on organics from landfill disposal. The City would need to comply with this regulation. • It is unknown if there are alternatives for diversion or markets for some or all materials that may be banned, particularly for small quantities that may be generated through home renovations. • It is unknown how many additional tonnes of recyclable material or organics would be collected and whether the processing facilities have adequate capacity to process the materials. • Costs for setting up alternative disposal options for the banned materials are unknown and will require further investigation.

Category:	Program/Policy
Supporting System Requirements for Success:	• Material bans are not effective as a stand-alone measure and would need to be part of a multi-tool approach, combined with other policies and mechanisms to support the process as whole, for example, could be coupled with a clear bag policy for ease of enforcement. • Well-established and easily accessible programs and options need to exist to properly divert the banned materials in order to avoid illegal dumping. • Would require the identification or development of markets for banned materials or location of private sector facilities or organizations that can manage these materials. • Would require a by-law amendment. • Bans are not fully effective unless they are enforced, thus requiring enforcement at the point of collection. Enforcement could be done by collection contractors and/or City staff. • Would require an extensive P&E campaign to inform customers of changes. • Could include drop-off areas at TWF to manage banned materials that can be diverted.
Potential Outcomes:	• Potential for increased waste diversion. • Potential to extend TWF landfill by 6-8[12] years based on waste audit data and assuming diversion of 65 – 75 per cent of Green Bin Organics, LYW, C&D, WEEE, textiles and bulky waste (assuming bans would be implemented in 2025).
Measurement:	• Implementation of this option could be measured by an increase in materials diverted, a reduction in tonnes disposed at the TWF landfill, and waste composition studies to assess increased capture rates of divertible material and reduced presence of banned materials in the residential garbage streams.

[12] GovLabPHL Releases Behavioral Science Studies on Litter Reduction

Category:	Program/Policy
Case Study #1:	• As a means to encourage food waste recycling, reduce methane gas contributions and create compost and bioenergy, Metro Vancouver has implemented an organics ban from landfill. This ban applies to all sectors (residential, self-haul, IC&I and C&D), including each member municipality in the Region, as of January 2015. • Fines are levied on waste haulers rather than on the generators of organic materials. It is unclear how enforcement at the curb/generation is carried out.
Case Study #1: (continued)	• Enforcement is carried out at regional disposal facilities by Metro Vancouver Inspectors, who visually assess incoming waste loads at six transfer stations, the Waste-to-Energy facility, and the Vancouver Landfill. Scale operators on site at the City of Vancouver's Transfer Station and Landfill are responsible for pre-screening loads and site employees on the tipping floor and at the active face of the landfill assist disposal ban inspectors. A surcharge of 50 percent on the cost of disposal is applied for any loads with an excessive amount of food scraps (typically 10% or more food waste is considered excessive). • The Region provides food scraps recycling tools, case studies and tips for restaurants and grocers. • Metro Vancouver also has a disposal ban on auto parts and bodies, recyclables, clean wood, cardboard, expanded polystyrene packaging, hazardous waste, materials with high operational impacts (e.g. mattresses, gypsum, railroad ties), and product stewardship materials. • Over 50 materials are currently banned in Metro Vancouver. In 2018, 25% of garbage loads were inspected and about 9% contained banned materials. In the majority of loads, banned materials were observed but not disposed, with inspectors providing alternative recycling options to customers.[13]

[13] GovLabPHL Releases Behavioral Science Studies on Litter Reduction

Category:	Program/Policy
Case Study #2	• The City of Markham approved changes to its waste collection by-law in 2012 to strengthen its enforcement abilities for non-collectible garbage by adding a provision to require mandatory separation of recyclable materials, organics and yard waste as a condition of receiving City collection services. The by-law allows for "friendly reminders" as well as fines[14]. • Enforcement of the material bans was further supported through the clear bag program for garbage collection, which was implemented in 2013. This program allows for enforcement by collection operators to leave garbage behind that contains non-acceptable items. At the time of implementation, a total number of 85,000 households participated and a curbside diversion rate of 72% was recorded. Markham achieved a 20% decrease in garbage tonnages in less than a year post-implementation. • In April 2017, Markham banned textiles from curbside collection, supported by its clear garbage bag program, becoming the first community in North America to do so. It can easily monitor the textile ban through the City's Clear Bag program.

[14] City of Markham Waste Bylaw 32095 Amendment

Category:	Program/Policy
Case Study #3:	• In order to achieve a diversion goal of 70 percent by 2025, Calgary implemented a Green Cart program in 2017 for curbside residents along with a Food and Yard Waste By-law requiring multi-residential complexes and businesses to divert food and yard waste. Single-family waste is collected by City collection trucks, whereas multi-residential buildings and businesses are collected via private haulers. • The City initially increased disposal rates for IC&I loads containing food and yard waste at disposal facilities before implementing an organics disposal ban at City landfills. Effective October 1, 2018, loads of IC&I garbage must contain less than 20 percent of food and yard waste or they are subject to a disposal surcharge. Loads are visually inspected. The by-law is only enforceable at City owned facilities. The City does not have authority to enforce its waste by-law at any private waste facility. • Materials that can be recycled or composted that are subject to a surcharge currently include food and yard waste, paper and cardboard, concrete, brick and masonry block, road asphalt, scrap metal, recyclable wood and drywall. The City's waste by-law includes definitions for recyclable and food and yard waste materials[15]. • In 2019, the City suspended the surcharge on asphalt shingles due to limited recycling options and the material is accepted for disposal at the same rate as garbage.[16]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[15] City of Calgary Bylaw Number 4M2020

[16] City of Calgary Disposal surcharge materials

2A2 – Single-Use Item Reduction Strategy

Category:	Policy
System Overview	• This option involves the development of a single-use item reduction strategy to address single use items, including plastic and expanded polystyrene (EPS), as well as other materials such as paper-based single-use items. • The intent of the strategy is to reduce the amount of waste generated by finding sustainable solutions, not substituting one single-use item for another. • The strategy would encompass City facilities, operations and events, with the overall goal of the strategy being to reduce the amount of waste generated through the consumption of single-use items. • The strategy would consider different approaches, such as voluntary bans on certain items, as well as outright bans on some items. • This option is tied to 3A5 - Develop Corporate Strategies and Opportunities to Increase Waste Reduction, Reuse and Recycling. • Single use item reduction for the IC&I sector is addressed under 3A4 – Develop Community Strategy to Avoid, Reduce and Divert Waste.
Status:	• Emerging. • Some jurisdictions in Canada, including Vancouver, Toronto, Calgary, Halifax, Huron County, ON and Surrey, BC have implemented or are developing Single-Use Item Reduction Strategies to reduce waste at the source.
Source of Option:	• Consultant, Staff, Consultations
Proposed Strategic Alignment:	Goals: • 2. Reduce waste generation. Guiding Principles: • Honouring the 5R waste management hierarchy. • Changing community values. • Protecting the environment for future generations to come. • Leading by example. • Adopting circular economy principles.

Category:	Policy
Needs Assessment Alignment:	• Aligns with the need to identify more ways to reduce and reuse waste generated by residents and the City in its own operations to decrease the amount of waste entering the City's solid waste management system. • Also aligns with the need to have appropriate regulatory tools in place to facilitate the prevention of waste entering the system and improve sorting practices and participation rates in the City's waste diversion programs.
Individual Producer Responsibility (IPR) Impact:	• No impact, except for City managed long-term care facilities, based on draft Provincial Blue Box regulations.
System Consideration:	• Secondary – will be an overlay onto core system.
Sector Applicability:	• Applicable to Single Family (SF), Multi-Residential (MR) and City Facilities/Operations (CF).

Category:	Policy
Environmental Considerations:	• Bans on single-use items at City facilities and in City operations will likely show decreases in waste generation, however the reduction will be variable, depending on the nature and use of the facility or operation[17]. In addition, these materials are often light-weight and do not contribute significantly to waste generation rates. • Bans on single-use plastics, foams and other single-use items will likely have minimal impacts on greenhouse gas (GHG) emissions from City facilities and operations. • Banning single-use items at City facilities may reduce litter in the community, including local waterways.
Social Considerations:	• This option requires behaviour change by both users of City facilities and City employees. This change is a requirement for success. • Alternatives to single-use items will need to be identified in advance of any material being banned. • Consultation with accessibility committees and advocacy groups will need to be completed to understand the minimum requirements for staff/residents with accessibility needs. • Exceptions or special/medical considerations will need to be reviewed for those clients using City facilities or staff working there. • During development of the strategy, consideration would be given to accessibility.

[17] Waste audits conducted on a variety of City facilities in 2019 showed that single-use items and foam comprised between 1% and 35% of the garbage stream, by weight.

Category:	Policy

Technical/Operational Considerations:	• The City would need to confirm what single-use items this strategy would apply to, for example, only plastic or other single-use items.
	• Extensive consultations would be required with City facility and operations staff throughout development of the plan, including procurement staff.
	• Detailed waste audits specific to each facility will be required to understand what problematic materials would be most appropriate to tackle.
	• Consideration will have to be given to what feasible alternatives exist to replace these materials within City operations and facilities depending on the type of service provided, for example re-usable or recyclable alternatives.
	• Consideration would need to be given to the proposed Federal Regulations – plans were announced by the Federal Government in October 2020 to ban six single-use plastic items (plastic check-out bags, straws, stir sticks, six-pack rings, cutlery, foodware made from hard to recycle plastics). These regulations are expected to be finalized by the end of 2021.
	• Consideration will need to be given to contracted service providers either operating in City facilities or contracted as part of City operations. Contracts may need to be amended in support of recommendations of the strategy.
	• It is anticipated that any bans would take a couple of years to implement as there would need to be, at minimum:
	  ○ Consultation with facility managers and procurement staff;
	  ○ Consultation with vendors; and
	  ○ Consultation with accessibility committees.
	• This option would be very difficult to enforce at City facilities offering public facing programs, activities and services. Therefore, the focus on promotion and education of employees and facility users will be required to help support any recommended material bans.

Regulatory Considerations:	• This option would need to be considered in the adaptation of existing City policies and the Solid Waste by-law. • Plans were announced by the Federal Government in October 2020 to ban six single use plastic items (plastic check-out bags, straws, stir sticks, six-pack rings, cutlery, foodware made from hard to recycle plastics). The Federal Government expressed their intent to finalize the regulations by the end of 2021, however no further details on the proposal are available at this time.

Category:	Policy
Financial Considerations:	• The cost to develop a Single Use Item Reduction Strategy for City facilities and operations is expected to be low ($<500,000). Costs would depend on whether or not the strategy could be developed in-house or by external expertise and the requirements for internal and public consultations. • There would be indirect costs to the City as a result of replacing single-use items with reusable or recyclable options (e.g. one-time costs for purchase of reusable items or ongoing costs for alternative recyclable single use items).
Unknowns/ Assumptions:	• At this time it is not fully known what federal and provincial regulations will look like in response to single use plastics and other single use items and how this may impact City facilities and operations. • It is unknown what single use items the City would recommend for inclusion in the strategy.
Supporting System Requirements for Success:	• A dedicated cross-functional project team with representatives from each department. • City facilities and procurement staff will be required to support the development of any material ban and to support and implement the material bans. • Identification of acceptable alternatives for single-use items. • Successful preliminary discussions with facility managers, procurement staff and vendors, and cross-departmental buy-in from staff. • Buy-in and support from accessibility committees. • Updating of procurement processes and contracts to require alternatives to single-use items. • Staff education for any policy changes. • Education for facility users on any policy changes. • Supporting policies such as Circular procurement or Green Procurement policy/standards that prohibits the purchase of banned materials and offer appropriate alternatives for staff. • This option is tied to 3A5 - Develop Corporate Strategy to Increase Waste Avoidance, Reduction, Reuse and Recycling.
Potential Outcomes:	• Development and implementation of the strategy. • Once implemented, a reduction in the amount of single-use items is anticipated.

Category:	Policy
Measurement:	• Measurement of the success of this strategy may be completed through a review of waste generation tonnages pre and post option implementation as well as through waste audit studies at each City facility. • Could also track specific purchases made and any associated reductions.
Case Study #1:	• On June 5, 2018, the City of Vancouver Council approved the Single-Use Item (SUI) Reduction Strategy for a made-in-Vancouver strategy to reduce waste from SUIs. The Strategy includes plastic and paper shopping bags, cups, containers, foam, straws and utensils and includes all material types - not just plastic. • On November 28, 2019, City Council approved new by-laws to reflect the strategy and a phased approach to ban items over the next several years, starting with a ban on foam cups and foam take-out containers on January 1, 2020. Plastic and compostable plastic straws were banned on April 22, 2020. On January 1, 2022 a ban on plastic bags with fees on paper ($0.15 increasing to $0.25 in the second year) and reusable bags ($1 increasing to $2 in the second year) is proposed, as well as a $0.25 minimum fee on all disposable cups and by-request requirement for single-use utensils. • City staff are currently working with Vancouver Coastal Health to explore opportunities to launch a reusable takeout container program in Vancouver. Additional efforts are currently being undertaken to encourage a mug share program throughout the City. • In 2019, it was recommended that all City facilities adapt to a civic facilities single-use item free policy for all facilities and events. This policy is currently being developed.
Case Study #2:	• The City of Markham implemented a zero waste policy in 2012 at all its City facilities. The City provides garbage, recycling, Green Bin services to municipal facilities. In its Civic Centre, all garbage bins were removed from cubicles and offices and were replaced with recycling and organic bins. As part of its zero waste policy, organic Green Bins are provided in every washroom to collect paper towels to be composted. • Through the City's Zero Waste Food Services Policy, any food services and events held in Markham facilities cannot use single-serving condiments, must divert food waste and recyclables, cannot use polystyrene food containers and all straws/stir sticks must be compostable. • For City functions, enforcement is easier as it is written into the Mission Green Policy for the City, as compared to external events where vendors can more or less select the materials used at events.
Recommendation:	• It is recommended that this option proceed to the evaluation stage.

2B1 – Enforce Set-out Limits for Garbage and Reduce Container Limit

Category:	Policy
System Overview:	• The intent of implementing limits on the number of garbage bags, containers or items set out at the curb is to increase participation in the City's waste diversion programs and reduce the amount of garbage sent to the Trail Waste Facility landfill. As participation in diversion programs increases and/or new diversion programs are implemented, garbage bag/container limits can be reduced. The success of establishing set out limits for garbage is dependent upon the level of enforcement applied. • There are different approaches that can be implemented with respect to set-out limits for garbage. Bag/container limits can be set to a maximum limit, where no additional garbage bags/containers are allowed beyond this number, or a bag/container limit can be implemented in conjunction with a pay-as-you-throw (PAYT) approach, where additional bags/containers over the set limit are paid for (e.g., two bags/containers can be set out per collection period and any additional bags/containers must be affixed with a purchased bag tag or bag). Refer to Option 2C5 regarding the use of bag tags. This approach is referred to as partial pay-as-you-throw. Special consideration programs (i.e., medical, infant and adult diapers, etc.) are typically administered to accommodate certain residents that may be required to set-out additional bags. • Currently, Ottawa has a six-bag limit with bi-weekly curbside collection of garbage, which equates to three bags of garbage per week. The bag limits are not currently enforced. The current average curbside set out, based on 2018-2019 waste audit study, is 3.6 items set out bi-weekly for garbage and 0.6 items set out biweekly for bulky items. In order for bag limits to work, they must be set at a limit that is below or at the average garbage set-out rate in order to encourage diversion[18]. • This option would require the City to amend the Solid Waste By-law and review, update and enforce curbside garbage set-out limits for all customers serviced under the City's curbside collection contract. As diversion increases and/or waste generation decreases, limits can be reduced over time. This option would also see the equivalent reduction in the curbside set-out limit being applied to the multi-residential garbage allocation for each building.

[18] CIF, Collection Policies – Bag Limits https://thecif.ca/centre-of-excellence/collection/curbside-collection-policy/bag-limits/

Category:	Policy
Status:	• Proven • Bag and container limits are commonly used as a policy mechanism to increase waste diversion in Ontario and Canada-wide.
Source of Option:	• Consultant, City staff and public consultations.
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly. • 4. Maximize the recycling of waste. Guiding Principles: • Honour the 5Rs hierarchy.
Needs Assessment Alignment:	• Aligned with the need to identify an approach to support increased curbside waste diversion performance by increasing participation in waste diversion programs.
Individual Producer Responsibility Impact:	• Partial. May support increasing diversion of recyclables from the City-managed garbage stream to the producer-managed recycling stream.
System Consideration:	• Secondary - will be a policy to overlay onto the core system.
Sector Applicability:	• Applicable to waste collected from Single Family (SF), Multi-residential (MR), City Facilities/Operations (CF), Partner Programs (PP). • Bag/container limits are applicable to single family households. Container limits can also be applied at the multi-residential building level (for building container allocation, not at the individual unit level), as well as potentially to City facilities and those businesses participating in the City's Yellow Bag Program.

Category:	Policy
Environmental Considerations:	• This policy change and enforcement of the Solid Waste by-law has the potential to increase curbside diversion rates. For example, the City of Hamilton noted a 1% increase and the Region of Halton noted a 2% increase in diversion rate after implementing a similar policy (although it should be noted that it is unknown what the current impact of this policy is in these municipalities). • While the majority of households are complying with the bag limit, the City's 2018-2019 curbside waste audit study found that 58% of material in the garbage could have been diverted through the City's curbside diversion programs. An enforced bag/container limit below the current set out average will encourage participation in the recycling and organics collection programs and extend the life of the Trail Waste Facility landfill. • This option could result in minimal reductions in greenhouse gas (GHG) emissions associated with increased diversion of waste, as less waste is disposed at Trail Waste Facility Landfill.
Social Considerations:	• Residents may express initial opposition to the policy change, leading to an increased volume of complaints or customer service inquiries. • Exceptions or special considerations on bag limits for households who are likely to produce more waste, such as larger families, licensed day cares, due to medical conditions and farming properties will need to be reviewed. • Will require residents to participate in diversion programs in order to comply with set-out limits.

Category:	Policy
Technical/ Operational Considerations:	• Successful implementation of this option may require additional staffing, including staff for enforcement, customer service and coordination or administration. Depending on the available resources, customer service and coordination/administration may be completed by existing staff. • A coordinator or administrative staff may be required to manage an increase in applications or expansion of the current special considerations program. Additional P&E surrounding the change to enforcement levels or limits will also be required, as will data management of new metrics and coordination of educational / enforcement materials (e.g., “Sorry” stickers). • However, some enforcement, such as leaving additional bags at the curb, would likely be carried out by the collection contractor or be combined with a partial PAYT system where residents can pay extra to set out bags over and above the set-out limit. • Common pad collection areas and shared curbside set out locations would have to be reviewed to determine appropriate enforcement approach. • Promotion and education (P&E) will need to focus on any changes to bag/container limits and the application of enforcement. • Targeted P&E would be required for multi-residential building staff regarding reduced garbage limits with residents being informed of the changes.
Regulatory Considerations:	• A revision to Solid Waste By-law 2012-370 will be required if bag/container limits are further reduced. • No change to the By-law is required to enhance enforcement.

Category:	Policy
Financial Considerations:	• Expected capital costs are in the low range (<$500,000). Established P&E approaches could incorporate messaging associated with this option. Additional P&E tools may be required, such as notification tags for excess garbage and information leaflets. • Additional enforcement resources will be required for the implementation of this policy. However, enforcement of the limit at the curb may be carried out by the collections staff, which would mean there is no need for additional enforcement staff. • Additional staffing costs may be incurred for an additional full-time staff member to coordinate or administer the bag limit (e.g. P&E, increased interest in the special considerations program, customer service inquiries/concerns, limit exemptions, managing data from new metrics, and coordination of enforcement materials). It is expected annual operating costs will be in the medium/low range ($100k – $500k). • There may also be cost impacts to the curbside collection contract if enforcement of the limit was done by waste collection operators. These costs would be related to the tagging of bags or items that are over the limit and the distribution of leaflets informing residents of the limit and ways to achieve it, which take additional time. • If a bag-tag approach is implemented alongside this option, operational costs over and above those noted above would also apply. Refer to option 2C5 – PAYT for these additional costs.
Unknowns/ Assumptions:	• Assumptions have been made that the City would require additional staff to administer the policy. It is unknown if administration may be conducted by existing staff.
Supporting System Requirements for Success:	• Staff and contractor education would be required for enforcement and education of residents on changes to the existing policy. • Curbside enforcement may include leaving non-complying bags uncollected and applying educational material to the left behind garbage (e.g. “Oops” or “Sorry” stickers). • Curbside enforcement requirements may need to be written into future waste collection contracts. • Regular review of data (e.g., waste audit, set-out studies) to determine if further reductions in limits could be implemented. • A targeted P&E campaign to support the program is recommended to prevent excessive customer service complaints. • Additional customer service staff hired temporarily to respond to initial increase in customer service calls.

Category:	Policy
Potential Outcomes:	• Potential for an increase in diversion rate and participation in diversion programs. • Increased participation in diversion programs has the potential to reduce the amount of waste disposed, increasing the life of the Trail Waste Facility landfill by 1 year[19]. The potential impact is difficult to quantify given the other factors affecting garbage generation across all sectors; however, it is estimated to be 5-7%[20] reduction in garbage generation depending upon the bag limit selected.
Measurement:	• Quantitative metrics such as tonnes collected, tonnes disposed, waste audit data (including average garbage set-outs and participation rates) and diversion rate. • Number of annual non-compliances, as well as bag-tag requests (if implemented), may also be used to track the program's success.

[19] This estimate is pending confirmation.

[20] These percentages are pending confirmation.

Category:	Policy
Case Study #1:	• The City of Hamilton currently implements a one bag/container limit per week, along with a maximum number of bag tags per year. Initially, the City provides 12 bag tags and an additional 14 tags may be requested, all free of charge. The average household paid $167 for waste management services in 2019. • Prior to the introduction of the one-bag limit in 2010, the City incrementally reduced bag limits starting with a six-bag limit, further reducing it to three bags, with a voluntary one bag limit with the roll out of the green-cart program in 2006 and then a two-bag limit (one garbage bag + one clear garbage bag) in 2009. • Over the phased implementation, the diversion rate increased from 40% at the implementation of the three-bag limit to 48.6% in the year following implementation of the one-bag limit. Although this resulted in an initial increase in diversion, Hamilton's diversion rate has decreased to in recent years (40.6% in 2019 RPRA Datacall). Other municipalities in its municipal grouping have implemented additional measures to encourage waste diversion such as PAYT or biweekly garbage collection and have higher diversion rates. • A special consideration policy was developed for medical circumstances, households with two or more children under the age of four, registered home daycares and agricultural businesses with a need to set out more bags or cans of garbage. Households can apply online for special consideration (not exemption) for additional tags (104 additional tags, in addition to the 12). No evidence is requested for special considerations. However, daycares and households with two or more children under four years of age need to re-apply annually for special considerations. Special consideration applications are at about a 1-2% of the total number of households. • The City was able to implement the policy with no additional capital or operating costs. • Hamilton tracks the number of free bag tags provided but does not monitor the number of tags used by residents.

Category:	Policy
Case Study #2:	• The Region of Halton's bag limit allows single-family homes to set out up to three untagged garbage bags/cans at the curb every other week on their collection day. They may also place up to three additional tagged bags. Garbage tags are available for purchase in packs of five for $10.00. The addition of new materials to the blue box program coincided with the launch of the bag limit, resulting in less waste for residents to place in their garbage. • A phased introduction of bag limits was utilized, starting with weekly garbage collection and a six-bag limit and bi-weekly blue box collection from 1996 to 2008 and then the introduction of weekly green cart organics alongside a bi-weekly garbage collection with a six-bag limit in 2008. In 2013, bi-weekly garbage collection with a three-bag limit and an additional three tagged bags was introduced. • Considerations were made for residents that may be impacted due to increased diapers, as well as those with healthcare considerations. Diaper tags require a clear bag. Healthcare tags are more discrete because they are the same colour as garbage tags and simply say "Garbage Tag" and do not require a clear bag. Regular garbage tags have a unique number. To obtain free tags residents must register but are not required to prove why they are eligible. • Sale of tags and participation studies to identify number of bags per household and use of tags are used to monitor the success of the program. Currently, around 97% of households are still putting out three bags or less. However, as of now, this policy change (tags for additional bags) only affects 3% of the population. • Halton Region's 2019 diversion rate was 51.6% (RPRA, 2019 Datacall).
Recommendation:	• It is recommended that this option proceeds to the evaluation stage.

2B2 – Mandatory Waste Diversion in all City Facilities

Category:	Program/Policy

System Overview:	• This option would see the City implementing mandatory waste diversion in all City facilities. This could include diversion of any or all of the following:
	  ○ Blue and Black Box recyclables
	  ○ Green Bin organics
	  ○ Electronics
	  ○ Hazardous waste (e.g. batteries, hazardous waste from City operations)
	  ○ Other materials (e.g. textiles (sheets, towels, uniforms), construction and demolition materials)
	• The City would be responsible for providing collection containers for all materials, providing appropriate P&E for the program, provision of collection of items and arranging for processing or disposal of materials collected.
	• Waste diversion could be mandatory through a by-law or administrative policy. It could also be achieved by a ban on organics or recyclables at Trail Road Facility landfill.

Status:	• Most municipalities, including the City of Ottawa, have implemented diversion programs for one or more material streams at City facilities, however diversion programs are not mandatory. • There is little evidence of by-laws mandating waste diversion in municipal facilities in Canada. Many municipalities provide waste diversion of some materials in some municipal facilities but on a voluntary basis or to comply with provincial regulations.
Source of Option:	• Consultations, Staff

Category:	Program/Policy
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly. • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 10. Make sustainable waste management design an essential part of the city's planning process. Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Protect the environment. • Lead by example.
Needs Assessment Alignment:	• Aligns with the need for municipal policies to support and facilitate the prevention of waste entering the system and improve sorting practices and participation rates in waste collection programs. • Also aligns with the need to identify specific waste streams that can be diverted from landfill disposal and develop new recycling programs to promote diversion. • Also aligns with the need to identify and implement technologies and approaches to promote and educate users on effective participation in waste management programs.
Individual Producer Responsibility (IPR) Impact:	• Partial. • In absence of final Blue Box regulations, it is unknown the exact impact provincial IPR regulations will have on this option. • Based on draft Blue Box regulations, management of recycling from City facilities is expected to remain responsibility of municipalities, with the exception of long-term care facilities. • Unknown at this time what recovery rates will be achieved and how recycling will be collected from municipal facilities.
System Consideration:	• Secondary - will be a policy to overlay onto core system.
Sector Applicability:	• Applicable to waste from City Facilities/Operations (CF).

Category:	Program/Policy
Environmental Considerations:	• Diverting 75-85% of paper and paper packaging, PET, metals, glass, food waste, tissue/toweling generated in City facilities would result in diverting 43-48% of garbage generated in City facilities. • Increased organic waste diversion may reduce landfill greenhouse gas (GHG) emissions. • Minimal potential to impact air/water quality.
Social Considerations:	• Will require significant behaviour change by visitors, staff and/or occupants of City facilities to use the appropriate waste diversion programs to divert more materials. • Anticipated to improve accessibility, equity and inclusion as all visitors, staff and occupants of City will have access to the same programs.
Technical/Operational Considerations:	• City would need to provide collection containers to divert more materials (e.g. recycling bins, Green Bins, bins for batteries). • City would need to provide collection and processing of more materials (either themselves or by private service provider). • City should consider making this program and the associated infrastructure (same bins, set-up, signage, etc.) harmonious across all City facilities. • City may need to conduct research into collection and processing options for materials generated at certain City facilities that are not currently managed by the City. • City would need to determine if City facility organics (considered part of the IC&I sector) is acceptable under the current processing contract and how it would affect/impact the annual put or pay tonnage and the weekly tonnage limits in the future. • City would need to find space for more collection containers at facilities. • City would need to develop signage and a P&E campaign to rollout program. • City would need to consult with facility staff to implement diversion programs. • Potential for increased contamination of diverted materials in City facilities such as arenas, recreation facilities with high usage by the public.
Regulatory Considerations:	• May require a change to the Solid Waste by-law which would require municipal approval. • If a by-law amendment is not required, a formal policy would need to be developed and communicated to all City facilities users.

Category:	Program/Policy
Financial Considerations:	• May be some capital costs depending on the materials to be diverted and the number of new collection containers required. Costs are anticipated to be medium/low ($500,000-$1 million). • Annual operating costs anticipated to be medium/low ($100K-$500K) depending on how the program is rolled out, number of material streams, collection processes, and breadth of P&E campaign developed to support change. • May incur separate processing costs if not included under the existing processing contracts. • May be an impact on operating costs of other curbside collection programs with an increase of materials diverted.
Unknowns/ Assumptions:	• City facility waste is collected with residential waste under the curbside or multi-residential collection contracts, therefore the amount of waste generated at each City facility is unknown. • It is unknown how producers may collect recyclables, which could impact the City's decision on how to collect recyclables from City Facilities in the future. • It is unknown when the Province will enforce targets for organics diversion which would include City facilities. It is also unknown if this will need to be tracked separately for City facilities. • It is unknown if the City would divert diapers, which would increase diversion rate. • It is unknown what the extent of recycling is in City facilities, and whether materials such as textiles are already recycled. • It is unknown if the same suite of diversion programs would be mandatory in all types of City facilities. • Assume many facilities have established recycling and Green Bin programs in place, so a full-scale rollout of all diversion programs would not be required. • It is unknown what types and quantities of waste are generated from each facility given that there are different types and sizes of City facilities. • It is unknown what diversion programs would be rolled out in City facilities and/or the number of City facilities where programs would be implemented. • It is unknown if this is option would be implemented through a by-law, formal policy or as a best practice through "leading by example". • There is little evidence of by-laws mandating waste diversion in municipal facilities in Canada. Many municipalities provide waste diversion of some materials in some municipal facilities but on a voluntary basis or to comply with provincial regulations. • It is unknown any dedicated staff would be used to support the implementation and maintenance of this option.

Category:	Program/Policy
Supporting System Requirements for Success:	• May require an amendment to the Solid Waste by-law. Would require a P&E campaign to inform staff, residents and occupants of City facilities of changes and potentially different messaging to target different types of waste generated at City facilities. • May increase tonnes of materials managed through diversion programs. • Would need to include facilities that are not serviced by the City of Ottawa (i.e. have private service collection). • Will need to ensure facility managers, employees, and custodial staff and cleaners are onboard and educated about the programs and how to properly dispose of materials collected. • Could consider dedicated staff to oversee the program.
Potential Outcomes:	• Potential for waste diversion through promotion and education. • Increased awareness and education on how to effectively participate in waste diversion programs with consistent programs and messaging between City facilities and places of residence. • Assumed minimal impact on life of the Trail Waste Facility landfill as it is difficult to quantify exactly how much waste would be diverted by City facilities as the quantities of waste are generated from each facility are unknown.
Measurement:	• Implementation of option could be measured by an increase in materials diverted, and a reduction in tonnes disposed at the Trail Waste Facility landfill. This would require reporting and change in the current operational process.
Case Study:	• No information available on mandatory waste diversion in municipal facilities.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

2B3 – Enforce Source Separation Requirements for Recycling and Organics

Category:	Policy
System Overview:	• Currently, the City's Solid Waste by-law has provisions for source separation of recyclable material, leaf and yard waste and organic material. While almost all leaf and yard waste is source separated, a large proportion of the garbage stream is comprised of blue and black box recyclables, and green bin organic material. These provisions are not currently enforced. • The 2018/19 Curbside Four Season Waste Audit Study found that 58% of the garbage stream comprised of materials that could have been diverted through the City's waste diversion programs - green bin organic material represented 45% while 8% consisted of black bin material and 5% consisted of blue bin material. Similarly, a multi-residential waste audit conducted in November 2019 showed similar results, with 58% of the garbage stream also comprised of materials that could have been diverted through the City's waste diversion programs - green bin organic material represented 39%, while 7% consisted of black bin material and 12% consisted of blue bin material. • City facilities waste audits also indicate that there is significant potential to improve source separation, depending on the facility. • This option looks at enforcing the current source separation provisions contained within the Solid Waste by-law, requiring garbage be separated from recycling and/or green bin material. It would apply to all sectors receiving the City's waste collection service. • This option is tied to option 5B5 - Clear Bags for Curbside Garbage.
Status:	• Proven • Mandating and enforcing that all waste streams are set out for collection is not a practice that is widely used throughout the industry.
Source of Option:	• Consultations

Category:	Policy
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill. • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the Industrial, Commercial and Institutional sector, including multi-residential, small businesses, and the agriculture sector, the Construction & Demolition sector, to reduce, reuse and divert waste in the broader community. Guiding Principles: • Honour the 5Rs hierarchy. • Changing community values.
Needs Assessment Alignment:	• This option aligns with the need support increased curbside waste diversion performance by increasing participation in the City's residential waste diversion programs. • It aligns with the future need of recognizing the inherent challenges that exist in increasing participation and the waste diversion rate in the multi-residential sector, actively work with stakeholders in this sector to improve multi-residential waste diversion performance. • Also aligns with having appropriate regulatory tools in place can facilitate the prevention of waste entering the system and improve sorting practices and participation rates in the City's waste diversion programs. Aligns with the need to develop a strategy that identifies ways in which City facilities and operations can avoid, reduce and divert more waste from disposal. • Aligns with the need to support and facilitate waste minimization and waste diversion at special events.
Individual Producer Responsibility (IPR) Impact:	• Partial. • Recycling would no longer be a City responsibility once IPR is implemented and would be excluded from the option.
System Consideration:	• Secondary – will be a policy to overlay onto the core system.
Sector Applicability:	• This option is applicable to the Single-Family (SF) sector, City-collected Multi-Residential (MR) City Facilities (CF), businesses participating in the Yellow Bag program and Special Events where the City provides collection services.

Category:	Policy
Environmental Considerations:	• Based on curbside, multi-residential and City facility waste audit results, there is significant potential to increase waste diversion. • Has the potential to increase the life of the Trail Waste Facility landfill by approximately 1 - 2 years. • The diversion performance achieved depends on the extent of the accompanying level of education and enforcement.
Social Considerations:	• Enforcement can be met with some public resistance, as anticipated with any new change to waste management programs. • This option will require significant behaviour change from some customers. However, strong education regarding diversion options and benefits, combined with an implementation plan that emphasizes education, can greatly reduce public opposition. • This option may have the potential to increase illegal dumping.
Technical/ Operational Considerations:	• Additional Waste Inspector staff and resources may be required for enforcement. Alternatively, enforcement requirements could be carried out by the collection contractor. • The implementation approach for source separation would need to be developed. This could include the requirement for residents to place garbage in clear plastic bags or requiring recycling bins and green bins to be set out along with garbage. • Will need to determine: what is the minimum requirement for setout of recyclables and organics. For example, can a resident put out 6 bags of garbage with a blue box that has 3 items in it and a green bin? A significant P&E campaign for customers will be required regarding the new approach i.e. enforcement. • Enforcement at the curb is relatively easy and should not impact collection efficiencies. Common pad collection locations and shared curbside set out locations would have to be reviewed. Enforcement for multi-residential properties, City facilities and special events will be more difficult than at the curb and as such, an enforcement strategy for these will need to be developed. • The enforcement of this option will likely result in an increase in customer service calls regarding garbage not collected. Risk of illegal dumping will likely require enhanced enforcement strategy to monitor, collect and follow-up. • May need to include requirement in collection contracts for the collection contractor to be responsible for making the determination to collect materials, based on the City's requirements.
Regulatory Considerations:	• No change to the Solid Waste by-law is needed as source separation requirements already exist.

Category:	Policy
Financial Considerations:	• Minimal capital costs are anticipated (<$500K) for initial P&E and enforcement materials (e.g., information handouts, notification tags for uncollected garbage). • Minimal capital costs are anticipated (<$500K) the purchase of additional Waste Inspector vehicles. • Annual operating costs are anticipated to be medium/low ($100K-$500K) for a targeted P&E campaign and increased enforcement. • Annual operating costs for additional staff and vehicles are anticipated to be medium/low ($100K $500K), based on an additional 5 Waste Inspectors. • The potential increase in materials being diverted may increase the operating costs related to the processing of recyclables and organics.
Unknowns/ Assumptions:	• Some residents only set out their bins/carts when they are full. Enforcement of source separation requirements would require residents to participate every week and P&E would need to reflect this requirement. • Should warnings be given out initially about the change in approach, this will require collection operators (or City to retain additional staff) to track setouts.
Supporting System Requirements for Success:	• Enforcement of Solid Waste By-law requirements by collection staff. • An extensive P&E campaign. • Significant support from collection contractors, which would need to be included in future collection contract(s) or negotiated as part of existing contracts. • Support from customer service/ for any calls related to garbage left behind or illegal dumping. • An enforcement strategy will need to be developed specific to illegal dumping. • An enforcement strategy will need to be developed specific to source separation for each of the different customer types.
Potential Outcomes:	• This option is anticipated to increase participation in waste diversion programs, thereby increasing the amount of materials captured in these programs. • With more materials being diverted, this option has the potential to extend the life of the Trail Waste landfill.

Category:	Policy
Measurement:	• The success of this option can be measured quantitatively through tonnes collected, diversion rates and waste audits. • Curbside set-out studies can measure changes in household participation in diversion programs. • Contamination rates would need to be assessed through waste audits to understand how the policy change impacted the quality of setouts within each of the curbside programs. • The number of homes complying/not complying with the policy could also be tracked.
Case Study #1:	• The County of Simcoe considered this as an option for waste collection as part of its 2017 Solid Waste Management Strategy Update as part of a Mandatory Diversion By-law. The rationale for considering collection of garbage only when accompanied by set out of divertible materials was that it would be easier to enforce compared to examining the contents of garbage containers for compliance. • Mandatory Participation was reviewed as a Mandatory Diversion By-Law. It was noted that although this by-law would have potential benefits, it requires a high degree of enforcement and County effort. It was estimated that capture rates may increase by 1 to 2% applying this policy. This diversion increase did not seem to outweigh the effort and enforcement required to make this option a success and the County chose not to implement this option. Simcoe County proposed the policy in 2017; however, their Council did not support the idea as it was viewed as “draconian” or harsh.”
Case Study #2:	• In the City of Markham, all residents (single-family and multi-family residential properties) must participate in recycling and Green Bin programs to receive garbage collection. It is unknown to what degree the mandatory participation ruling is enforced. Markham has a curbside ban on grass clippings, textiles, MHSW and electronic waste through By-law 32-95. These material bans are being effectively enforced through the City’s clear bag program.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

2B4 – Mandatory C&D Waste Diversion

Category:	Program/Policy
System Overview	• The City may impose a requirement by way of a by-law to divert construction and demolition (C&D) waste from landfill. • While such a requirement could apply to both the residential and IC&I sectors, for the purpose of this option, the scope would be limited to C&D waste from residential and City sources (projects, operations and facilities) only. It would also extend to C&D waste disposed of at the Trail Waste Facility landfill. Jurisdiction for IC&I waste diversion lies with the Province. • It is recognized that well established recycling facilities or end-markets would need to be in place before this policy could be implemented. • In support of this option, the City could extend its curbside collection ban to include C&D waste renovation waste, which is currently collected at the curb, pending viable recycling options or end markets. In addition, through the Business Licensing By-law, the City may choose to include source separation requirements or request waste management and diversion plans as a condition of a license.
Status:	• Proven • There are cities in Canada, such as Vancouver and Port Moody, that have enacted by-laws to reduce the amount of C&D materials sent to disposal.
Source of Option:	• Consultant, Consultations
Proposed Strategic Alignment:	Goals: • 1. 1. Extend the life of the Trail Road Landfill significantly. • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 11. Collaborate with external stakeholders, including industry and other levels of government, to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Changing community values. • Leading by example. • Adopting circular economy principles. • Embracing innovation. • Protect the environment.

Category:	Program/Policy
Needs Assessment Alignment:	• Aligned with the need to identify specific waste streams that can be diverted from landfill disposal and develop new collection and diversion programs to capture these streams. • Supports the need to have appropriate regulatory tools in place that can facilitate the prevention of waste entering the system and improve sorting practices and participation rates in the City's waste diversion programs.
Individual Producer Responsibility (IPR) Impact:	• None
System Consideration:	• Secondary - will be a policy to overlay onto core system.
Sector Applicability:	• This option is applicable to the Industrial, Commercial and Institutional (IC&I) sector and City Facilities to the extent described in the System Overview. May also be applicable to the Single-Family (SF) and Multi-Residential (MR) sectors if a total collection ban is imposed for C&D waste.
Environmental Considerations:	• It is estimated that in 2018 approximately 32,000 tonnes of C&D waste was generated by City of Ottawa sources and that approximately 17% may have been diverted (5,600 tonnes) in 2018. The remainder is thought to be disposed of at Trail Waste Facility and Navan Road landfills (Source: Kelleher report).212018/19 waste audit results estimate 13,000 tonnes of C&D waste disposed in garbage, predominantly from single-family residences. 22 • Approximately 14,000 tonnes of C&D material was disposed at the Trail Waste Facility landfill in 2020.23 Is anticipated to reduce greenhouse gas (GHG) emissions by diverting these materials from landfill. Minimal potential to impact air/water quality. • Potential to increase waste diversion rates for C&D materials, which has the direct impact of increasing landfill capacity.

[21] Industrial, Commercial, and Institutional, Construction and Demolition and Agricultural Waste Projections for Ottawa, 2020 prepared by Kelleher Environmental.

[22] Long-Tern Waste Management Needs Technical Memorandum #7

[23] Based on information from Geoware -Trail Waste Facility weigh scale software and on 28,241 loads.

Category:	Program/Policy
Social Considerations:	• If C&D waste is no longer collected at the curb, residents will need to find alternate options to manage this waste stream and may have to transport materials themselves to diversion/disposal locations. • It may be difficult for residents to find convenient and economic outlets to manage various waste streams. This could be seen an accessibility issue for residents. • Residents may object to no longer being able to set out small amounts of C&D waste at the curb. • May be opposition from residents and other stakeholders such as home renovation contractors and smaller builders due to potential extra costs and level of effort and inconvenience required to manage these materials themselves.
Technical/Operational Considerations:	• City would need to ensure there are recycling options and/or markets for C&D materials before implementing the policy. • Would need to update the Solid Waste by-law if C&D waste is deemed a non-accepted item in the City's garbage collection program. • City may choose to establish a drop-off depot at the Trail Waste Facility for materials that can be recycled/marketed and be responsible for managing this waste stream. Refer to option 4D3 – Expanded Drop-off Areas for Divertible Materials at Trail Waste Facility. • City would need to enforce by-law at the Trail Waste Facility to prohibit materials from being disposed at the landfill. • Would need a mechanism to enforce by-law at the curb to prevent materials from being set out at the curb and collected. • The City of Ottawa's High-Performance Development Standard is proposing to require all construction projects to submit a preliminary version of their construction waste management plan required by the Ministry to the City, along with their permit application.

Category:	Program/Policy
Regulatory Considerations:	• The Municipal Act allows a municipality to pass by-laws respecting social and environmental well-being of the municipality. While the authority is broad, it must not conflict with the purpose of provincial or federal laws. • The IC&I sector, including construction projects and multi-residential buildings, are already required to implement source separation programs under O.Reg 103/94 (Industrial, Commercial and Institutional Source Separation Programs) passed under the Environmental Protection Act (EPA). Additionally, C&D projects over a certain size are required to conduct waste audits and waste reduction work plans under O. Reg. 102/94 (Waste Audits and Waste Reduction Work Plans). • The City would need to submit an amendment application to the province to allow for C&D waste to be separated at the Small Load Facility transfer station at the Trail Waste Facility.
Financial Considerations:	• May be some capital costs if a drop-off area was established at the Trail Waste Facility for diversion of C&D materials. Costs are anticipated to be medium/low ($500K-$1M). Annual operating costs are anticipated to be medium/low ($100K-$500K), depending on additional staffing required for enforcement and to administer any business licensing requirements related to source separation or waste management and diversion plans. • Annual operating costs for P&E for new by-law and enforcement anticipated to be medium/low ($100K-$500K). • Any additional costs for managing C&D waste at the Trail Waste Facility are considered as part of Option 4D3 - Expanded Drop-off Areas for Divertible Materials at Trail Waste Facility. • May reduce revenue from tipping fees associated with the disposal of C&D material at the Trail Waste Facility landfill, however, would result in cost savings due to extended life of the Trail Waste Facility landfill.

Category:	Program/Policy
Unknowns/ Assumptions:	• It is unknown how much C&D waste is generated from City operations and where/how it is managed. • It is unknown how much C&D waste would be directed to private facilities for diversion or disposal. An estimated 32,000 tonnes24 of C&D waste was generated in the City of Ottawa in 2018, with approximately 18% of this total being diverted from disposal. • It is unknown what C&D recycling options are currently available, including drywall, asphalt, concrete and wood, and what the cost to recycle these materials is. • It is unknown whether there are sustainable markets for C&D materials that could be reused or recycled. • The extent to which the IC&I sector complies with O.Reg. 103/94 and 102/94 is unknown. • It is unknown how much push back there would be from home renovation contractors, small home builders, or residents on the proposed changes.
Supporting System Requirements for Success:	• Would require an amendment to the Solid Waste by-law. • Would require a P&E campaign to inform the residential and non-residential sectors of any changes to how C&D waste is managed by the City. • Would require collection contractor to enforce a collection ban of C&D waste at point of collection, if C&D waste was deemed a non-accepted item. • Would require coordinating a process through the issuance of business licenses advise of the any new mandatory diversion requirements.
Potential Outcomes:	• Potential for waste diversion. • Assuming diversion of 75-85% of residential C&D waste in garbage and C&D waste in “other garbage” received at TWF starting in 2025, the Trail Waste Facility landfill could be extended by approximately one year. This is based on City waste audit data and the assumption that the City continues to receive approximately 14,000 tonnes of C&D at TWF annually (as reported in 2020), which comprises approximately 56 percent of the estimated 25,000 tonnes of “other garbage” managed at the Trail Waste Facility landfill.

[24] Industrial, Commercial, and Institutional, Construction and Demolition and Agricultural Waste Projections for Ottawa, 2020 prepared by Kelleher Environmental, Table 5: 2018 Ottawa Baseline for ICI and C&D Waste Quantities Generated, Diverted and Disposed

Category:	Program/Policy
Measurement:	• Implementation of option could be measured by an increase in materials diverted, a reduction in tonnes disposed, and changes in the amount of C&D waste in the residential waste stream identified in waste audit studies. • Implementation could be measured by number of business licenses issued and reporting on quantities of materials recycled/disposed.
Case Study#1:	• In 2011, the City of Port Moody, BC passed a by-law to reduce the amount of C&D materials sent to landfills. It requires a Waste Management Plan be part of both the Building Permit Application and Demolition Permit Application. • Cost for a demolition permit is based on the square footage of the building being demolished. • To receive the maximum refundable amount, at least 70% of recyclable or reusable waste must be recycled or reused. • A compliance report, with receipts from recycling facilities and landfills must be submitted. 25
Case Study#2:	• In 2014, the City of Vancouver passed the Green Demolition By-law, requiring the minimum recycling and reuse rate for pre-1940 homes to be 75% and 90% for pre-1940 homes that have character status. In 2015, the by-law was amended to include newer homes to include different requirements for homes of different ages. • The City collects a fee of $350 for green demolition projects which covers staff time to review compliance reports and administer the program.26 • In 2018, the City allocated $250,000 to provide financial support for the establishment and operation of a locally operated non-governmental deconstruction hub, with the proviso that the private operator of the hub provide at least matching funds. The hub is intended to help advance the local market for upcycling and selling recovered materials. • As of 2018, the Green Demolition By-law has diverted nearly 40,000 tonnes (~10,000 tonnes annually).
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[25] Compliance-Report.pdf (portmoody.ca)

[26] https://council.vancouver.ca/20180516/documents/pspc2c.pdf

2B6 – Making Green Bin a Prerequisite to Receive City Waste Management Services

Category:	Program/Policy
System Overview:	• The City provides collection services to the multi-residential sector, which is considered part of the IC&I sector under provincial regulations, collecting from approximately 120,000 units, 114,000 of which are serviced through the multi-residential collection contract. As of March 2021, 46% of multi-residential properties receiving City waste collection are registered to participate in the Green Bin program, with an estimated 37,000 multi-residential units having access to the Green Bin program. • There are requirements to source separate organic material from garbage in the Solid Waste By-law, however it is recognized that there are inherent challenges that exist in the multi-residential sector that make it difficult to facilitate this. • Findings of the November 2019 Multi-residential Waste Audit indicated that 2.43kg/unit/week of organic material was generated, with 39% of the garbage stream being comprised of organic material that could be diverted through the City's Green Bin program. The organics capture rate for two audited properties with a green bin program in place was 22.7%. • The current waste diversion rate for the multi-residential sector is 17%. • This option would see the City implement requirements for all multi-residential properties to implement and participate in the City's Green Bin program in order to receive City waste management services. • This option has the potential to extend the life of the Trail Waste Facility landfill (TWF) by approximately one year, based on City waste audits and a capture rate of 75% of Green Bin organics, assuming a 2025 start date.
Status:	• Proven • There are cities in Canada that have enacted by-laws to reduce the amount of multi-residential materials sent to disposal.
Source of Option:	• Consultant, Consultations, Staff

Category:	Program/Policy
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly. • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. Guiding Principles: • Honour the 5Rs hierarchy. • Protect the environment.
Needs Assessment Alignment:	• Supports the need to increase participation and the waste diversion rate in the multi-residential sector. • Aligns with the need to have appropriate regulatory tools in place to facilitate the prevention of waste entering the system and improve sorting practices and participation rates in the City's waste diversion programs. • Is also in alignment with the City's Multi-Residential Diversion Strategy, currently under development.
Individual Producer Responsibility (IPR) Impact:	• None
System Consideration:	• Secondary - will be an overlay onto core system.
Sector Applicability:	• Applicable to Multi-residential (MR) sector.

Category:	Program/Policy
Environmental Considerations:	• Findings of the November 2019 Multi-residential Waste Audit indicated that 2.43kg/unit/week or organic material was generated, with 39% of the garbage stream comprised of organic material that could be diverted through the City's Green Bin program. • As of September March 2021, 46% of multi-residential properties receiving City waste collection are registered in the Green Bin program, with an average of around 60 tonnes per month of organic material being collected under the containerized collection contract27. • The organics capture rate for the two audited properties with a green bin program in place was 22.7%. The current waste diversion rate for the multi-residential sector is 17%. • There is significant diversion potential from multi-residential properties receiving waste collection services from the City. • Greenhouse gas (GHG) generation could be reduced by diverting organic materials from the Trail Waste Facility landfill.
Social Considerations:	• Building owners/managers would be responsible for the implementation of a Green Bin program at each multi-residential property, including identification of appropriate locations for the green bins. • Residents of multi-residential buildings will have to significantly change their behaviour to divert more organic waste, making use of the Green Bin program. This can increase accessibility to diversion programs throughout the City.
Technical/Operational Considerations:	• Staff would need to work with property owners/managers of each building to ensure a customized approach to implementing the program, supplying the appropriate number and size of green bins, arranging for collection and providing P&E materials in support of the program. • Will require on-going P&E to educate users of the green bin program. • Would increase the amount of organic material collected, which will impact the amount of organic material requiring processing. • May need to develop and enter into property access agreements with each building owner.

[27] Based on monthly average data from – January to October 2020 for curbside contract and June to October 2020 for multi-residential contract.

Category:	Program/Policy
Regulatory Considerations:	• The Municipal Act allows a municipality to pass by-laws respecting social and environmental well-being of the municipality, including climate change. While the authority is broad, it must not conflict with the purpose of provincial or federal laws. • Any City-imposed diversion requirements must not be inconsistent with the diversion requirements on the multi-residential sector by provincial regulations. • As part of the "Made in Ontario Environment Plan", released in 2019, the province has indicated there will be a number of policy commitments relevant to the IC&I sector, which includes multi-residential buildings, including those relating to food waste avoidance, supporting food donation, expanding organics collection and banning food waste from landfills. • As part of the 2018 Food and Organic Waste Framework, targets for food waste diversion from the IC&I sector (including multi-residential) were set, with varying targets, depending on the size of the facility and the quantity of organics generated weekly. It is anticipated these regulations will have a significant impact on how IC&I waste, particularly organic waste, is managed. • As part of its Food and Organic Waste Framework, the Province of Ontario intends to review the Building Code Act to assess whether new multi-residential buildings may be required to enable and promote design and construction options that support the resource recovery of food and organic waste. If the Act is amended as proposed, the City will have the responsibility to enforce the requirement for the design and construction of resource recovery options. • The province has announced its intention to ban the landfilling of organics in 2030.
Financial Considerations:	• No direct capital costs associated with this option, however there will be capital costs associated with the provision of green bins to multi-residential properties. • Annual operating costs for P&E anticipated to be medium/low ($100K-$500K).
Unknowns/ Assumptions:	• It is unknown the extent to which the multi-residential sector complies with existing provincial diversion requirements imposed under the Environmental Protection Act. Multi-residential buildings of six or more units and located in a municipality of at least 5,000 are required to implement a source separation program under Ontario Regulation 103/94 (Industrial, Commercial and Institutional Source Separation Programs). • It is unknown if the provincial ban on the landfill of organics will come into effect in 2030. • It is unknown how much push back there would be from property managers/building owners to implement green bin program at their properties.

Category:	Program/Policy
Supporting System Requirements for Success:	• May require an amendment to the Solid Waste by-law. • Would require on-going P&E to inform the multi-residential sector of the changes.
Potential Outcomes:	• Potential for additional waste diversion if all multi-residential buildings in the City, and other IC&I establishments were forced to comply with the new by-law. • Potential for significant waste diversion of organics over time and possible waste reduction or avoidance with greater emphasis on diversion. • Potential to extend the life of Trail Waste Facility by approximately one year (assuming the option would implemented in 2025).
Measurement:	• Implementation of option could be measured by an increase in organic material diverted, and a reduction in tonnes disposed at Trail Waste Facility landfill. • Waste audits could be used to assess garbage stream composition.
Case Study #1:	• The City of Seattle's Municipal Code requires all buildings with more than four units to provide diversion of recycling and organics to residents. To receive services from the City, landlords must sign an agreement to provide waste diversion services.28
Case Study #2:	• The Town of Richmond Hill stipulates in By-law 18-19 the requirements for municipal collection service for multi-residential buildings, including active participation in applicable diversion programs, dedicated chutes for garbage, recyclable material and organics, provision of P&E materials to all dwelling units, and participation in waste composition studies upon request by the Town. • The by-law was amended in 2019 to allow for front-end collection of organics from multi-residential buildings, provision of additional garbage collection for a fee and requirements for three separate chutes (instead of tri-sorters) for new high-rise buildings. 29
Recommendation	• It is recommended that the option proceed to the evaluation stage.

[28] http://www.seattle.gov/utilities/your-services/collection-and-disposal/ban-of-recyclables-in-garbage

[29] waste-bylaw.pdf (richmondhill.ca)

2C1 - Develop a Circular Economy Strategy

Category:	Strategy
System Overview:	• This option would see the City develop a Circular Economy Strategy that would align with Provincial and Federal efforts and be the primary framework and action plan for how Ottawa will work towards its aspirational vision of becoming a Zero Waste and circular city. Zero Waste and Circular Economy share similar principles and objectives, in that they prioritize waste avoidance, reduction, and reuse (supporting sharing economy, refurbishment and remanufacturing) above recycling and disposal. • The strategy would be developed based on the three core principles of a circular economy[30]: 1. Designing out waste and pollution; 2. Keeping products and materials in use; and 3. Regenerating natural systems. • According to the Ellen McArthur Foundation, city governments have a strong influence over the physical development of a city, the management of its assets, and the procurement of public goods and services. By embedding circular economy principles into urban policy levers, cities can bring about changes to the use and management of materials in cities; and urban priorities around access to housing, mobility and economic development can also be met in a way that supports prosperity, jobs, health and communities. • This option would involve the development of a dedicated cross-departmental Circular Economy Committee, with support from external stakeholders and industry experts that would work to develop a community and organization Circular Economy Strategy and action plan and work collectively to implement it. At a high level, the strategy would: • Explore the integration of circular economy principles into public procurement frameworks and develop implementation plans and frameworks that can be implemented across departments. • Develop a circular framework that can also be embraced and implemented in a phased approach across all City facilities and operations. • Investigate municipal policy levers, initiatives and actions the City could implement to support the community transition to a circular economy. • Explore opportunities to become an innovation hub for circular economy innovations and accelerate the transition to a circular economy.

[30] Ellen MacArthur Foundation: Circular Economy in Cities – City Governments and their role in enabling a circular economy transition

Category:	Strategy
Status:	• Proven/Emerging • Over the past five years there has been uptake of circular economy principles around the world. Municipalities have started adopting circular economy strategies or have begun the process of developing such strategies. Governments at all levels have been implementing policy initiatives, an increasing amount of research is being conducted and companies have been innovating new ideas and business plans.
Source of Option:	• Consultant, Staff, Consultations
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly. • 2. Reduce the amount of waste generated. • 3. Maximize the reuse of waste generated. • 4. Maximize the recycling of waste. • 5. Maximize the recovery of materials and energy • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 9. Minimize costs to taxpayers. • 10. Make sustainable waste management design an essential part of the City's planning process. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles • Honour the 5Rs hierarchy. • Lead by example. • Adopt circular economy principles. • Embrace innovation. • Utilize the triple bottom line.
Needs Assessment Alignment:	• Aligned with the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management
Individual Producer Responsibility (IPR) Impact:	• Partial. • It is unknown how PROs will be collecting recycling and municipal special hazardous waste. The City's programs will need to be aligned to what PROs put in place. • Also, it is unknown what the impact of IPR could be on the development/use of new packaging materials (e.g. shifting from plastic to compostable packaging).
System Consideration:	• Secondary - will be a policy to overlay onto core system.

Category:	Strategy
Sector Applicability:	• Applicable to waste from all sectors - Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Ultimately should lead to increased diversion of waste, and avoidance of waste entering the system through zero waste actions and circular economy initiatives. • Ensuring packaging used by Ottawa businesses, as well as new packaging accepted in City diversion programs, is compatible with the City's processing systems will reduce quantities of non-recyclable/processible waste being disposed at the Trail Waste Facility landfill. • Should result in a decrease in greenhouse gas (GHG) emissions, particularly due to source reduction, reuse and recycling.
Social Considerations:	• May require residents to change their behaviour from purchasing items which may be just "recyclable" to avoiding waste, purchasing items that can be refilled, reused, repurposed or that are longer-lasting. • Some potential to impact equity, as items that are refillable or use different packaging may be more expensive to purchase. • Potential for push back from retailers. • Could result in opportunities for jobs/entrepreneurs to develop circular economy strategies. • Positive impact on equity and inclusion, as all residents can benefit from wasting fewer materials, food, which may result in financial savings.
Technical/Operational Considerations:	• Would require the City to identify zero waste actions and opportunities to support a circular economy. • May require changes to City business processes and policies to support circular economy initiatives. • Would require the City to identify waste materials that could be used in a circular economy. • Would require the City to develop a by-law to require packaging used by businesses in the City (e.g. carrier bags) to be recyclable in the City and compatible with future programs. • Would require the City to develop standards for recycling or composting to ensure materials introduced to the City's waste diversion programs (e.g. compostable coffee pods) are compatible with processing technologies. • Would require City to work with contracted processors of divertible materials to determine guidelines (or for the City to develop their own if they own/operate a facility). • Would require enforcement of the packaging materials used by businesses in the City. • Would require City to work with manufacturers to ensure compatibility.

Category:	Strategy
Regulatory Considerations:	• Regulatory requirements or constraints would depend on the initiatives that are developed in the strategy. • The City could use its authority under the Municipal Act, 2001 to pass by-laws to support circular economy initiatives, which would require Council approval. • A legal review of the Municipal Act, 2001 as amended by Bill 130, focused on the City's ability to legislate and control the IC&I waste stream, and indicates that the City has the authority to pass by-laws that impose requirements on users of the City's municipal waste management system. The exercise of this authority cannot, however, result in a conflict with the legislative purpose of a more senior level of government; for example, Ontario's provincial regulatory regime addressing waste management. As well, the City may not regulate and control private, non-municipal waste management systems, except to the extent that it affects the Municipality's system. • Under the City of Ottawa Act, 1999, the City's consent is required for facilities for receiving, dumping and disposing of waste. The consent can require that certain conditions be met and/or compensation required. The exceptions, where the City's consent is not required, include the services and facilities to deal non-residential waste, or for facilities that were in place prior to December 31, 2000. The City can control what comes into the public system through regulatory and financial means but cannot control the flow of waste to private sector operators.
Financial Considerations:	• The capital cost to develop a strategy is anticipated to be medium/low (e.g. $500,000 to $1M). Difficult to estimate future capital costs associated with recommendations arising from the strategy, as it is unknown if circular economy strategies may require any infrastructure. • Annual operating costs anticipated to be medium/low ($100,000 to $500,000) for staff time related to developing/implementing zero waste/circular economy strategies and enforcement. Annual P&E costs anticipated to be medium/low ($100,000 to $500,000) for educational campaigns for businesses, and to promote and educate about zero waste/circular economy strategy.
Unknowns/Assumptions:	• It is unknown what the impact of IPR could be on the development/use of new packaging materials (e.g. compostable packaging). • It is unknown what type of opportunities may develop for zero waste and circular economy strategies.

Category:	Strategy
Supporting System Requirements for Success:	• Will require cooperation between many different City departments (legal, solid waste, economic development, communications etc.). • Will require coordination with other complementary options in the Solid Waste Master Plan (e.g., 3A4: Develop Community Strategies, Opportunities and Partnerships to Increase Reuse and Recycling and Avoid Waste and 3A5: Develop Corporate Strategy to Increase Waste Avoidance, Reduction, Reuse and Recycling). • Will require the City to work with PROs and processors to identify any new materials introduced into diversion programs and whether they can be managed in the City's system.
Potential Outcomes:	• There is potential for waste avoidance, reduction and diversion through various initiatives the City may decide to implement, but it is difficult to estimate this quantitatively. • There is potential to reduce the amount of waste being landfilled, which could extend the life of the Trail Waste Facility landfill.
Measurement:	• Implementation of this option is measurable by completion of the strategy.

Category:	Strategy
Case Study #1:	• In 2016 the City of Amsterdam launched their Circular Innovation Program for 2016 to 2018, which projects and developments to accelerate the transition of the city to a circular economy. Such projects include generating electricity locally, designing and constructing buildings that can be dissembled and reassembled, and lease contracts for washing machines.[31] • In addition to learning by doing, the City also looked into developing circular knowledge, circular procurement and policies and regulations impeding circularity [32,33]. • In 2018, the program and projects were evaluated and found successful. Key value chains identified included construction, biomass and food, and consumer goods, while two key instruments were procurement and research information provision and networks.[34] • A key part of achieving circular economy was both internal collaboration within the City and external collaboration with other levels of government, business and institutions. • In 2020, the City released a new five-year strategy with additional projects to be completed with an emphasis on reducing the use of new raw materials.

[31] City of Amsterdam, "Policy: Circular city" (2017). Retrieved from: https://www.amsterdam.nl/en/policy/policy-innovation/policy-circular-city/.

[32] Addition of New Materials to the City's Waste Diversion Programs (Adapt Policy) (toronto.ca) (accessed January 2021)

[33] Amsterdam Smart City, "Circular Innovation Program – City of Amsterdam (Dutch)" (December 5, 2016). Retrieved from: https://amsterdamsmartcity.com/updates/project/circular-innovation-program-dutch.

[34] C40 Cities, "Case Study Amsterdam's Circular Economy Roadmap: Lessons Learned and Tools for Upscaling" (November 15, 2018). Retrieved from: https://www.c40.org/case_studies/amsterdam-s-circular-economy-roadmap-lessons-learned-and-tools-for-upscaling.

Category:	Strategy
Case Study #2:	• Montgomery County, Maryland, USA enacted Council Bill 41-14 which places a ban on the use and sale of expanded polystyrene (EPS) (#6-PS) products such as Styrofoam™ products, including foam containers, bowls, plates, trays, cartons, cups, egg cartons etc. and polystyrene loose fill packaging (e.g. packing peanuts). • This legislation prohibits food service businesses from using EPS for food service ware (i.e. take out containers), requires all county agencies, contractors, and lessees using disposable food service ware to use compostable or recyclable food service ware and requires all food service businesses selling or providing food or beverages in disposable food service ware to use compostable or recyclable disposable food service ware. • The legislation applies to all food service businesses, including full-service restaurants, limited-service restaurants, fast food restaurants, cafes, delicatessens, coffee shops, supermarkets, grocery stores, vending trucks or carts, food trucks, businesses or institutional cafeterias, not-for-profit organizations, all food service operated by or on behalf of Montgomery County departments and agencies, as well as other businesses selling or providing food or beverages within the County for consumption on or off the premises and all retailers in Montgomery County, Maryland.[35]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[35] Ban on Expanded Polystyrene Food Service Ware and Loose Fill Packaging (montgomerycountymd.gov)

2C2 - Supporting Waste Minimization and Diversion at Special Events

Category:	Policy/Implementation Tool

System Overview:	• Garbage collection and waste diversion for all special events held in the city is the responsibility of and at the expense of the event organizer, which results in inconsistent diversion programs and receptacle types available at events.
	• Use of recycling stations and organics collection at events is strongly encouraged through the comprehensive event guide that the City's Event Central provides to organizers. The event guide also outlines best practices and tips for greening an event.
	• This option would see the City develop a plan to phase-in additional waste management requirements at small and large events over the short, medium and long term. These could include:
	• Creating a waste management toolkit that covers topics such as best practices for waste avoidance and reduction, for example, water refilling stations, deposit return systems, reusable dishware and cutlery, as well as recycling and organics management.
	• Exploring opportunities for the City to partner with event organizers to promote waste avoidance, reduction, reuse and recycling.
	• Encouraging event organizers to recruit volunteers to assist with on-site source separation of waste and education around the benefits of doing so.
	• Exploring opportunity to introduce by-law requirements addressing how materials are collected, processed and disposed of at special events and festivals.
	• Investigating the City providing collection of recycling, organics and garbage for small special events.
	• Reviewing the City facility rental agreement to determine how best to integrate waste avoidance, reduction and recycling into small and large events held at City facilities.
	• Investigating the opportunity to require special event organizers to submit a waste management plan for each special event that could include such things as:
	  ○ Demonstrating recycling and diversion efforts if event is over a certain number of anticipated participants;
	  ○ Details of hauler and waste sorting station information; and
	  ○ Submission of waste avoidance, reduction and diversion data to track overall waste management practices at special events.
	• In September 2019, City Council approved the by-law review work plan for By-law 2013-232 to include recycling and organic waste collection for large special events and for City staff to work with special event organizers to encourage adoption of waste management best practices.

Category:	Policy/Implementation Tool
Status:	• Proven • Many municipalities have developed processes and waste management and diversion requirements for special events (e.g., application process, resources for event organizers, submission of a waste management plan) prior to event approval.
Source of Option:	• Consultant, Staff, City Councillors
Proposed Strategic Alignment:	Goals: • 2. Reduce waste generation. • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 10. Make sustainable waste management design an essential part of the City's planning process. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Protect the environment. • Lead by example.
Needs Assessment Alignment:	• Aligned with the need to support and facilitate waste minimization and diversion at special events through policies and waste management practices.
Individual Producer Responsibility (IPR) Impact:	• None
System Consideration:	• Secondary - will be a policy to overlay onto core system. • If the plan that is developed includes the City providing collection from events, this would be an implementation tool.
Sector Applicability:	• Applicable to waste generated at special events.
Environmental Considerations:	• May result in waste avoidance/reduction. • May result in additional waste diversion of waste from special events. • May result in a slight increase in greenhouse gas (GHG) emissions if the City provides collection at special events or festivals.

Category:	Policy/Implementation Tool
Social Considerations:	• Waste avoidance/reduction is likely to be supported by attendees of special events. • Increased recycling/diversion likely to be supported by attendees of special events.
Technical/Operational Considerations:	• Will require City staff or a consultant to develop the plan. • Will require consultations with special event organizers during development of a plan. • Will require City staff to work with special event organizers to encourage adoption of waste management best practices. • Would need to consider the work being done under the 2019 Council approved by-law review on By-law 2013-232 to include recycling and organic waste collection for large special events and for City staff to work with special event organizers to encourage adoption of waste management best practices. • May require updates to the City's event guide to include recommendations or requirements for permits, if recommended. • If the City provides containers, collection and processing or disposal to special events, will need to ensure sufficient collection equipment, containers and staff are available to service the special event. City would need to confirm what types of materials would be acceptable at their processors' facilities (e.g. MRF and organics processing facilities). City may need to develop a procedure to accept, review and approve permits within specific timelines if specific waste diversion requirements are included in the special events application process.
Regulatory Considerations:	• May require City to develop a policy and/or amend By-law 2013-232 to include recycling and organic collection for large special events.
Financial Considerations:	• Cost to develop a plan is expected to be medium/low ($100,000 - $500,000) for external support and will depend on the extent of consultation required with event organizers. • Difficult to estimate capital costs as a result of the implementation of the plan's recommendations, as it is unknown if the City may supply any containers which may need to be purchased. • Annual operating costs anticipated to be medium/low ($100,000 to $500,000) for staff time related to supporting improved waste management practices at special events. • Annual P&E costs will depend on the number of events and are anticipated to be medium/low ($100,000 to $500,000) for producing event guide and to promote and educate about special event permits and if P&E materials are provided to event organizers for signage, attendees, etc.

Category:	Policy/Implementation Tool
Unknowns/ Assumptions:	• It is unknown the extent to which waste avoidance, reduction and diversion currently occurs at special events. • The composition of waste generated at special events is unknown, as is how could be reduced and/or diverted. • It is unknown what future role City would play in collection, processing or disposal of waste from special events. • It is unknown if requirements would differ for special events of different sizes. • Unknown if the plan would extend to special events organized by the federal or provincial governments.
Supporting System Requirements for Success:	• Would need to work collaboratively with special event organizers. • City would need to identify current waste management practices at special events, including the extent of waste reduction and diversion already taking place. • City would need to coordinate with various departments (e.g. solid waste, permitting, legal etc.).
Potential Outcomes:	• There is potential for waste avoidance, reduction and diversion, but it is difficult to estimate this quantitatively. • There is potential to reduce the amount of waste being landfilled which could extend the life of the Trail Waste Facility landfill, however this amount would be likely be minimal.
Measurement:	• Implementation of the plan and its recommendations.
Case Study #1:	• The City of Vancouver has a Green Events Planning Guide to help plan an event with information for vendors, volunteers and organizers. As part of the event application (Green Events form), organizers are asked about reduction of waste including food and single-use products, use of sustainable products, ethical procurement of goods and services and education of guests about environmental initiatives. • There are two types of applications – one where the organizer plans to remove event waste with a business or by themselves, and the other where the City provides equipment such as water stations, bike racks and waste containers at various costs. City services include delivery, pickup and cost of waste disposal at a cost of $225 per event. 36 • As part of the permitting process for special events, organizers are required to submit a Green Events Upon receipt of conditional approval, a green events waste management form is also required.

[36] Green Event Planning Guide (vancouver.ca)

Category:	Policy/Implementation Tool
Case Study #2:	• The City of Guelph requires completion of a Waste Management Plan in accordance with By-law (2011) 19199 – Section 11. There are different requirements for smaller events under 1,000 participants and for those expecting over 1,000 participants or substantial waste generation. • The Waste Management Plan outlines the expected requirements (e.g. who is collecting waste and where will it be sent, size and quantity of carts required, waste sorting station information, waste diversion policies (e.g. no Styrofoam etc.), education and training plan for volunteers, vendors/
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[37] SpecialEventWasteDiversionHandbook.pdf (guelph.ca)

[38] SpecialEventWasteManagementPlan.pdf (guelph.ca)

2C3 – Multi-residential Development Standards

Category:	Policy
System Overview:	• The City has existing Collection Design Guidelines for Multi-unit Residential Development (October 2012), outlining considerations for developers in the design of new multi-unit residential properties. It is well documented within the industry that building design can either facilitate or discourage recycling behaviour among residents. • The City would enhance the Multi-residential Building Development Standards to support waste diversion and reuse and sharing of resources under the City's development review process. The City would review and update the Development Standards to incorporate more recent better practices that support increased resident participation in waste diversion programs and reuse activities. The City could consider different standards for smaller low-rise multi-unit (e.g. 12 units or fewer), and those for larger low-rise buildings with more than 12 units. Examples could include: • Provision of in-unit space for waste containers. • Appropriate physical infrastructure and shorter distance to collection points. • Central waste storage located within buildings that include convenient and equal access to all waste and diversion streams. • Chutes for all diversion streams for high-rise buildings. • Expanding on-site recycling options to include other streams (e.g., textiles). • Dedicated space for providing shared assets and services such as tools, books, small appliances or bicycles in a lending library, equipment and weights in a gym, or games and toys in a shared activity room for both kids and adults. • Dedicated space to support used good swaps such as clothing and household items. • Any update would also need to consider the transition of the provincial Blue Box program to IPR and what the future producer operated system will entail. • The update could also consider a requirement of a letter of credit (see Option 2D3 – Bonds for Green Buildings) to ensure buildings are designed and constructed with sustainable waste management practices and that the program delivery remains in effect.
Status:	• Proven • Many municipalities have development standards in place that support removing barriers to participating waste diversion programs.
Source of Option:	• Consultant

Category:	Policy
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 10. Make sustainable waste management design an essential part of the City's planning process. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Protect the environment. • Lead by example.
Needs Assessment Alignment:	• Tied to the need to actively working with stakeholders in this sector to improve multi-residential waste diversion performance. • Also tied to the need to have appropriate regulatory tools in place that can facilitate the prevention of waste entering the system and improve sorting practices and participation rates in the City's waste diversion programs.
Individual Producer Responsibility (IPR) Impact:	• Partial • In absence of final Blue Box regulations it is not clear how IPR for recycling will be implemented in multi-residential buildings. Based on draft regulations, producers will become responsible for managing the collection, processing and bin allocation for multi-residential buildings. The draft regulations also include an expanded list of items to be accepted in the future Blue Box program, and thus it is unknown at this time what impact that may have on space/storage requirements. • Future building standards will need to consider the future Blue Box program as well as producer space requirements and collection needs.
System Consideration:	• Secondary consideration - will be a policy to overlay onto core system
Sector Applicability:	• Applicable to multi-residential (MR) sector.
Environmental Considerations:	• Enforcement of development standard requirements would likely increase the diversion potential in multi-residential buildings, increasing the life of the Trail Waste Facility landfill. • Could decrease greenhouse gas (GHG) emissions through diversion of materials from disposal (e.g. landfill).

Category:	Policy
Social Considerations:	• Anticipated to make diversion of recycling and organics more accessible, consistent and more for residents by incorporating waste diversion into building design. • Will require significant behavioural change tactics to achieve effective participation in the waste diversion programs.
Technical/Operational Considerations:	• Requires review of current standards, guidelines and review/approval processes and updating with enhanced requirements based on best practices that have achieved positive results in other jurisdictions. Will require consultation with developers, City Planning staff and designers/builders. • Requires review of development applications. • Requires coordination with other City departments (i.e. Planning for site plan control). • Requires enforcement.
Regulatory Considerations:	• Needs to be consistent and not conflict with Planning Act or Fire Code.
Financial Considerations:	• Anticipated to be no/low capital costs (i.e. <$100,000). • Anticipated to be medium/low annual operating costs ($100,000 to $500,000) to administer the program. • Requires staff time to review applications, similar to the current system that the City has in place today. May require some additional staff time if stricter/different requirements are implemented.
Unknowns/ Assumptions:	• It is unknown how producers will undertake recycling collection in multi-residential buildings, and if City have any role in how recycling is managed. • It is unknown what updates to existing guidelines or other requirements may be recommended.
Supporting System Requirements for Success:	• City would need inter-departmental collaboration to determine changes and updates to the current process and also to implement recommendations. • City would require an inspection process during construction to ensure the waste management requirements in the application are being met at the time of building, and after a period of time following occupancy to ensure system is working. The process could be supported by a letter of credit process, making release of the letter of credit conditional upon conditions for the waste management requirements being met. • Requires P&E efforts with developers and multi-residential building owners/managers. • Will require ongoing P&E with residents to encourage participation in diversion programs, including information on building diversion programs and how to use them.

Category:	Policy
Potential Outcomes:	• Can improve access and use of diversion programs in multi-residential buildings by incorporating best practices into the building design, thereby improving participation and diversion rates in these facilities. • Can create opportunity for consistent diversion programs across the City.
Measurement:	• Can measure the number of development applications approved under the new standards. • Can measure diversion and participation rates in multi-residential buildings. • Can measure tonnages collected for each stream.
Case Study #1:	• The Town of Richmond Hill updated its Solid Waste By-law (159-07) in 2019 with a number of changes related to multi-residential buildings:[39] o Provision of organics collection using front-end containers. o Collection of additional waste for a fee. o All new multi-residential properties must comply with the "Waste Management Design and Collection Standards for Development" to receive municipal collection. o New high-rise buildings with 5+ storeys must provide three separate waste chutes (separate ones for garbage, recycling and organics). Previously the use of tri-sorters was required but it was observed that these systems malfunction/break down frequently hindering access to diversion programs and that they are not convenient for residents who wish to access the chutes at the same time (i.e. system is locked out until material has been sorted/disposed properly).

[39] Waste By-law Update (escribemeetings.com)

Category:	Policy

Case Study #2:	• The City of Toronto's development standards for new buildings are set out in the Toronto Green Standard. It includes a range of sustainability standards including for solid waste management for various building types (low, mid and high rise). The standard was introduced in 2006 on a voluntary basis and the third version of the standard took effect in 2018 and were updated in 2019.
	• The Green Standard has a number of Tiers, with Tier 1 being the minimum that the project must meet. Compliance is reviewed through the planning approval process.
	• The Green Standards specify, according to Tiers (dependent on the size/type of facility):
	  ○ Storage and Collection of Recycling and Waste
	  ○ Building material reuse
	  ○ Construction waste management
	  ○ Use of sustainable building materials.
	• Toronto has also built into its development standards that new multi-residential buildings must establish a three-stream collection system that ensures that waste diversion is as convenient as garbage disposal. Buildings can construct a three-chute system on every floor, a three-stream collection station on every floor, or a tri-sorter approach. Buildings can also choose to not install a chute system at all and have all residents/tenants take their materials to a common storage location.

Recommendation:	• It is recommended that the option proceed to the evaluation stage.

2C4 – Chute Closure Program at Multi-residential Buildings

Category:	Program/Policy
System Overview:	• This option would see the City implement a chute closure program at multi-residential buildings that have single chutes for garbage to facilitate waste diversion. • Approximately 48% of all high-rise properties, which represent approximately 76% of all multi-residential units, which are serviced by the City of Ottawa have garbage chutes. • The program would entail eligibility requirements, including support from residents. • The City would likely implement the program through the Property Standards By-law, outlining procedures to issue permits to close waste chutes in multi-residential buildings.
Status:	• Proven • There are municipalities in Canada that have implemented a chute closure program and have shown an increase in waste diversion.
Source of Option:	• Consultant, Consultations, Staff
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. Guiding Principles: • Honour the 5Rs hierarchy. • Protect the environment.
Needs Assessment Alignment:	• Aligned with the need to actively work with stakeholders in this sector to improve multi-residential waste diversion performance.
Individual Producer Responsibility (IPR) Impact:	• None
System Consideration:	• Primary - will be reconfiguring collection procedures.
Sector Applicability:	• Applicable to the multi-residential (MR) sector.

Category:	Program/Policy
Environmental Considerations:	• Potential to increase waste diversion. Added limitations on garbage disposal procedures can increase effective participation and diversion for waste management programs. • Risk of minimal additional diversion, as uptake may be low.
Social Considerations:	• Residents of multi-residential buildings where chutes have been closed will have to significantly change their behaviour to dispose of garbage in a garbage room and use diversion programs. This does not alleviate the issue of anonymity when disposing of materials. • Would make the garbage stream not as easily accessible and could help incentivize behaviour change and source separation if residents are able to dispose of their waste in one single area. • Could adversely impact residents with disabilities or limited mobility who can easily access a garbage chute on their unit floor to dispose of garbage. • If the addition to the by-law was applicable to all multi-residential buildings, including those serviced by the private sector, diversion programs may need to be offered by private sector service providers or building/property managers, who will need to implement programs and require the collection provider to collect more material streams.
Technical/Operational Considerations:	• City would need to develop eligibility requirements, conditions of approval and determine a timeframe that the program should be implemented. Accessibility would also need to be considered when developing program requirements. • City would need to develop a process to determine the eligibility requirements, conditions of approval, and how permits must be maintained and/or conditions for revoking. • City would need to inspect building to ensure eligibility requirements are met prior to issuing a permit, and after issuing a permit to ensure the garbage chute has been closed properly, and any other conditions have been met. • The program would be limited to buildings with a single garbage chute. • May require additional inspection staff.

Category:	Program/Policy
Regulatory Considerations:	• Currently, the City's Property Standards By-law requires garbage chutes to be cleaned, disinfected and maintained in good repair. The by-law also requires every garbage room and garbage storage area to be readily accessible to all occupants for whom the facility is required to be provided, or in the alternative, be readily accessible by an operable garbage chute provided for this purpose. • This option would require amendments to the Property Standards By-law to implement such a program, including the issuance and revocation of any permits • The City would issue permits to buildings that comply with the program requirements.
Financial Considerations:	• No capital costs. • Annual operating costs anticipated to be low (<$100,000) for administration of the program. • Costs for a P&E campaign is estimated to be low (<$100,000). • Could result in cost savings from multi-residential buildings owners in terms of less maintenance of chutes, reduced cleaning/disinfection costs, costs associated with fire inspections of chutes, treatments for insect management, etc.
Unknowns/ Assumptions:	• It is unknown how many multi-residential buildings would make this change. • It is unknown if this program does much to alleviate the issue of anonymity with respect to waste management behaviour in multi-residential buildings, as now residents are simply placing waste in a different location. • It is unknown if participation in diversion programs would increase or decrease as residents have to manage their waste that may be seen as less convenient.
Supporting System Requirements for Success:	• Would require a P&E campaign to inform property managers/building management and residents/tenants groups about the program. • Would require inspections of the multi-residential buildings to ensure program requirements are met. • Requires support from owners, tenants and property managers.
Potential Outcomes:	• Potential for waste diversion and possible waste reduction or avoidance with greater emphasis on diversion.
Measurement:	• Waste audits could be conducted prior to and following the closure of garbage chutes to determine changes in waste diversion rates. • City could track the number of garage chutes that are closed as a result of the program.

Category:	Program/Policy
Case Study #1:	• City of Toronto has established the Chute Closure Program[40] under the Toronto Municipal Code, Chapter 844, Waste Collection, Residential Properties in an attempt to allow multi-residential buildings which receive City of Toronto collection services to close their garbage chutes. Closing the chute allows buildings to have greater oversight over their buildings waste streams, saves them money, and reduces overall contamination. To be eligible for the program, property managers must apply to the General Manager of Solid Waste Management Services to obtain and maintain the permit. • To be eligible for the permit, buildings must have support of 51% of the units, receive the City's collection services; have sufficient space for storage of un-compacted waste containers on the property; have sufficient space for storage of recycling containers on the property; and have ordered, received, distributed, and made residents aware of in-unit containers a minimum of six months prior to the initial chute closure application. • It is unknown how many buildings have closed garbage chutes.
Case Study #2:	• In 2011, the City of Hamilton amended the Property Standards By-law 10-221[41] to include the provision to close a garbage chute in a building containing 3 or more dwelling units if the owner provides a waste storage area on each floor of the building with daily collection and occupants are not required to deliver waste to the ground floor, basement or parking lot of the building or if the owner has a current and valid permit to close a waste chute issued by the Director. • In 2010, the City undertook a survey regarding the proposed changes. Of the 105 responses, 70% of the tenants who responded said they would have problems if the chutes were closed. Comments regarding the issues of convenience (distance to walk, weather), bins/carts located outside are unsightly, location not user friendly, inaccessible for people with disabilities, safety, space requirements for containers (either outside or on each floor). • It is unknown how many buildings have closed garbage chutes.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[40] Chute Closure Program – City of Toronto Accessed January 22, 2021

[41] property_standards_10-221_consolidated.pdf (hamilton.ca) Accessed January 22, 2021

2C5 – Pay as You Throw (PAYT)

Category:	Policy
System Overview:	• Pay-As-You-Throw (PAYT) is a user-pay based approach to generate revenue to cover waste management costs based on use of services instead of property taxes. Fees are established for services provided (e.g. collection, drop-off) and typically structured to provide a financial incentive to reduce waste and increase waste diversion. • In this option the City would undertake a financial analysis of its waste management system costs to assign costs based on the services provided and review ways to recover some or all of those costs from the various users (e.g., collection, multi-residential), beyond the current fees in place at the Trail Waste Facility and the Yellow Bag Program for small businesses. • There are a variety of approaches to expanding user fees, depending on objectives such as level of costs to be recovered, diversion targets and how financial incentives will encourage desired behaviour. • Municipalities can choose to implement a full or partial PAYT system to recover costs based on services and/or more material streams (e.g. garbage only, or including recycling and/or organics) as follows: o Partial PAYT: recovers a portion of the waste management costs and may be directed to specific users (e.g., curbside, multi-residential). Material drop-off is based on quantity of waste and is charged as a tipping fee or set rate for small quantities. Collection fees can be based on weight, volume of waste set out or number of items (e.g., bulky waste) and vary based on the collection system (e.g., bags, carts, bins). Fees associated with collection can be charged either through a billing system or by requiring advance purchase of tags or specific bags. Some costs would continue to be funded from property taxes. o Full PAYT: requires all users to pay for services provided and fees are calculated based on waste management system costs and allocated to the service. Services would be fully funded by user rates, similar to water and wastewater rates. • There is no standardized approach to design and implement PAYT programs. Programs can be coupled with other policy and program options, such as clear bags, set out limits, material bans, and provisions to occasionally set out additional “free bags” following major holidays. • This option can be tied to option 4C1 – Separate Bulky Waste Collection and Recycling.

Category:	Policy
Status:	• Proven • Both partial PAYT and full PAYT approaches for garbage collection are used in Ontario and other Canadian municipalities. There are 132 municipalities in Ontario with a PAYT program for garbage – 78 using partial PAYT and 54 using full PAYT.[42] The City of Gatineau also has a partial PAYT approach. • This approach is currently applied to the City's Yellow Bag program, where participating businesses pay only for the amount of garbage that they set out for collection and at the Trail Waste Facility landfill, where tipping fees are charged based on quantity of waste disposed. • PAYT for all waste streams is less common in Canada. • Various funding mechanisms for bulky item collection by municipalities are employed throughout Ontario.
Source of Option:	• Consultant, Consultations
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly. • 2. Reduce waste generation. • 3. Maximize the recycling of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 9. Minimize costs to taxpayers. Guiding Principles: • Honour the 5Rs hierarchy • Change community values
Needs Assessment Alignment:	• Aligns with short-term need to have appropriate regulatory tools to prevent waste from entering the City's solid waste management system. • Supports the need to increase curbside waste diversion.
Individual Producer Responsibility (IPR) Impact:	• No impact • PAYT can be applied to remaining streams managed by the City (e.g., organics, garbage).

[42] Based on 2019 Datacall.

Category:	Policy
System Consideration:	• Secondary – will be a policy to overlay onto core system.
Sector Applicability:	• Applicable to the Single-Family (SF) sector and Partner Programs (PP).
Environmental Considerations:	• PAYT programs can have significant impacts on changing behaviour towards the generation of garbage and increasing participation in waste reduction and diversion programs. • The diversion performance associated with a PAYT approach depends on the extent of the requirements, the accompanying level of education and enforcement and the maturity of diversion programs. • Potential diversion is difficult to estimate, but could range from a 1 to 8%% increase in diversion based on existing programs and other policy changes.[43] • It is anticipated to reduce some greenhouse gas (GHG) emissions by diverting these materials from landfill and/or from preventing the generation of waste.
Social Considerations:	• PAYT can be met with some public resistance, as it may require significant behaviour change from residents and may potentially increase costs for some. However, strong education regarding diversion options and benefits, combined with an implementation plan that emphasizes reduction, can reduce public opposition over time. • PAYT programs can be viewed as unfair to people with lower socio-economic status and/or large families. • Will require significant behaviour change by some residents to use the appropriate programs to manage their waste appropriately. • The fee needs to be set appropriately to disincentivize residents who can afford to just pay extra to dispose of more waste, but still remain affordable for others. • Diverting reusable bulky items creates an opportunity to acquire items at a lower cost or for free from non-profit agencies with whom the City may partner (e.g. Furniture Bank).

[43] Muller, Adam, City of Kingston Public Outreach and Promotion Coordinator, Personal Communication, November 16, 2020

Category:	Policy
Technical/Operational Considerations:	• Increased P&E for residents regarding collection policy change. • If a cart-based PAYT is implemented and the City wishes to offer multiple sizes to residents, would need to implement a system for residents to choose a suitable sized cart and for exchanges if the size is not suitable. The City would also need to deliver and replace carts. • If bag or tag based PAYT is implemented, the City would need to develop a system for distribution and sale of bags/tags. Could be sold at City facilities or by retailers. • Often in the beginning of the program, PAYT requires significant enforcement of the policy to be successful. The City would need additional ongoing enforcement staff for curbside collection to ensure only waste that is paid for is collected. This ongoing enforcement is often provided at the curb by the waste collection operators. If this approach is taken, waste collection conditions may need to be updated to reflect this requirement. • Bag or tag based programs will typically utilize manual collection whereas cart based programs can use semi or fully automated collection. • PAYT programs can have the consequence of increased illegal dumping, although this is often anecdotal information and not necessarily confirmed with data. • City may need to implement the ability to receive payment for bulky item collection, and/or schedule bulky item collection. Additional collection vehicles may be required to collect this waste stream separately. Refer to option 4C1 – Separate Bulky Waste Collection and Recycling. • Separate collection of useable bulky waste requires additional collection approaches and storage space. • Would need to determine approach for special considerations garbage collection. • Could consider implementing exemption days during the year (e.g. spring or fall cleanup) where additional bags above the setout limit, up to a maximum, could be placed at the curb for collection or additional waste allocations given to the multi-residential sector in designated weeks.
Regulatory Considerations:	• Changes would be required to the Solid Waste by-law, with fees approved annually by Council. May also require a change in the tax-based system dependent upon full or partial PAYT approach taken.

Category:	Policy
Financial Considerations:	• There may be some capital costs associated with this option, such as financial and data tracking / invoicing software and bag tags. Costs are anticipated to be low (<$500K). • Capital costs of a bag-based program would be lower because the responsibility of purchasing bags is on the customer (versus a cart). A volume based PAYT system could be implemented in conjunction with the introduction of a cart based collection system (Refer to option 5B4 – Cart Collection for Curbside Garbage) and the associated capital costs would be high (>$15 million). • Annual operating costs can range from low to medium depending on the level of education, targeted campaigns and enforcement that accompanies new PAYT programs ($100K - $500k) for the first couple of years. Ongoing operational costs are anticipated to be low (<$100k) for program administration. • A portion of the bag/tag fees will be payable to retailers. • Would likely result in cost savings due to extended life of the Trail Waste Facility landfill. • Additional capital costs to assist with scheduling and/or payment of bulky item collection are anticipated to be low (<$500k). • Additional operating costs are anticipated for separate bulky item collection. Since there are several permutations of bulky waste collection systems, these costs are currently unknown.
Unknowns/Assumptions:	• Unknown if the system implemented will be full or partial PAYT. • Unknown if the program will be bag, tag or cart based. • Unknown what the PAYT fee for bag/tag or cart-based system would initially be set at. • Unknown what the set-out limit would be. Industry guidelines suggest that the set-out limit needs to be below the average set-out limit in order to encourage behavior change and be effective (average curbside garbage set-out rate is currently 4.18 items every two weeks). • Unknown what impacts would be on future curbside collection contracts. • Unknown if bulky items would be part of the PAYT approach and the type of fee set for collection. • Level of P&E and enforcement that would be accompanied by this major change is unknown.

Category:	Policy
Supporting System Requirements for Success:	• Consideration as part of a future rate study/financial plan. • By-law amendment and potentially annual Council approval for fees. • Determine where the bags/tags would be sold. Arrangements with City, for example, at Client Service Centers or local retailers to have constant supply bags or tags that customers can purchase. • Additional staff for enforcement of policy and customer service initially. • Financial and data management system depending on extent of program. • An extensive P&E campaign. • A collection approach for bulky items would need to be determined in advance of implementing a PAYT approach for these items.
Potential Outcomes:	• Potential for increased waste diversion (1-8%[44]). • Potential to extend life of Trail Road Facility landfill by up to three years[45] for an enforced PAYT program. Including diversion of reusable bulky items and having financial incentives to divert waste from disposal could potentially extend the life of Trail Road Facility more.
Measurement:	• Depending on the type of PAYT approach, this option could be measurable (e.g., use of variable cart sizes can improve volume and tonnage estimates). • Could measure the reduction on waste quantities disposed at the landfill, as well as the number of items diverted from separate bulky item collection. Could also measure tonnages of recycling and green bin organics. • Number of bag tags/specially marked bags purchased.

[44] These percentages are pending confirmation.

[45] This estimate is pending confirmation.

Category:	Policy
Case Study #1:	• Kingston, ON implemented a partial PAYT program for curbside waste collection in 1999. It was introduced as part of the weekly three bag garbage limit that was implemented at the same time. In 2003, a weekly two bag garbage limit was implemented and in 2012 Kingston transitioned to a one bag garbage limit. • The current program allows for one untagged bag of garbage to be placed at the curb each week and unlimited tagged bags/containers. Bag tags can be purchased online or at retailers for $2 each. The only exemption to the bag limit is for medical reasons and residents must provide a medical note to receive 52 free tags on an annual basis. • Total waste diversion was the only identified performance indicator for the program. In the first year of program implementation, the City achieved a 1% increase in waste diversion, with a 6% increase the following couple of years, which indicated that the combination of PAYT and lower bag limits could be successful in increasing waste diversion. • Kingston notes that it is difficult to measure the effectiveness of the PAYT program alone, as the green bin program was implemented the year before the one-bag limit. Staff noted that these two policy changes back-to-back likely caused fatigue with residents and lack of participation. Overall, the key element that made this program successful for Kingston were the cost to residents to dispose of additional waste; however, curbside enforcement by collection staff has played the largest role in the effective implementation. • Kingston is currently reviewing their Solid Waste Master Plan and noted that the consideration for full PAYT has not been well received by the public as they feel that they are being penalized for generating waste and that tax dollars are not being used adequately.

Category:	Policy
Case Study #2:	• The City of Toronto waste management system operates as a rate-based service and has eliminated all IC&I cross subsidy of the residential program and reliance on property taxes. All solid waste operations are self-sustaining and costs are recovered by a variety of user fees to fully recover all costs for waste management services. The various revenue sources result in a negative net budget that is balanced to zero through transfers to reserves to fund capital. Rate categories include: residential home owners (SF); apartments above businesses; multi-residential buildings; businesses; charities, institutions and organizations; and fees at drop off depots. All fees are available on the City's website: https://www.toronto.ca/services-payments/property-taxes-utilities/utility-bill/solid-waste-rates/ • Toronto has a variable cart program for curbside waste collection in which residents pay a different fee based on the size of the garbage cart and the rate increases as the size of the garbage cart increases. For single family, 2021 fees ranged from $270.23 (small cart – 75 litres) to $$516.79 (extra-large cart – 260 litres). Annual rates are billed on the City's utility bill based on the size of the garbage bins registered for the property. • The City of Toronto bundles all waste management and waste diversion system costs into the garbage collection fee, which covers garbage collection and disposal, recycling collection and processing, Green Bin collection and processing, leaf and yard waste collection and processing, and other waste diversion activities. The pricing structure for the carts provides a financial incentive to reduce garbage and use the diversion programs. • Financial relief is available for low income seniors and low income persons living with a disability through an application process.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

2D1 – Waste Diversion Infrastructure Fee for New Development

Category:	Policy
System Overview:	• This option would see the City implement a Waste Diversion Infrastructure Fee for developers to fund the purchase and distribution of waste diversion equipment for new development. This policy would require developers of new single-family and multi-residential homes to pay for and/or distribute Green Bins and educational materials to new homes as part of the subdivision/site plan approval process. The City could charge a fee which covers administration, the cost of the carts and P&E materials and potentially delivery (depending on the model). The City would be responsible for procurement of Green Bins and production of P&E materials. The City may negotiate with developers to include distribution of recycling bins as the City will likely not be responsible for provision, distribution or P&E related to recycling with the transition of the program to IPR. • Distribution of bins by the developer would reduce the fee and would make the move in process easier for the developer and reduce new homeowner complaints associated with waste collection until collection services in the new development is transitioned to the City. • This option would replace the current City process which requires residents moving into new homes to contact the City, either through calling 311 or putting in a request through Ottawa.ca. This would also create an opportunity to have welcome information packages to accompany the new bins to explain the programs and benefits of waste diversion. • As the City grows, this option could assist with financial sustainability, and ensuring the developers are considering waste management as part of the design and approval process. • A system would need to be put into place for the City to ensure compliance with requirement for developers to provide carts and conduct follow-ups if carts are not delivered.
Status:	• Emerging • There are limited examples of municipalities in Canada implementing this option.
Source of Option:	• Consultant

Category:	Policy
Proposed Strategic Alignment:	Goals: • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 9. Minimize costs to taxpayers. • 11. Collaborate with external stakeholders to advance waste management practices Guiding Principles: • Lead by example.
Needs Assessment Alignment:	• The option is in alignment with the need for financial sustainability.
Individual Producer Responsibility (IPR) Impact:	• Partially. • Based on draft Blue Bin regulations, developers will be responsible for provision of recycling containers to single-family households.
System Consideration:	• Secondary consideration - will be a policy to overlay onto core system.
Sector Applicability:	• Would apply to the Single-Family (SF) and Multi-residential (MR) sectors.
Environmental Considerations:	• Distribution of bins as soon as units are occupied will result in residents participating in waste diversion programs sooner and will improve diversion at the outset. Limited additional diversion potential on an ongoing basis. • This option would help promote and educate residents on diversion programs and help make waste diversion programs more accessible by removing the requirement for residents to call and request green and recycling bins from the City and/or developers when moving into their new home or unit.
Social Considerations:	• Would increase resident accessibility as this approach would ensure all residents in new subdivisions and buildings have all the containers required to participate in all waste programs when they move into their new residence. • Costs may indirectly be passed on to home buyers by developers.

Category:	Policy
Technical/Operational Considerations:	• City would need to coordinate pick-up and delivery of carts and P&E material to new developments with developers. • City would need to ensure compliance with requirement for developers to deliver carts and conduct follow-ups if carts are not delivered. • City would need to determine the fee charged for carts and P&E materials. • City would need a system to manage the fee charged and authorization to release carts and P&E material to developers. • The City could require developers to pre-order and pay for carts in advance and the City could deliver the containers.
Regulatory Considerations:	• May be a condition of Site Plan Approval. • May require amendment to the Site Plan approval process, and Council approval to do so.
Financial Considerations:	• City would need to determine the fee charged for carts and P&E materials. • Capital costs of carts should be covered by the fee charged. • There will be some additional operating costs associated with staff administering the program and coordinating with developers anticipated to be medium/low ($100,000 to $500,000). There may be reduced administration costs for processing individual requests, especially for larger developments.
Unknowns/ Assumptions:	• It is unknown how developers would distribute blue and black box containers to new developments and if there is an opportunity to partner to distribute containers and P&E materials for economies of scale. • Unknown how this would be implemented if the City decides to go with a variable garbage cart PAYT system.

Category:	Policy
Supporting System Requirements for Success:	• Would need coordination with the City's Planning, Infrastructure and Economic Development (PIED) department for site plan approval. • Would need a system whereby Solid Waste Services coordinates with PIED to authorize approval upon payment of fee and distribution of carts. • Would need an inventory system that considers new developments to ensure a sufficient supply of carts is available when needed. • Would need a process by which developers advise the City that carts have been delivered and City can verify so that collection can commence. • Coordination between developers and the City's customer service/dispatch so that the City is not delivering containers when it is the developer's responsibility. • Accompanying P&E materials
Potential Outcomes:	• No impact on diversion or on the Trail Waste Facility landfill as carts would be provided by either the City or the developers. • May make the site plan approval process more complicated and time consuming.
Measurement:	• Total fees collected and number of new single-family homes or multi-residential units occupied annually. • Number of site plan approval applications reviewed by Solid Waste Services. • Unknown what a measure of "success" would be for this option.
Case Study #1:	• In the City of Markham, developers of new single-family homes are required to pay for and distribute recycling and green bins and educational materials to new homes as part of the subdivision / site plan approval process. The City charges $75 per unit which covers the costs of the bins and P&E material. • Authority for the fee is through a condition in the site plan / subdivision agreement and letter of credit. • Waste Management is a commenting department on all development applications, including new builds and site plan amendments. All development applications are reviewed by Waste Management and clauses are added as conditions in the development agreement. At this time, the developer agrees to purchase two recycling containers, one green bin and one kitchen collector, ensure they are deposited in each home prior to closing, along with P&E materials, and to contact the City at least four weeks prior to unit occupancy to arrange an appointment time to collect the containers.

Category:	Policy
Case Study #2:	• Several municipalities in the United Kingdom require developers to purchase bins for new developments. Bins can be ordered online or through a customer service centre. Fees generally cover an administrative charge and delivery of the bins which generally remain the property of the municipality. In some cases, fees are charged to cover the cost of the bin. • Examples are Eastleigh Borough Council, Falkirk Council, Newcastle Dorset in the UK.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

2D2 - Development Charges for Waste Diversion Growth

Category:	Policy
System Overview:	• Development charges (DC) are one-time fees paid to the City to offset the growth-related capital costs required to provide additional municipal services arising from new development and redevelopment. Functions including collection, treatment and processing of organics and recycling are all considered eligible components and can be included in the DC calculation. These types of functions are typically referred to as "Waste Diversion" (e.g. recycling and organics) and "Waste Collections" (e.g. curbside pick-up). The provision of disposal at landfill sites and incineration are not eligible waste management services and those costs cannot be recovered through development charges. • The City would use development charges to fund growth related waste diversion and collection.
Status:	• Proven • Many Ontario municipalities have set fees for development charges related to waste diversion.
Source of Option	• Staff
Proposed Strategic Alignment:	Goals: • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 9. Minimize costs to taxpayers. Guiding Principles: • Lead by example.
Needs Assessment Alignment:	• The option is in alignment with the need for financial sustainability.
Individual Producer Responsibility (IPR) Impact:	• Partial • The City could not claim costs associated with recycling programs covered by producers once the Provincial Blue Box program transitions to producer responsibility.
System Consideration:	• Secondary consideration - will be a policy to overlay onto core system
Sector Applicability:	• Not applicable to any one sector.
Environmental Considerations:	• Would not directly increase diversion potential. • No direct greenhouse gas (GHG) impacts.
Social Considerations:	• No change to resident effort or behaviour. • Indirectly, residents who own their own residence pay for these fees as part of purchasing a property.

Category:	Policy
Technical/Operational Considerations:	• City would need to undertake a review of development charges, currently scheduled to take place in 2024. • In advance of this review, staff will have to determine the 10-year historic level of service requirements for solid waste. This process could be lengthy and complicated for a number of reasons, including that it's the first time that this exercise has been undertaken by the City specific to waste management services and the fact that it is service-based as opposed to a capital project based.
Regulatory Considerations:	• In 2016, the Development Charges Act (DCA) was amended to include certain waste management functions as a DC eligible service. Functions including collection, treatment and processing of organics and recycling are all considered eligible components and can be included in the DC calculation. • Bill 197, the COVID-19 Economic Recovery Act, 2020 still allows development charges for waste diversion. • Further review of the legislation to determine the appropriate fee structure would be required, with projects reviewed on a case-by-case basis. • Council approval would also be required to update By-Law No. 2019-156 – 2019 Development Charges.
Financial Considerations:	• There are no additional capital costs anticipated to implement development charges to fund growth-related waste services. • Minimal additional operational costs are anticipated to administer development charges. The City would need to establish initial waste-related charges through the next development charges review that is scheduled for 2024 and would need to conduct annual analysis on the expected growth-related projects and ensure the development charges rates are set to adequately help fund the growth plan. • Including/increasing DC revenues as a funding source for growth related projects would reduce the need to fund these via capital reserves and/or tax revenues.
Unknowns/ Assumptions:	• It is unknown how the new IPR regulations would impact the City's costs to deliver collection and diversion programs. • The rate of residential development in the City is unknown over the next 30 years as it is highly dependent on the economy. • It is unknown how quickly funds may be accumulated to cover growth-related capital costs of projects.

Category:	Policy
Supporting System Requirements for Success:	• Support from other departments to analyze and set development charges rates. • City would need to conduct a historical service level analysis, which has proven to be a complex exercise to date given the City's reliance on contracted service providers for collections and processing.
Potential Outcomes:	• City would receive additional funding to support growth-related capital projects.
Measurement:	• This option would be measured by the revenue from development charges.
Case Study #1:	• Simcoe County is levying fees under development charges as part of By-law 6555 for solid waste management. Residential charges by unit type are as follows: singles - $228, multiples - $189, apartments - $129, non-residential charge per square metre of gross floor area - $1.14, effective Jan 1, 2020.[46]
Case Study #2:	• A study undertaken by Waterloo Region developed estimates of residential development charges for waste management. The by-law was amended in 2018 with the following charges for waste management, effective January 1, 2018. Charges per unit are as follows: Single/Semi-detached - $255, Townhouse Dwelling - $192, Apartment Dwelling - $139, Lodging Unit - $79. Non-residential charges are $0.01 per square foot of gross floor area. [47]
Case Study #3:	• Peel Region's development charges are as follows (for the cities of Brampton and Mississauga): Single and Semi-detached - $367.13, Apartment (>750 sq ft) - $266.13, small unit (<=750 sq ft) - $140.84 and other residential – $290.77. These are effective January 22, 2021.[48]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[46] development charges bulletin JAN 2020.pdf (simcoe.ca) (accessed Jan 13, 2021)

[47] BY-LAW NUMBER insert by-law number (regionofwaterloo.ca) accessed January 13, 2021

[48] dc-rates-schedule.pdf (peelregion.ca) accessed January 13, 2021

2D3 – Bonds for Green Buildings

Category:	Policy
System Overview:	• This option would see the City implement a financial mechanism to ensure waste reduction/diversion or waste-related green building standards (for example, Option 2C3 - Multi-residential Building Development Standards) are incorporated into new development and are performing as planned by requiring developers to provide a financial security. • An example of this could be a system that builds upon the City's existing letters of credit process for planning applications and require developers to post a letter of credit to ensure convenient collection systems for divertible materials are developed and maintained. After a certain time has elapsed, buildings are inspected for successful operation and that the building has met the City's requirements, and the letter of credit cancelled. • There is opportunity for the City to consider this option in the immediate term as part of its development of the High Performance Development Standards.
Status:	• Proven • There are some municipalities in Canada (e.g. Markham and Toronto) who have implemented financial mechanisms to drive sustainability efforts and improve waste management in multi-residential buildings.
Source of Option:	• Staff
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 10. Make sustainable waste management design an essential part of the City's planning process. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Protect the environment. • Lead by example.

Category:	Policy
Needs Assessment Alignment:	• Aligned with the need to have appropriate regulatory tools in place can facilitate the prevention of waste entering the system and improve sorting practices and participation rates in the City's waste diversion programs. • Also aligned with the need to improve multi-residential waste diversion performance.
Individual Producer Responsibility (IPR) Impact:	• No impact.
System Consideration:	• Secondary consideration - will be a policy to overlay onto core system.
Sector Applicability:	• Applicable to Multi-residential (MR) and also to non-residential buildings.
Environmental Considerations:	• Enforcement of requirements for source separation is expected to increase the diversion potential in buildings by ensuring developers. • Anticipated to decrease greenhouse gas (GHG) emissions through diversion of materials from disposal (e.g. landfill).
Social Considerations:	• Anticipated to make diversion of recycling and organics more accessible and more convenient for residents by incorporating convenient waste diversion into building design.
Technical/Operational Considerations:	• May be incorporated into the City's current Multi-Unit Residential Development Guidelines and the upcoming High Performance Development Standards, which are currently under development by the City. • Requires coordination with other City departments (e.g. building, planning and growth management etc.). • Requires enforcement. • May require consultation with the local development community.
Regulatory Considerations:	• Requires Council approval. • Must be consistent with and not contradict the Ontario Planning Act.
Financial Considerations:	• Anticipated to be no/low capital costs (i.e. <$100,000). • Anticipated to be medium/low annual operating costs ($100,000 to $500,000) to develop the system and administer the policy. • Fees would need to cover staff and administrative time for enforcement and confirmation of adherence to requirements.

Category:	Policy
Unknowns/ Assumptions:	• It is unknown the level of support of this option from the local development community.
Supporting System Requirements for Success:	• Multi-residential Building Development Standards/High Performance Development Standards. • Would require consultation with stakeholders to identify what is feasible/acceptable in Ottawa. • Would require enforcement/confirmation of adherence to requirements.
Potential Outcomes:	• Can improve access and use of waste diversion programs in multi-residential buildings, thereby improving participation and diversion rates in these facilities.
Measurement:	• Can be measured by the number of applications and letters of credit received. • Can measure diversion and participation rates in buildings meeting different requirements.
Case Study #1:	• The City of Markham requires developers to post letters of credit (ranging from $5,000 to $50,000) for all new multi-residential and commercial buildings that go through its planning application and approval process. • The requirement for a letter of credit helps ensure that the applicant develops and maintains convenient recycling and organics collection systems. • After two years, staff will inspect the buildings to ensure that the diversion program is working properly and the building has met the City's design and operating requirements. If a building passes inspection, the letter of credit is cancelled, if not, the owner is given a set time to correct the problem. • The policy was amended in 2016 to require an additional letter of credit of $50,000 for buildings incorporating automated recycling systems to ensure that high quality systems are installed and operating as intended.
Case Study #2:	• The City of Toronto offers a partial development charge refund program for projects that have demonstrated higher levels of sustainable design beyond the minimum (Tier 1) required as part of the Toronto Green Standard program. • Achieving Tier 1 is verified by Site Plan approvals and higher tiers are verified by third parties and certified by pre-qualified consultants. [49]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[49] Development Charge Refund Program Version 3 – City of Toronto

2D4 - Tipping Fee Strategy for Trail Waste Facility

Category:	Policy
System Overview:	• Tipping fees are a common way to charge users for the cost of waste disposal both in Canada and internationally. Operators charge a fee directly on waste brought to landfills and the price is based on the type, volume, or weight of the material. As a landfill operator, the City has the ability to set its fees, which it does and updates them on an annual basis. The City's current approach to setting tipping fees is based on a cost recovery and also considers market factors such as fees charged by other local private landfills. • This option would involve the City exploring a tipping fee strategy for the Trail Waste Facility (TWF) that would create an incentive to reduce waste disposal of difficult to manage items. Evidence from around the world illustrates a strong link between higher disposal prices and reductions in landfilled waste[50]. This could include: ○ Increase tipping fees for certain materials to discourage generators from disposing of these materials (e.g. C&D waste). ○ Decrease tipping fees for certain materials that could be beneficially reused (e.g. material used for daily cover). ○ Remove tipping fees for materials to encourage source separation (i.e. in addition to the materials for which there is currently no tipping fee, for example scrap metals and electronic waste. ○ Review the approach to tipping fees charged to registered charities/not for profit organizations and develop a consistent policy that would apply to the disposal of materials they cannot sell.
Status:	• Proven • Many municipalities have a variety of tipping fees to incentivize or disincentivize behaviour.
Source of Option:	• Staff

[50] Ecofiscal Commission Solid Waste Report – Cutting the Waste

Category:	Policy
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly beyond its existing anticipated end of life. • 4. Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. Guiding Principles: • Protect the environment. • Utilize the triple bottom line.
Needs Assessment Alignment:	• Contributes to extending the life of the Trail Waste Facility landfill and ensuring financial sustainability.
Individual Producer Responsibility (IPR) Impact:	• None
System Consideration:	• Secondary consideration - will be a policy to overlay onto core system.
Sector Applicability:	• Primarily applicable to non-residential waste accepted at the Trail Waste Facility landfill.
Environmental Considerations:	• Reducing or eliminating the tipping fee for some divertible materials may divert more materials from landfill and extend the life of Trail Waste Facility landfill. • Raising the price of waste disposal for items that do not have a viable diversion/recycling options could encourage an increase in illegal dumping. • Anticipated little to no change in greenhouse gas (GHG) emissions as the system remains essentially unchanged in terms of emissions from vehicles, or quantities disposed. There is the potential to see a small decrease in GHG emissions through increased diversion of organic materials.
Social Considerations:	• No impact to level of resident effort. • May provide increased access to dispose of divertible materials that are not currently accepted at the Trail Waste Facility landfill. • If tipping fees are reduced, may positively impact charities/not for profit organizations which may indirectly increase accessibility and equity.

Category:	Policy
Technical/Operational Considerations:	• Would need to develop the strategy, which would involve consultations with stakeholders such charities/not for profit organizations. • Low level of effort to implement this strategy. • City would need to study and decide what materials would be eligible for increased or decreased tipping fees. • City would need to advertise changes to tipping fees on its website and/or at the Trail Waste Facility. • City would need to identify the number of registered charities and/or not for profit organizations currently using the Trail Waste Facility landfill to dispose of unsold materials, including which ones are not charged tipping fees and which ones are, and would need to identify those implications in terms of waste composition and tonnages that would be disposed of at the landfill if a change was made to current approach. • If City is to offer free tipping to all registered charities, it would need to determine eligibility requirements (e.g. a primary function of accepting goods for reuse for raising funds or donation to assist others) for registered charities/not-for-profit organizations. • City would need to determine terms and conditions for exemptions for registered charities/not-for-profit organizations and develop an application form. • Requires staff time to maintain a database of organizations registered with the Canada Revenue Agency and review/approve applications.
Regulatory Considerations:	• Would require Council approval.
Financial Considerations:	• It is anticipated the capital cost to develop the strategy would be low (<$500,000). • There may be some operating costs associated with staff time and P&E (medium/low $100,000-$500,000). • Anticipated to have an impact on operating costs at the Trail Waste Facility, however, it is difficult to say if costs would go up or down depending on the City's decision(s). More or fewer materials may be managed. • There may be an impact to tipping revenue (more or less) depending on the City's decision(s).

Category:	Policy
Unknowns/ Assumptions:	• The extent to which the strategy could impact diversion and extend the life of the Trail Waste Facility landfill are not known at this time given the unknowns around what the strategy would recommend. • It is unknown what decisions the City may make regarding fees for certain materials. • It is unknown how this will impact the tonnes of materials managed at the Trail Waste Facility.
Supporting System Requirements for Success:	• The City would need to review the current approach to tipping fees charged to registered charities/not for profit organizations and develop a policy that is equitable to all organizations under this category. • The City would need to communicate any changes to tipping fees at Trail Waste Facility through a P&E campaign. • The City would need to enforce the strategy at Trail Waste Facility.
Potential Outcomes:	• Other private disposal facilities may also change their tipping fees to match those being charges at the Trail Waste Facility, which would reduce the success of using this strategy to reduce waste being disposed of at the landfill. • Trail Waste Facility may manage more or fewer tonnes depending on the outcome of the strategy. Potential to increase tonnes of waste managed at the Trail Waste Facility with new policy if more material is received from registered charities/not-for-profit organizations as a result of a different approach to tipping fees (e.g. reduced fees). • Consistent policies related to tipping fees for registered charities and not for profit organizations.
Measurement:	• Could be measured by tonnes disposed/diverted and revenue received at Trail Waste Facility.

Category:	Policy
Case Study #1:	• Peel Region – non-profit organizations receive an exemption on tipping fees at community recycling centres. A non-profit community agency is defined as a non-profit organization that is classified as such by the Canada Revenue Agency, or its successor, that is involved in programs that assist or improve the quality of life in the Region and that carries on activities without pecuniary gain that perform a function of benevolence, vocational training, or charity; or that organizes community activities such as agricultural fairs, parades, festivals and/or celebrations that allow for unrestricted public access, such as Canada Day picnics, Multi-Cultural Day celebrations and Communities in Bloom events.[51] • The City of London accepts waste from charitable organizations at its landfill at no charge.[52] • Niagara Region does not charge tipping fees to non-profit organizations at its waste management facilities, including at the landfill of its contracted service provider. Niagara Region's service provider invoices waste delivered by non-profit organizations at a specified rate per tonne ($72.91/tonne in 2019). The cost to Niagara Region in 2019 was approximately $13,500.[53]
Case Study #2:	• The City of Calgary uses tipping fees and surcharges to support programs and policies to achieve its waste diversion goal of 70 percent by 2025. • Following the implementation of a curbside Green Cart program in 2017 and a Food and Yard Waste By-law requiring multi-residential complexes and businesses to divert food and yard waste, the City initially increased disposal rates for IC&I loads containing food and yard waste at disposal facilities before implementing an organics disposal ban at City landfills. Once the disposal ban took effect (October 1, 2018), loads of IC&I garbage containing more than 20 percent of food and yard waste are subject to a disposal surcharge. Loads are visually inspected. • Materials that can be recycled or composted are subject to a surcharge include currently include food and yard waste, paper and cardboard, concrete, brick and masonry block, road asphalt, scrap metal, recyclable wood and drywall. The City's waste by-law includes definitions for recyclable and food and yard waste materials[4]. • In 2019, the City suspended the surcharge on asphalt shingles due to limited recycling options and the material is accepted for disposal at the same rate as garbage.

[51] By-law 35-2015 - Region of Peel (peelregion.ca) Accessed February 9, 2021

[52] Waste disposal fees | City of London Accessed February 9, 2021

[53] Public Works Agenda Package (escribemeetings.com) Accessed February 9, 2021

Category:	Policy
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

3. Waste Avoidance, Reduction and Reuse

3A1 Sharing Space/Swaps/ Sharing Library/ Repair Cafes (for various materials)

Category:	Program
System Overview:	• This option would see the City develop one or more temporary/event based or permanent sharing spaces, swaps, sharing library or repair cafes or partner with community/charitable organizations for materials that can be shared, reused or repaired rather than recycled or disposed of in landfill. • Examples of items could include books and school materials, appliances, waste electronics and electrical equipment (WEEE), construction and demolition material (C&D), tools, bicycles, toys, textiles, etc. • Depending on the materials diverted, there is some diversion potential, estimated at 0.5 to 1% per year for materials such as textiles, electronics and electrical equipment, bulky items and C&D material, which is equivalent to approximately 275 to 550 tonnes per year[54].
Status:	• Proven • There are a number of municipalities in Canada who have developed partnerships to support events or stand-alone centres to host sharing spaces/ swaps/ sharing library and/or repair cafes. There are 24 Repair Café locations in Canada, including in the cities of Guelph, Kitchener, and Toronto.
Source of Option:	• Consultant, Staff, City Councillors, Consultations
Proposed Strategic Alignment:	Goals: • 2. Reduce waste generation. • 3. Maximize the reuse of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Adopt circular economy principles.

[54] Based on 2019 waste audit information and professional judgement on diversion potential.

Category:	Program
Needs Assessment Alignment:	• Aligned with the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. • Aligned with the need to provide enhanced convenience and additional drop-off opportunities for residents to reduce, reuse and recycle.
Individual Producer Responsibility (IPR) Impact:	• No impact
System Consideration:	• Not a core system component. Option is secondary to system-wide considerations.
Sector Applicability:	• Not directed at any one type of waste generator, but applicable to all residents.
Environmental Considerations:	• Depending on the materials diverted, there is some diversion potential, estimated at 0.5 to 1% per year for materials such as textiles, electronics and electrical equipment, bulky items and C&D material, which is equivalent to approximately 275 to 550 tonnes per year55. • Unlikely to result in changes in greenhouse gas (GHG) emissions from the current baseline system. • No impact to air/water quality.
Social Considerations:	• Can increase equity for participants through provision of goods at low/no cost. • Provides an educational opportunity to teach residents how to use tools and repair broken items. • Provides skills development and promotes social inclusivity.
Technical/ Operational Considerations:	• City could develop a partnership(s) with an organizations or charity to host/run events or stand-alone centres. • May require the City to provide space at a City facility (e.g. library, Trail Waste Facility, community centre, etc.). • Could be integrated into any future community recycling centre/drop-off depot.
Regulatory Considerations:	• No regulatory requirements unless a permanent facility is developed, which would require municipal approvals.

[55] Based on 2019 waste audit information and professional judgement on diversion potential.

Category:	Program
Financial Considerations:	• Anticipated to be low capital costs (e.g. <$500,000), depending on whether the City would supply items for a sharing library, or rely on donations, whether City develops a facility for these options and the total number/type of events offered. • Annual operating costs anticipated to be medium/low ($100,000-$500,000), mainly support through P&E and some staff time to oversee or potentially administer some events and/or partnering arrangements.
Unknowns/ Assumptions:	• Assume there are a number of local charities and non-profit organizations in the City with similar mandates with whom the City could explore potential partnerships with. • Unknown what materials would be managed and/or what portion of the materials received would actually be reused or repaired. • It is unknown what quantities of materials are already diverted informally through friends, family, social media/grassroots community based sharing sites, organizations such as Kijiji etc., or donated to for/non-profit agencies and if some of these materials may now enter a more formal City-run program or partnership.
Supporting System Requirements for Success:	• City would need to identify materials that could be managed (including potential tonnes disposed which could be diverted) and identify potential partners. • Programs such as a sharing space/reuse centre would require a dedicated space(s) and staff to oversee or administer and they could be done in partnership with another organization(s). • Would require a significant P&E program to support and advertise programs and events. • Potential to partner with one or more organizations to run the events. • Many programs would likely rely on volunteers to participate in the programs. • Programs need to be accessible to participants.

Category:	Program
Potential Outcomes:	• Some materials could be diverted from landfill, but anticipate overall low potential for diversion from landfill as these materials may be managed at thrift stores/non-profit agencies, and/or shared through other means. Tonnage diverted would depend on the type of materials diverted, number and type of events. • Avoids the purchase of new materials, delays disposal of materials/items. • Enhanced community knowledge about importance to repair and reuse items and skills development in how to repair common broken/damaged items. • Potential to partner with not-for-profit organizations with similar mandates and interests to deliver events such as repair cafes in exchange for free space in a City facility.
Measurement:	• It is difficult to quantitatively measure the success and environmental impact of this option unless the City is able to weigh or count items reused and repaired. • City could monitor number of events held, number of participants at events and success in repair rates.
Case Study #1:	• Ottawa is home to a tool lending library, the Ottawa Tool Library. Other types of lending libraries are found in Canada and the U.S. including: • Four tool lending libraries and a kitchen appliance lending library (Portland, OR) – Kitchen Share is a community-based tool library that offers kitchen appliances for rent, and also provides space for community members to make food together, and to host workshops and community events. • Musical instrument library, including short and long term rentals (Halifax, NS) - run through the public library with support from the private sector. • Media lending library (Indianapolis, IN) - run through a community organization. Loans electronics, AV equipment, photography equipment, computers, and other media items. • Library of Things (camping and sports equipment, party supplies, board games, toys) – Sacramento, CA – the inventory is kept at two library locations and is partly funded through federal grants. The library also gives away gently used formal wear through community donations at designated giveaway days.

Category:	Program
Case Study #2:	• City of Toronto hosted five Community Reduce & Reuse Programs as part of their Long-Term Waste Management Strategy and to support the Toronto Strong Neighbourhoods Strategy. These programs include: Urban Harvest (redistribution of surplus food), The Sewing Program (repair, reuse and textile diversion), Community Bicycle Hubs (reuse and repair of bicycles), Community Composting and Sharing and Reuse Spaces. The program sites were based primarily in Neighbourhood Improvement Areas, this included multi-residential buildings and community hubs. This was part of a four-year pilot program that began in 2017. The five programs were: 1. Urban Harvest: Partnered with organizations, helps reduce food waste by collecting surplus fruits and vegetables from residents' backyards and redistributing them to local food banks and programs. As of the end of 2019, 3,950 pounds of surplus fruits and vegetables had been redistributed and 28 canning and preserving workshops had taken place. 2. Sewing Repair Hubs: Partnered with various organizations, provided workshop spaces to encourage repair and reuse of clothing and other textiles. Activities included regular instruction on basics of alterations and repairs, designing of clothes from repurposed textiles, etc. As of the end of 2019, over 3.5 metric tonnes of clothing and textiles have been diverted and 524 sewing classes and workshops have taken place. 3. Bicycle Repair Hubs: Partnered with various organizations, provided workshop spaces to train residents in bicycle assembly, repair, maintenance and safety, and provided access to bicycle tools, equipment and supplies. As of the end of 2019, over 3,700 bikes have been repaired/ refurbished and 635 bicycle repair workshops have taken place. 4. Community Composting: Partnered with FoodShare, equipped resident groups with tools, skills and knowledge to maintain community gardens and process compost. As of end of 2019, 70 composting workshops have taken place and 130 metric tonnes of carbon dioxide is saved per year. 5. Sharing and Reuse Spaces: Promoted reusing, sharing, repairing and repurposing items. As of end of 2019, 200 items had been repaired/repurposed and 40 share and reuse workshops had taken place.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

3A2 Community Reuse Events

Category:	Program
System Overview:	• This option would see the City develop one or more temporary drop-off events or partner with community/charitable organizations for personal and household goods that can be reused rather than recycled or disposed of in landfill. Items could be dropped off at designated City facilities or other locations. The City could also explore increasing the number of Give Away days from two per year. This option could include move-out programs held in conjunction with local colleges and universities. Examples of reusable items include books and school materials, toys, electronics, bicycles, furniture, etc. • Drop-off of reusable items at the events will be sent to and taken by local charities. • Depending on the materials diverted, there is some diversion potential, estimated at 0.5 to 1% per year for materials such as textiles, electronics and electrical equipment, bulky items and C&D material, which is equivalent to approximately 275 to 550 tonnes per year[56].
Status:	• Proven • Some municipalities have developed partnerships to host reuse drop-off events.
Source of Option:	• Consultant, Staff, Consultations
Proposed Strategic Alignment:	Goals: • 2. Reduce waste generation. • 3. Maximize the reuse of wast • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Adopt circular economy principles.
Needs Assessment Alignment:	• Aligned with the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. Aligned with the need to provide enhanced convenience and additional drop-off opportunities for residents to reduce, reuse and recycle.

[56] Based on 2019 waste audit information and professional judgement on diversion potential.

Category:	Program
Individual Producer Responsibility (IPR) Impact:	• No impact.
System Consideration:	• Not a core system component. Option is secondary to system-wide considerations.
Sector Applicability:	• Not directed at any one type of waste generator, but applicable to all residents and staff.
Environmental Considerations:	• Depending on the materials diverted, there is some diversion potential, estimated at 0.5 to 1% per year for materials such as textiles, electronics and electrical equipment, bulky items and C&D material, which is equivalent to approximately 275 to 550 tonnes per year57. • Unlikely to result in changes in greenhouse gas (GHG) emissions from the current baseline system. • No impact to air/water quality.
Social Considerations:	• Residents would need to transport items to a reuse drop-off event, however, local events may increase participation if locations are more convenient than existing options. Give Away days would not require residents to transport items. • Event participation levels will depend on the convenience compared to other options (e.g. location, frequency, timing, operating hours, etc.). • Potential to increase equity by providing items at low/no cost through local non-profit organizations.
Technical/Operational Considerations:	• May require City to develop a partnership with an organization(s)/charity to host/run events. • Would require City to develop a partnership with an organization(s)/charity to take donated items for reuse. • May require City to provide space at a City facility (Trail Waste Facility, community centres, etc.). Could be integrated into any future community recycling centre/drop-off depot.
Regulatory Considerations:	• No regulatory requirements unless a permanent facility is developed, which would require municipal approvals.

[57] Based on 2019 waste audit information and professional judgement on diversion potential.

Category:	Program
Financial Considerations:	• Anticipated to be low capital costs (e.g. <$500,000), for one-time set up costs to acquire equipment required for an event (e.g. vehicles, bins, containers, signage, etc.), which would be used at each event. Costs would depend on the types of items that can be accepted, availability of equipment from potential program partners and any handling or transportation requirements prevent damage of items. • Annual operating costs anticipated to be medium/low ($100,000-$500,000), mainly support through P&E and some staff time to oversee or potentially administer events and/or partnering arrangements. Potential to reduce capital and operating costs if events can be coordinated with Option 4D1 – Temporary Neighborhood Drop-off Depots for Divertible Materials or 4D2 –
Unknowns/Assumptions:	• Assume there are a number of local charities and non-profit organizations in the city with complementary mandates with whom the City could explore potential partnerships with. • Unknown what materials would be managed and/or what portion of the materials received would actually be reused or recycled. • Unknown how materials that are not swapped or taken will be managed (i.e., responsibility of City or partnering organization). • It is unknown what quantities of materials are already diverted informally through friends, family, social media /grassroots community based sharing sites, organizations such as Kijiji etc. or donated to for/non-profit agencies and if some of these materials may now enter a more formal City-run program.
Supporting System Requirements for Success:	• City would need to identify materials that could be managed, including potential tonnes disposed which could be diverted, and research potential partners and locations. Potential to partner with one or more organizations to run the programs or take donated items for reuse. • May require staff to oversee or administer the program if done in partnership with another organization. Would require a significant P&E program to support and advertise programs and events. Many events could rely on volunteers to participate in the running programs. Events would need to be accessible to participants. • City would need to develop a policy to compensate organization for disposing of items that are not reusable and require disposal.
Potential Outcomes:	• Some materials could be diverted from landfill but anticipate overall low potential for diversion from landfill. Tonnage would depend on the type of materials diverted, number and type of events. • Avoidance of purchase of new materials, delay in disposal of materials.

Category:	Program
Measurement:	• It is difficult to quantitatively measure the success of this measure unless the City is able to weigh or count items reused. • City could monitor number of events held, number of participants at events.
Case Study #1:	• Many colleges and universities are implementing programs to recover and reuse items that students leave behind when finished school. Materials can be diverted by identifying an area where materials can be placed for other students or non-profits to take, or by providing a storage area where students can donate and/or take items. • Some municipalities are encouraging schools to provide furnished rooms/apartments to reduce quantities of materials left behind when students move out. • "Operation Separation" runs for one week off-campus using two shipping containers in the City of Guelph, home to about 800 students, half of whom move out each year. In 2018, the program collected over 450 kilograms of food and nearly 400 pieces of furniture and household goods. University of Ottawa has a similar program.
Case Study #2:	• In New York City, GrowNYC, holds Stop 'N' Swap events throughout the year at various locations throughout the city. Their goal is to hold one event in each community annually. These events may be held in partnership with other organizations such as parenting groups and sometimes feature repair cafes. Materials brought to these events are weighed in order to estimate how much is diverted. • In 2019, GrowNYC held 56 Stop 'N' Swap events which attracted over 12,000 people and diverted almost 65 tonnes of materials from disposal.58 • Residents are encouraged to bring clean, reusable, portable items such as clothing, housewares, games, books and toys, and to take something home as well. It is not required to bring something to take something. All items are free and offered on a first come, first served basis. Leftovers are sorted and recycled or donated for reuse to the extent possible. • These events provide an opportunity to educate residents about recycling worn textiles instead of disposing them in the garbage. The events have proved so popular that residents are limited to attending only six swaps per calendar year to ensure everyone can experience an event.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[58] GrowNYC. "Annual Report 2019." GrowNYC's 2020 Annual Report by GrowNYC - Issuu. (Accessed January 2021).

3A3 Develop Specialized Reuse Centre(s)

Category:	Program/Facility/Infrastructure
System Overview:	• City would develop one or more permanent reuse centre(s) or partner with community and /or charitable reuse organizations for personal and household goods that can be reused rather than disposed of in landfill. Examples of items include art and craft supplies, office supplies, building materials, furniture, etc. Given that there are many existing organizations, including not-for-profits, that run existing programs, an option could be looking only at materials that are not currently handled by these organizations. Depending on the materials diverted, there is some diversion potential, estimated at 0.5 to 1% per year for materials such as textiles, electronics and electrical equipment, bulky items and C&D material, which is equivalent to approximately 275 to 550 tonnes per year[59].
Status:	• Proven • Some municipalities have developed reuse centres as part of community recycling centres/drop-off depots or have developed partnerships to support stand-alone centres. Several municipalities have established large scale Recycling/Reuse Drop-off Centres that create opportunities for household and small business goods to be reused and recycled rather than disposed. Some charitable organizations in Ontario (e.g., Habitat for Humanity, Goodwill, Salvation Army, Furniture Bank) are also active, both independently and in collaboration with some municipalities, in providing a range of reuse services.
Source of Option:	• Consultant, Staff
Proposed Strategic Alignment:	Goals: • 2. Reduce waste generation. • 3. Maximize the reuse of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Adopt circular economy principles.

[59] Based on 2019 waste audit information and professional judgement on diversion potential.

Category:	Program/Facility/Infrastructure
Needs Assessment Alignment:	• Aligned with the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. Aligned with the need to provide enhanced convenience and additional drop-off opportunities for residents to reduce, reuse and recycle.
Individual Producer Responsibility (IPR) Impact:	• No impact.
System Consideration:	• Not a core system component. Option is secondary to system-wide considerations.
Sector Applicability:	• Not directed at any one type of waste generator, but applicable to all residents.
Environmental Considerations:	• Depending on the materials diverted, there is some diversion potential, estimated at 0.5 to 1% per year for materials such as textiles, electronics and electrical equipment, bulky items and C&D material, which is equivalent to approximately 275 to 550 tonnes per year[60]. Unlikely to result in changes in greenhouse gas (GHG) emissions from the current baseline system. • No impact to air/water quality.
Social Considerations:	• Residents would need to transport items to a reuse centre. • Permanent location(s) and established hours provide a reuse option when an item is no longer wanted instead of waiting for a reuse event to be held. • Potential to increase equity by providing items at low/no cost.
Technical/Operational Considerations:	• May require City to develop a process to enter into a partnership with an organization(s)/ charity to host/run centre. • May require City to provide space at a City facility (Trail Waste Facility, community centre). • Could be integrated into any future community recycling centre/drop-off depot.
Regulatory Considerations:	• No regulatory requirements unless a permanent reuse facility is developed which would require municipal approvals and may require an amendment to Trail Waste Facility Environmental Compliance Approval (ECA) for acceptance/storage of building materials, if the facility was located on the site.

[60] Based on 2019 waste audit information and professional judgement on diversion potential.

Category:	Program/Facility/Infrastructure
Financial Considerations:	• Anticipated to be medium/low capital costs (e.g. $500,000 - $1 million) if an existing building can be repurposed and also depending on the number/type of facilities. Costs would be higher for a new building compared to using an existing facility. • Annual operating costs for a model based on a partnership with a not-for-profit organization are anticipated to be medium/low ($100,000-$500,000), mainly support through P&E and some staff time to oversee or potentially administer program and/or partnering arrangements. • Annual operating costs are anticipated to be medium/low ($100-$500K) if operated as a program in partnership with an existing provider, or higher (<$1M) if operated in a purpose-built City facility for staffing and other operating expenses.
Unknowns/Assumptions:	• Unknown how many centres would be used and where they would be located or who would run them. • Unknown what materials would be managed and/or what portion of the materials received would be reused or recycled. • It is unknown what quantities of materials are already diverted informally through friends, family, social media sites, organizations such as Kijiji etc. or donated to for/non-profit agencies and if some of these materials may now enter a more formal City-run program.
Supporting System Requirements for Success:	• City would need to identify materials that could be managed, including potential tonnes currently disposed at Trail Waste Facility landfill which could be diverted, and research potential partners and locations. • Would require staff to oversee the program or administer it in partnership with another organization. • Would require a P&E program to support and advertise programs. • Facilities would need to be accessible to participants. • City would need to develop a policy to compensate organization for disposing of items that are not reusable and require disposal.
Potential Outcomes:	• Some materials could be diverted from landfill but anticipate overall low potential for diversion from landfill. Tonnage would depend on the type of materials diverted, number and type of depots. • Avoidance of purchase of new materials, delay in disposal of materials.
Measurement:	• It is difficult to quantitatively measure the success of this measure unless the City is able to weigh or count items reused. • City could monitor number of visitors to the reuse centre.

Category:	Program/Facility/Infrastructure
Case Study #1:	• Both the City of Hamilton and Region of Halton operate a reuse depot at a waste management facility using a non-profit organization. Materials such as textiles, clothing, books, electronics, housewares, barbecues, air conditioners and stuffed toys are accepted. Items are sold at low-cost.
Case Study #2:	• The City of Edmonton operates a reuse centre which accepts items free of charge and makes them available to organizations and individuals at a nominal fee for reuse. Individuals are charged $5 per purchase for every 25 kg. Non-profits may purchase a $50 membership which gives them 25 “punches” per year, each 25 kg purchased counts as one “punch”. • The centre accepts arts and crafts supplies, office and school supplies, paper and plastic products, samples of flooring, tiles, upholstery, carpet etc., media (cables, cassette tapes, records, video games), some metals, wood and plastics, seasonal and party supplies, and other items such as board games and sporting goods. No furniture, toys, clothing, electronics, construction materials or housewares are accepted.[61] • The centre offers group programs, birthday parties and boardroom rentals. • The centre has pivoted to an online presence while closed due to Covid and is featuring a “swap space” to allow a place to find items or find a home to items. • Facebook is used as a tool to promote waste reduction and avoidance tips and information.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[61] Reuse Centre Accepted Items Brochure (edmonton.ca)

3A4 Develop Community Strategies, Opportunities and Partnerships to Increase Reuse and Recycling and Avoid Waste

Category:	Programs/ Implementation Tools/ Strategy

System Overview:	• This option involves the City supporting community-based initiatives that increase reuse and recycling and avoid waste. Some examples include:
	  ○ Create a dedicated Team/Group/Committee to implement waste avoidance, reduction and reuse options in the community (e.g. thrift markets and secondhand reuse strategy).
	  ○ Support for local waste avoidance, reuse, reduction and recycling initiatives. Could be through promotion on City website, offering free or reduced cost space, social media, or procurement.

Status:	• Proven • Developing community strategies, opportunities and partnerships to increase avoidance, reuse and recycling is very common within Canada, United States and Europe.
Source of Option:	• Consultant, Staff, Consultations
Proposed Strategic Alignment:	Goals: • 2.Reduce waste generation. • 3.Maximize the reuse of waste. • 4.Maximize the recycling of waste. • 7.Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 10.Make sustainable waste management design an essential part of the city's planning process. • 11.Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Protect the environment. • Lead by example. • Adopt circular economy principles.

Category:	Programs/ Implementation Tools/ Strategy
Needs Assessment Alignment:	• Aligned with the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. Supports the need to provide enhanced convenience and additional drop-off opportunities for residents To reduce, reuse and recycle.
Individual Producer Responsibility (IPR) Impact:	• No Impact
System Consideration:	• Secondary option to system-wide considerations.
Sector Applicability:	• Not applicable to any one type of waste generator but applicable to waste generated by the community.
Environmental Considerations:	• Potential to reduce the purchase of new goods through reuse. • Potential to divert some material from disposal although difficult to estimate quantities. • Potential for some reductions in greenhouse gas (GHG) emissions from avoided or source reduced materials depending on type of material avoided or source reduced. Expected to result in a minimal decrease in GHGs from the current baseline system.
Social Considerations:	• Change requires residents to move away from attitudes of consumption to conservation, which is not easy. Residents need to change their behaviour and participate in programs to effect change. • Requires tools, workshops, and equipment to be accessible, provided in a variety of languages and formats. • No impact on public health or safety. • Would increase accessibility, equity and inclusion through availability of goods at no/low cost. • Positive impact on equity and inclusion as all residents can benefit from these types of initiatives.
Technical/Operational Considerations:	• City may need to partner with organizations/partners to help develop and execute reduction and reuse programs. • There may be a need for City staff to develop, implement, maintain or oversee programs. • Programs are relatively easy to develop and typically low level of effort to implement. • May require City to provide space at a City facility (e.g. Trail Waste Facility, community centre). • Will require a P&E campaign and regular communication with residents about initiatives.

Category:	Programs/ Implementation Tools/ Strategy
Regulatory Considerations:	• No regulatory requirements unless a permanent reuse facility is developed, which would require municipal approvals and may require an amendment to Trail Waste Facility Environmental Compliance Approval (ECA) for acceptance/storage of building materials.
Financial Considerations:	• Anticipated to be low capital costs (e.g. <$500,000) depending on whether or not any financial support is provided for organizations to assist with one-time costs. • Annual operating costs anticipated to be medium/low ($100,000-$500,000), mainly support through P&E and some staff time to oversee or potentially administer program and/or partnering arrangements. • One-time P&E costs could be in the order of $1-$2.50 per household for a multi-media campaign to
Unknowns/Assumptions:	• Unknown which materials would be targeted and diversion potential. • Assume a variety of organizations are available to participate in strategies and develop partnerships to implement programs.
Supporting System Requirements for Success:	• Involves the development of campaigns and strategies and the possibility of partnerships with existing organizations within Ottawa (e.g. bike sharing, tool library) or establishing new sharing programs in different areas of the City and/or within multi-residential buildings. • May require the establishment of teams/groups/committees that set sustainable/circular economy targets and create plans to achieve these targets, as well as reuse strategies. These groups may partner with local organizations or educational institutions to aid in the implementation and operations of projects/plans. • Some of these initiatives may be located in City facilities, such as libraries or recreation centres or at the Trail Waste Facility. • Ongoing promotion and education for local avoidance, reuse, reduction and recycling initiatives.
Potential Outcomes:	• Very difficult to estimate impact on diversion, waste reduction or avoidance. Unlikely to make a significant impact on life of Trail Waste Facility landfill. • May divert some material from the Trail Waste Facility landfill, which will preserve capacity.
Measurement:	• Aspects of this program are likely qualitative. • City could measure success by metrics such as number of events, number of interactions, number of meetings, number of tools developed.

Category:	Programs/ Implementation Tools/ Strategy
Case Study #1:	• As a result of the Long Term Waste Management Strategy, the City of Toronto is working towards the aspirational goal of a circular economy, which moves away from the make-take-dispose approach to materials management, to a system that focuses on product longevity, renewability, reuse and repair. The City's Solid Waste Management Services division now has the Circular Economy and Innovation unit which aims to drive the circular economy in Toronto. The unit is responsible for developing and implementing detailed plans and recommends policies regarding solid waste related programs and policies to help Toronto achieve its circular economy target. • The unit pursues public engagement activities, representing the City/Division at industry associations and Committees, implementing City-wide change initiatives, executing pilot projects, including community reduce and reuse programs, working with small and medium sized businesses to inform them about waste reduction and the circular economy and exploring how the City can build circular principles into procurements, and achieve more sustainable outcomes in what it purchases. This unit also leads the Circular Economy Working Group, which is comprised of representatives from local businesses and community groups from various sectors in Toronto.

Category:	Programs/ Implementation Tools/ Strategy
Case Study #2:	• Metro Vancouver has developed a number of strategies to increase waste reduction, reuse and recycling including the following: ○ Create Memories, Not Garbage – The waste reduction campaign called "Create Memories, not Garbage" is launched for each Christmas season and aims to get people to think about what they are giving as gifts and consider giving gifts of time, experience or long lasting gifts rather than an item that will eventually end up in a landfill. ○ Love Food Hate Waste Campaign – Metro Vancouver paid a license fee to the UK Waste and Resources Action Program (WRAP) to use the Love Food Hate Waste promotional and web based materials. The campaign was officially launched in May 2015 and was intended to assist Metro Vancouver achieve its goal of reducing per capita waste generation by 10% by 2020. ○ Think Thrice About Your Clothes Campaign – The "Think Thrice About Your Clothes" campaign focuses on reducing textile waste. The campaign encourages residents to reduce, repair, and re-use their clothes to minimize waste. ○ Created a single-use item toolkit with resources and best practices to reduce the use of these items. • Prepared materials for waste reduction campaigns including posters, and jpgs for use in promotional material.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

3A5 Develop Corporate Strategy to Increase Waste Avoidance, Reduction, Reuse and Recycling

Category:	Programs/ Implementation Tools/Strategy
System Overview:	• This option involves the City developing a Corporate Waste Avoidance, Reduction, Reuse and Diversion Strategy to identify how the City as a Corporation will reduce the amount of waste it generates, reuses and recycles at its facilities and in its operations, including single-use items and how to support circular economy principles and zero waste opportunities. • Examples of what could be included in this strategy include the creation of: ○ A dedicated team/group/committee to implement waste avoidance, reduction and reuse options across all City operations. ○ A City/Corporate Reduction/Reuse Plan (e.g. to leverage procurement practices, staff education, use of reusable items such as cutlery/dishes, establish reuse locations in offices, swap events). ○ A Single Use Item Reduction Strategy for City facilities and operations. ○ A green procurement policy and/or strategy to support a move to a circular economy.
Status:	• Proven • Developing Corporate/City strategies, opportunities and partnerships to increase avoidance, reuse recycling is very common within Canada, United States and Europe.
Source of Option:	• Consultant, Staff, Consultations

Category:	Programs/ Implementation Tools/Strategy
Proposed Strategic Alignment:	Goals: • 2.Reduce waste generation. • 3.Maximize the reuse of waste. • 4.Maximize the recycling of • 6.Aspire to achieve 100% GHG emission reductions. • 7.Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 10.Make sustainable waste management design an essential part of the City's planning process. • 11.Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Protect the environment. • Lead by example. • Adopt circular economy principles.
Needs Assessment Alignment:	• Aligns with the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. • Aligns with the need to develop a strategy that identifies ways in which City facilities and operations can avoid, reduce and divert more waste from disposal.
Individual Producer Responsibility (IPR) Impact:	• No Impact.
System Consideration:	• Secondary option to system-wide considerations.
Sector Applicability:	• Applicable to: City Facilities/Operations (CF).
Environmental Considerations:	• Potential to divert materials but is difficult to estimate tonnes diverted or avoided. • Potential for some reductions in greenhouse gas (GHG) emissions from avoided or source reduced materials, depending on type of material avoided or source reduced. Expected to result in a decrease from the current baseline system.

Category:	Programs/ Implementation Tools/Strategy
Social Considerations:	• Change requires City staff and the organization as a whole to move away from attitudes of to conservation, which is not easy. • City staff and the organization as a whole will need to change their behaviour and participate in programs to effect change. • Positive impact on equity and inclusion as all staff can benefit from these types of initiatives. • Shows residents that the City is leading by example. • Plans and policies developed can influence suppliers, service providers and how City services and programs are delivered.
Technical/ Operational Considerations:	• Will require staff to identify strategies and opportunities to increase waste avoidance, reduction, reuse and recycling. • Will require staff to develop City-specific P&E materials and identify champions to lead initiatives in all areas of operations, including offices and facilities. • Would require purchase of durable items (e.g. cutlery) and identification of a system/staff for cleaning (e.g. a dishwasher and system to unload dishwasher). • Would require development of a Green Procurement policy/strategy, in consultation with other departments and adherence to the policy.
Regulatory Considerations:	• There are no regulatory requirements regarding waste avoidance, reuse or reduction. • There are no approval requirements.
Financial Considerations:	• The capital cost to develop a Corporate Strategy is anticipated to be medium/low (e.g. $500,000 to $1M). • There may be financial implications to the Corporation in moving to support circular economy principles, once the strategy is implemented. • Individual capital costs will vary and are generally anticipated to be low (e.g. <$500,000), for example, replacing single-use items with reusable ones. It is recognized that in some instances there may be higher up-front capital costs, but cost savings may be realized over the long-term. • In addition, some other initiatives that are implemented as a result of the strategy may have lower capital costs. • There are no operating costs associated with developing the strategy, however some initiatives may have operating costs associated with them, which would be identified in the strategy.

Category:	Programs/ Implementation Tools/Strategy
Unknowns/ Assumptions:	• The extent of the different types of materials and items that can be avoided, reduced, reused or is not currently known. • The diversion impact is unknown.
Supporting System Requirements for Success:	• Will require support and leadership from Council, senior management and procurement staff. • Requires cross-departmental collaboration to develop the strategy. • Requires dedicated City staff to develop resulting plans, policies, programs and initiatives, promote requirements and educate staff on their responsibilities. • Requires identification of areas where green procurement may be applicable and incorporation of language in procurement documents and processes.
Potential Outcomes:	• Very difficult to estimate impact on diversion, waste reduction or avoidance. Unlikely to make a significant impact on life of Trail Waste Facility landfill. • May divert some material from landfill, which will preserve landfill capacity.
Measurement:	• Tracking and reporting on amount of waste generated by City facilities/operations and waste diversion rates before and after implementation of the strategy. • Conducting periodic waste audits before and after implementation of the strategy to track waste stream composition. • Tracking of green procurement opportunities implemented. • Tracking of budget spent on supporting circular economy or zero waste project/initiatives implemented.

Category:	Programs/ Implementation Tools/Strategy
Case Study #1:	• The City of Mississauga has set strategic environmental goals and objectives to increase sustainability. A number of the actions target City operations and provide direction at a corporate level for waste diversion, GHG reduction and environmental sustainability. • The plan includes a corporate waste diversion program with a target of diverting 75% of waste from landfill. All departments are required to participate in the program. • The Environment Service Area provides support to other departments and conducts waste audits, equipment mapping and inventories to identify opportunities to improve waste management at the City. The group also conducts outreach through in person events, social media and trains "green leaders" who champion environmental action in the workplace. • The City tracks a number of performance measures through a balanced scorecard, which includes corporate waste diversion rates, GHG emissions and the number of City employees who have access in their workplace to a "Green Leader". The City also tracks a number of measures such as overall employee satisfaction for Environment from an employee engagement survey, waste diversion rate at Civic Centre, and number of waste audits62
Case Study #2:	• The City of Markham has developed a corporate waste diversion strategy, to be implemented between 2020-2023, with a target of 85% municipal diversion. A waste diversion committee has conducted a review of all city waste management and diversion programs and developed a consolidated list of initiatives and program improvements to achieve the target. • Internal outreach will be conducted through e-newsletters, posters, group staff education seminars and training modules. The City has also developed a zero waste policy for food and
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[62] 2019-environment-summary.pdf (mississauga.ca)

[63] https://www.markham.ca/wps/wcm/connect/markham/2415854f-c9df-47e2-867a-6549e1c68b2f/zero-waste-policy-food-and-catering-services.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_2QD4H901OGV160QC8BLCRJ1001-2415854f-c9df-47e2-867a-6549e1c68b2f-mvd8De9

3A6 Implement a Food Waste Reduction Strategy

Category:	Program
System Overview:	• This option involves the City implementing a food waste reduction strategy, either by licensing a program such as Love Food Hate Waste or developing its own program to educate residents about food waste reduction. • The City could also collaborate with the food industry, Ottawa Public Health and non-profit agencies to direct food to charities and food banks, provide educational programs geared towards supporting residents in changing food waste behaviour. • This option is related to Option 1F1: Develop a Food Waste Reduction Campaign. • At 50% reduction of avoidable food waste, there may be the potential to divert 23,000 tonnes of food waste from garbage, and approximately 15,000 tonnes of food waste from the Green Bin program every year.[64]
Status:	• Proven • The cities of Toronto, Vancouver, Victoria, Winnipeg, Guelph-Wellington, the Capital Region District Metro Vancouver are part of the Love Food Hate Waste campaign.
Source of Option:	• Consultant, City Councillors
Proposed Strategic Alignment:	Goals: • 2.Reduce waste generation. • 6. Aspire to achieve 100% GHG emission reductions. • 10. Make sustainable waste management design an essential part of the city's planning process. • 11.Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Protect the environment. • Lead by example. • Adopt circular economy principles.

[64] Based on 2019 waste audit data and City of Toronto food waste findings (see footnote below).

Category:	Program
Needs Assessment Alignment:	• Aligned with the need to focus on the value of food to increase the prevention of food waste, which is higher in the waste hierarchy. • Aligned with the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management
Individual Producer Responsibility (IPR) Impact:	• No impact.
System Consideration:	• Secondary option to system-wide considerations.
Sector Applicability:	• Not directed at any one type of waste generator, but applicable to all residents, food industry, businesses generating food waste, including City staff and food-based operations run by the City or operated within City facilities.
Environmental Considerations:	• Based on Ottawa's 2018/2019 curbside waste audits, over 46,000 tonnes of food waste was placed in the garbage and over 30,000 tonnes of food waste was placed in the Green Bin. At 50% avoidable food waste65, it is estimated that Ottawa residents are throwing away about 38,000 • tonnes of avoidable food waste annually in the garbage and Green Bins.66 Potential for reductions in greenhouse gas (GHG) emissions from avoided or source reduced food waste no longer being disposed of in landfill. • Expect to result in a decrease in GHGs from the current baseline system.
Social Considerations:	• Significant level of effort required for residents, businesses, staff etc. to change behaviour to reduce waste. • Change requires people to adjust attitudes and behaviours about buying, preparing and storing food, which is not easy. • Requires awareness and information tools (e.g. meal planning, recipes, food storage guidelines, workshops, etc.) to be accessible, provided in a variety of languages and formats. • Positive impact on equity and inclusion, as all residents can benefit from food waste reduction which result in financial savings with less waste food.

[65] In Toronto, waste audits have shown that the average single family household throws away over 200kg of avoidable and unavoidable food waste annually and avoidable food waste represents over 50% of all food waste generated.

[66] Note that Ottawa's waste audits did not identify avoidable vs non-avoidable food waste. It is assumed that Ottawa's residents behave similarly to Toronto's.

Category:	Program
Technical/ Operational Considerations:	• Minor operational considerations. • If City develops its own program, would require staff to design an Ottawa-specific program and execute the program. Alternatively, City could license a program and deliver the program themselves. • Would need to develop a P&E program to support the strategy. • City could collaborate with other departments, agencies or businesses to develop and deliver programs and initiatives, for example, Ottawa Public Health.
Regulatory Considerations:	• There are no regulatory requirements regarding waste avoidance, reuse or reduction. • There are no approval requirements. • The Ontario Public Health Standards - Ontario Food Safety Protocol (2019) mandates Boards of to have available, food safety information and/or educational material to raise public awareness about food safety practices, including among other items, the safe diversion of surplus food for donation, and new and emerging food safety risks. • The Ontario Food Premises Regulation (O. Reg. 493/17) has specific requirements related to specific special events for keeping records of food donated from a food premise that is not subject to inspection.
Financial Considerations:	• There are no anticipated capital costs. • Annual operating costs are expected to medium/low ($100K-$500K) including staff time. The annual licensing fee for the Love Food Hate Waste campaign is approximately $40,000. • Costs may be shared with partnering organizations or city departments to implement programs, projects and events. • One-time P&E costs could be in the order of $1-$2.50 per household for a multi-media campaign to launch the initiative. • Staff requirements would depend on how the program is developed/delivered. • Unlikely to generate revenue. There is a potential for cost savings by not collecting and processing of a significant portion of waste, however this would only be the case if food waste reduction efforts do not reduce tonnages below the City's current minimum put-or-pay contract for organic waste
Unknowns/Assumptions:	• Unknown if the City would develop its own program or license a program. • Assume the City would deliver the program. • It is unknown what percentage of the food waste generated by Ottawa residents is avoidable and non-avoidable.

Category:	Program
Supporting System Requirements for Success:	• Requires more waste audit data on food waste composition to design program and measure success. Collaboration with Ottawa Public Health to ensure alignment with food safety and security plans and initiatives. • Involves the development of campaigns and strategies and the possibility to partner or purchase licensing with/from existing organizations (e.g. Love Food Hate Waste) or establishing new food waste reduction programs in different areas of the City and/or within multi-residential buildings. • Could also involve the establishment of teams/groups/committees that set food waste reduction targets and creates plans to achieve these targets. These groups may partner with local organizations, or educational institutions to aid in the implementation and operations of projects/ plans.
Potential Outcomes:	• At 50% reduction of avoidable food waste, there may be the potential to divert 23,000 tonnes of food waste from garbage, and approximately 15,000 tonnes of food waste from the Green Bin program every year.67
Measurement:	• Aspects of the food waste reduction strategy may be measurable, depending on the type of program/ research project developed and implemented. • Waste audits can be designed to measure the amount of avoidable versus non-avoidable food waste found in the garbage and green bin. • The City could measure number of online interactions, number of meetings/workshops held, audience reached, etc. • Reductions in the quantity of food waste in garbage and Green Bin programs. • It may be difficult to attribute these reductions to this strategy alone.

[67] Based on 2019 waste audit data and City of Toronto food waste findings (see footnote above).

Category:	Program
Case Study #1:	• In 2015, Metro Vancouver launched the Love Food Hate Waste (LFHW) campaign, a three-year to reduce avoidable food waste. In 2018, the National Zero Waste Council launched the Love Food Hate Waste Canada program, modelled on the LFHW campaign developed in the United Kingdom (UK). It is a behaviour change campaign that has helped cut avoidable food waste by 21%, estimating to have saved UK consumers 13 billion pounds ($22 billion CAD) in its first five years of operation. • This campaign partners with businesses and government entities to help these organizations achieve their reduction and prevention targets. • Metro Vancouver prepared for the launch of the campaign by conducting baseline research to the extent of food waste and people's attitudes toward food. • The 2019 budget for Metro Vancouver's participation in the LFHW Canada campaign was $82,000; $42,000 for the national membership fee and $40,000 for regional activation. 68
Case Study #2:	• As part of developing the SM4RT Living Plan in 2013, York Region developed a Food Waste Reduction Strategy. Their Strategy aims to achieve 15% reduction in food wastage by 2031, with an additional 5% reduction achieved every year thereafter. They anticipate that there will be an annual reduction in food waste of over 13,800 tonnes, reducing costs to manage waste by $4.2 million by 2031 and potentially save 53,200 tonnes of greenhouse gases by 2031. • The Region launched the Good Food Program in 2015. In 2019, 46,411 people had been engaged at 67 Good Food Outreach events.69 • Green Bin waste generation rates, on average, have declined from 2015 to 2019 which suggests that the Region's P&E work is having an impact. The updated SM4RT Living Plan aims to reduce green bin waste by 15% from 2014 levels by 2031 by addressing food waste and encouraging on-site processing such as backyard composting.70
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[68] Zero Waste Committee Revised Agenda Package - May 17, 2019 (metrovancouver.org)

[69] York Region 2019 Annual Waste Management Report

[70] https://www.york.ca/wps/wcm/connect/yorkpublic/6f3f1734-1d45-4322-8903-ca7354a2db50/The+York+Region+Waste+Management+Master+Plan+2020.pdf?MOD=AJPERES&CVID=n50.7-p

3A7 Expand and Improve the Take It Back! Program

Category:	Program

System Overview:	• This option would see the City work with partners to increase the number of Take It Back! Options for residents. The Program encourages local businesses to "take back" some of the materials (e.g., automotive products, medical supplies, electronics) they sell from residents for reuse, recycling or disposal.
	• This option would also include improvements to the current program, for example:
	  ○ an interactive map showing locations that accept products for reuse/recycling or disposal, prioritizing local businesses that reuse or recycle materials, offering disposal options as a last resort;
	  ○ providing information on whether the local business reuses, recycles or disposes of the material; and,
	  ○ requiring members to report annually on the amount of materials reused, diverted or disposed of properly to determine program performance.

Status:	• Proven • The City implemented this program in 1997. In 2021, there are more than 180 different products taken back by over 550 retailers and charitable organizations participating in the program.
Source of Option:	• Staff
Proposed Strategic Alignment:	Goals: • 3.Maximize the reuse of waste. • 4.Maximize the recycling of waste. • 5.Maximize the recovery of materials and energy. • 7.Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 8.Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 11. Collaborate with external stakeholders to achieve waste management practices Guiding Principles: • Honour the 5Rs hierarchy. • Protect the environment. • Adopt circular economy principles.

Category:	Program
Needs Assessment Alignment:	• This option aligns with the need to increase reuse opportunities to decrease the amount of waste entering the City's waste management system. • This option also aligns with the need to identify waste streams that could be diverted and develop new partnerships to capture these waste streams. • It is also aligned with the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. • Aligned with the need to provide enhanced convenience and additional drop-off opportunities for residents to reduce, reuse and recycle. • Supports the need to identify specific waste streams that can be diverted from landfill disposal and develop new collection and diversion programs to capture these streams.
Individual Producer Responsibility (IPR) Impact:	• Partial impact - some retailers accept items that may be impacted by new IPR regulations and may be collected through different means under new regulations. There is the potential for new regulations to impact to the total number of members, depending on the items they currently accept.
System Consideration:	• Not a core system component. Is secondary to system-wide considerations.
Sector Applicability:	• Not directed at any one type of waste generator, but applicable to all residents.

Category:	Program
Environmental Considerations:	• It is estimated that over 500 tonnes of materials are diverted from the TWF landfill annually as a result of the Take It Back! program[71], however the City does not track the tonnages taken back to retailers. Waste audit data can identify materials that are often ending up in garbage that could be diverted through the Program. Expanding the number of accepted materials and participating businesses provides more convenient options for residents to take materials to instead of dropping it off at the City's seasonal mobile MSHW depots or incorrectly disposing of it in the garbage where it ends up at the Trail Waste Facility landfill. • Unlikely to result in changes in greenhouse gas (GHG) emissions from the current baseline system. As new materials and businesses are added to the program, there is a potential for less waste to enter the City's waste management system. • The Waste Explorer tool on the city's website does not indicate whether Take It Back! members recycle or dispose of items to assist residents in deciding on the best use of material. Proper disposal of materials such as Municipal Hazardous Special Waste (MHSW) protects local waterways.
Social Considerations:	• This program encourages consumers to return to the stores they purchased the item at, thus providing convenient method to reuse, recycle and/or dispose of their waste. • May allow charitable organizations to receive donations that they can sell at a low cost to residents. • The City's Waste Explorer tool lists participating businesses, with links to Google Maps so residents find the closest location. Donors are advised to phone the Take it Back! retailer member prior to returning an item. Operating hours are not listed on the Waste Explorer site. • Waste Explorer information provided is available in English and French.
Technical/ Operational Considerations:	• Significant effort for City staff to increase the number of members participating in the program, in addition to continuing to develop partnerships with retail businesses, organizations and charities. • City could require members to report on estimated quantities of materials diverted.
Regulatory Considerations:	• No regulatory requirements.
Financial Considerations:	• There would be no capital costs. • Medium/low annual operating costs ($100,000 to $500,000) for staff time to develop and maintain partnerships, promote the Program, gather data and maintain Waste Explorer tool.

[71] Take it Back! Program | City of Ottawa

Category:	Program
Unknowns/ Assumptions:	• It is unknown how successful this program is, as data is not readily available or tracked (i.e., tonnes diverted). • It is unknown how the City verifies the information provided by retailers and charitable organizations the registration form regarding how products that are "taken back" are managed. • It is unknown how many more retailers or charitable organizations could be included in the program or the number and type of additional products/items that could be added to the program.
Supporting System Requirements for Success:	• City staff to liaise with existing and potential Take It Back! members about materials that can be managed, benefits of being part of the program and updating the Waste Explorer application. • Ongoing promotion of the Program to residents. • Data collection to track amount of materials reused, diverted or disposed properly.
Potential Outcomes:	• Given the lack of data available on materials diverted, it is unknown the full diversion potential. given historical performance of the program, materials are being diverted annually, with the current estimate at 500 tonnes per year, per the City's website. • MHSW that may otherwise be placed in the garbage and be disposed of at Trail Waste Facility landfill disposed of correctly. • Avoid purchasing new materials and delay the disposal of materials. • Continued establishment of partnerships with local businesses and organizations. • Increase accessibility through more locations to drop off materials rather than only City mobile depots.
Measurement:	• It is difficult to quantitatively measure the success unless the partner is able to estimate volume, weigh or count items taken back and report back to City. • Number of additional retailers or organizations participating in the program. • Number of additional products/items accepted in the program.

Category:	Program
Case Study #1:	• New York City Department of Sanitation provides a search engine on their website that directs users the appropriate participating businesses/collectors to take their reusable items or where items can be found. • This program provides information for various materials such as bicycles, appliances, automotive, care, books and more. There is an option on the search engine to search if the user is looking for reusable materials, if the user is looking for a location to donate to and whether to show only vendors that pick up items. • The results show a map of locations with links to the organization. Information on each organization includes a short description, website, phone, email, address, hours and what can be donated or found.72
Case Study #2:	• There are many examples of “Get rid of it right” or “Recycle it right” online tools to help residents to identify where to donate items, but few examples of “Take it Back” programs which requires a “commitment” from retailers and other organizations to reuse, recycle or dispose of items responsibly. • Most municipal websites prioritize locations which reuse or recycle items, whereas on the City’s Waste Explorer there is no prioritization or indication of how the material is reused, recycled or disposed. Most sites offer limited information on disposal, instead focusing on reuse and recycling. • Metro Vancouver has an application/website 73 which searches by reusable or non-reusable items and location to show on a map where the item can be managed. • The Region of Waterloo offers a Reuse and Recycle Directory to residents which includes local take-back programs, businesses and organizations that deal with reusable items. 74 See Reuse and Recycle Directory
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[72] https://www1.nyc.gov/assets/donate/site/

[73] https://recycling.metrovancouver.org/

[74] https://www.regionofwaterloo.ca/en/living-here/residential-reduce-and-reuse-options.aspx#RESDIRECTORY

3B1 Subsidies, Rebates, Grants for Options that Avoid, Reduce or Reuse Waste

Category:	Program
System Overview:	• As a way to incentivize waste avoidance, reduction and reuse, the City could award a subsidy, rebate or grant to local residents, resident groups or non-profit organizations for options, ideas or programs that avoid, reduce or reuse waste. Some examples include: • A cloth diaper subsidy program - where the City would provide grants to buy or rent cloth diapers. Applicants would need to meet eligibility requirements, such as agreeing to use cloth diapers for a certain duration, buying a minimum number of cloth diapers or using a cloth diaper rental company service for a certain period. • Bike repair hubs - where the City would provide a grant to an organization that promotes bike repair and teaching residents how to maintain/repair bikes. • Sharing library - where the City would provide support by provision of space in a City facility. Information about waste reduction targeted to multi-residential buildings - where grants would provide funding for educational programming, welcome packages, on-site environment days etc. • This option could also include providing space at a City facility for free or at reduced rates to non-profit organizations. • The City would need to develop eligibility criteria, and a process for applying, evaluating and awarding. This option could be combined with Option 3A4: Develop Community Strategies and Partnerships to Increase Reuse and Recycling and Avoid Waste.
Status:	• Proven • Many municipalities in Canada have implemented this program.
Source of Option:	• Consultant, Consultations

Category:	Program
Proposed Strategic Alignment:	Goals: • 2.Reduce waste generation. • 3.Maximize the reuse of waste. • 11.Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Protect the environment. • Lead by example. • Adopt circular economy principles. • Embrace innovation. • Keep waste local.
Needs Assessment Alignment:	• Aligned with the need to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system.
Individual Producer Responsibility (IPR) Impact:	• No impact.
System Consideration:	• Secondary option to system-wide considerations.
Sector Applicability:	• Not directed at any one type of waste generator, but applicable to all residents.
Environmental Considerations:	• Potential to divert some material from disposal, although difficult to estimate quantities. • Potential for some reductions in greenhouse gas (GHG) emissions from avoided or source reduced materials, depending on type of material avoided or source reduced. Expected to result in a minimal decrease from the current baseline system.
Social Considerations:	• Community grants can be awarded to community-based projects that reduce residential waste and increase participation in the City's waste diversion programs. • Individual grants can also be awarded according to eligibility requirements and can be geared to • Funding can be prioritized for ideas that involve multilingual communities, equity seeking groups, neighbourhood improvement areas, service clubs, school groups, social enterprises etc. to increase equity and inclusion.

Category:	Program
Technical/Operational Considerations:	• The City will need to determine which materials would be most appropriate to target for removal from the waste stream. • The City will need to develop, implement, maintain or oversee funding programs. • The City would need to develop the criteria to award funding and to monitor funding program, including following up to determine success of each initiative. • The City would need to identify funding sources for the program and provide proper oversight to ensure program funding is being used for intended purposes and program performance is being measured and reported to City.
Regulatory Considerations:	• There are no regulatory requirements regarding waste avoidance, reuse or reduction. • There are no approval requirements.
Financial Considerations:	• There are not anticipated to be any capital costs. • Annual operating costs will be dependent on the level of funding the City is prepared to offer and uptake of programs. Some municipalities (e.g. Toronto) offer grants from $5,000 to $25,000 per application and others (e.g. Vancouver) offer both small (e.g. $500) to large (e.g. $225,000) grants. • Likely to require additional staff to administer, track and audit the grants, subsidies or rebate programs. Estimate this cost to be low (<$100,000).
Unknowns/Assumptions:	• It is unknown what materials the City may target, or eligibility requirements. • It is unknown what the long-term impact of these measures may be.
Supporting System Requirements for Success:	• Requires sustained annual funding. • Would require an annual application process and a system to award funds. • Requires P&E to promote programs. • Staff to support program. • Would require follow-up of each application to determine success of the initiative and overall
Potential Outcomes:	• Very difficult to estimate impact on waste reduction or avoidance. • Impact on Trail Waste Facility landfill would depend on the type of program and the quantities of materials avoided/reduced or reused.
Measurement:	• The City could measure the success of this option on the number and type of subsidies/grants/rebates awarded, as well as the total amount of grants given each year compared to budgeted amount. • The City may be able to estimate the impact on diversion (e.g. avoidance of use of disposable diapers). • Applicants could be required to identify and report on performance measures as a condition of funding.

Category:	Program
Case Study #1:	• City of Toronto has offered Waste Reduction Community Grants since 2018 to reflect the City's Waste Strategy guiding principles of working with community partners, increasing public engagement, and working together to deliver services. These grants are awarded to support innovative community-based efforts to reduce residential waste and increase waste diversion. Grants range from a minimum of $5,000 to a maximum of $25,000 annually. Since 2018, more than $188,000 in funding has been awarded. • Eligible projects must meet one of the following objectives: • Directly result in waste reduction or diversion; • Enhance the knowledge or ability of residents to engage in activities that will result in waste reduction diversion; • Foster long-term behaviour changes what will result in waste reduction or participation in the City's diversion programs. • There is no publicly available information on tonnes reduced or diverted as a result of these grants. It difficult to measure behaviour change and correlate to tonnes managed.
Case Study #2:	• From 2019 to 2020, Montreal completed a 2-year pilot program for subsidizing the cost of reusable diapers and feminine hygiene products. Eligibility for grants is dependent on borough location and grants vary by location. As an example, for Lachine, residents are eligible for a $150 grant if they are the parents of a child up to 12 months, agree to use cloth diapers as long as the child needs them, buy a minimum of 20 new cloth diapers or use a cloth diaper service for at least 12 months. A number of documents are required for proof of birth/residence and proof of purchase/use of service.75 Some boroughs also provide grants for sustainable menstrual76 and hygiene products77 (may be geared to income).
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[75] https://montreal.ca/en/how-to/apply-grant-to-get-cloth-diapers-baby

[76] https://montreal.ca/en/how-to/apply-grant-to-get-sustainable-hygiene-products

[77] https://montreal.ca/en/how-to/apply-grant-to-get-sustainable-feminine-hygiene-products

4.1 4. Recycling

4A1 – Textile Waste Diversion Enhancement

Category:	Program

System Overview:	• Currently, City of Ottawa residents have access to a few different options for textile diversion. These include the Take it Back! Program, where retailers and charities accept household items, including textiles, for reuse and recycling. Residents can also drop off materials at clothing donation bins located throughout the city. Some charities also offer at home clothing collection. The City is currently unable to track performance of the existing programs offered, including tonnages collected through the existing system, waste diversion rates, or reuse and recycling rates.
	• The purpose of this option is to look at ways to enhance the current textile waste diversion options that are available, through P&E aimed at promoting these different options, allowing more convenient placement of donation bins throughout the City, subject to regulatory requirements pertaining to public health and safety, property maintenance, and nuisance control and to implement mechanisms to track program performance.
	• There are several models for operating donation bin collection systems. These approaches typically involve some form of partnership or working relationship between non-profit and for-profit organizations. Two of the most common models are:
	  ○ Non-profit owns and operates donation bins and/or some offer curbside pick-ups based on appointment and sell what they collect to a for-profit business.
	  ○ For-profit business owns and operates donation bins and some offer curbside pick-ups based on appointment, and a charitable or non-profit partner receives a portion of money raised through the sale of collected textiles.
	• Both models can create benefits for charities and typically, the organizations are able to put the municipal logo on donation bins. Through ongoing engagement, it is important to understand how charities that cannot, or are not interested in operating their own donation bin program benefit by partnering with a for-profit business that owns and operates the donation bins. Regardless of the operating model selected, it is important for the City to consider how they will ensure public donation bins are safe and well-maintained.

Category:	Program
System Overview: (continued)	• The City could also consider participating in the Ontario Textile Diversion Collaborative, which aims to increase textile diversion rates and encourage the development of a textile recycling industry in Ontario. In addition to policy and research efforts, the group also develops public awareness campaigns to limit the amount of textiles that end up in the waste stream. • The City's Public Policy Development Branch is currently conducting a comprehensive review of the Clothing Donation Box By-law (By-law No. 2013-98). Any changes or enhancements to textile waste diversion strategies should be aligned with any applicable regulatory amendments. • In the 2018/2019 Four Curbside Season Waste Composition Study, approximately 5% of the total sent to landfill consisted of textiles. Similarly, the waste audit completed on multi-residential waste in November 2016 also found that 5% of the total waste sent to landfill consisted of textiles. Together, this represents approximately 10,000 tonnes of material that could be diverted from the Trail Waste Facility landfill[78].
Status:	• Proven • Textile drop off has been around for decades. Some municipalities have textile diversion partnerships programs in place, which are a newer approach to managing this material stream.
Source of Option:	Consultant, Staff, Consultations
Proposed Strategic Alignment:	Goals: • 3.Maximize the reuse of waste. • 4.Maximize the recycling of waste. • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour 5Rs hierarchy. • Change community values. • Adopt circular economy principles. • Keep waste local.

[78] Based on 2020 curbside and multi-residential tonnage disposed at Trail Waste Facility landfill of approximately 200,000 tonnes.

Category:	Program
Needs Assessment Alignment:	• This option supports the need for additional new waste collection programs and increased waste diversion.
Individual Producer Responsibility (IPR) Impact:	• No impact at this time. However, the Province of Ontario has sought feedback from industry on additional materials in Ontario's waste stream that could be managed through producer responsibility programs to maximize diversion. Various stakeholder across the textile industry highlighted textiles as an opportunity. While nothing is known at this time, there is potential for the Provincial government to consider textiles for future IPR programs.
System Consideration:	• Secondary – will be a program option to overlay onto core system component.
Sector Applicability:	• This will most likely only apply to the Single Family (SF) and Multi-Residential (MR) sectors. • Could also consider expansion to City facilities operations and/or partner programs.
Environmental Considerations:	• Can lead to increased waste diversion as textile materials may be diverted to donation bins versus disposed of as garbage at the Trail Waste Facility landfill. Potential for diversion of up to 5% of current disposed tonnes to landfill. • Textiles release greenhouse gas (GHG) emissions when decomposing in a landfill. There may be reduction in GHG emissions if they are diverted from landfill. • Decomposing textiles also leach chemicals into the landfill, which find their way into the leachate. This option may slightly improve the quality of leachate produced at the Trail Waste Facility landfill with a lower quantity of textiles being sent for disposal, resulting in reduced treatment requirements.
Social Considerations:	• Residents need to change their behaviour and participate in programs to affect change. • New programs may increase accessibility, equity and inclusion such as supporting social enterprises and revenue streams for charities.
Technical/ Operational Considerations:	• The City will need to collaborate with partners and engage with City residents to understand the best locations for new donation bins. • Staff resources will be required to coordinate information on available community drop-off locations. • City will need to design and execute a focused textile P&E campaign to support an enhanced program and could potentially partner with partner organization on P&E campaign. • By-law enforcement may be required to ensure bins are safe and are properly maintained. • Opportunity to promote locations of textile donation bins on Take-it-back! or on City website and/or an interactive map showing donation box locations.

Category:	Program
Regulatory Considerations:	• May need City By-law amendments for donation bin placement and procurement, or a partner may need permits to add bins to a site. • Current Clothing Donation Box By-law is under review by City staff. • Donation box placement in multi-residential sectors would require an amendment to the current zoning regulations in the City's Clothing Donation Box By-law. Current regulations state that donation boxes are not permitted in areas zoned residential.
Financial Considerations:	• No capital costs are anticipated. Typically, partnering organizations assume these costs. • Annual operating costs are expected to be low to medium ($100K to $500K) and includes promotion education. May be some additional operating costs associated with enforcement.
Unknowns/ Assumptions:	• Availability of markets to support additional textile reuse and recycling is unknown. • The extent of circular economy efforts by clothing manufacturers and retailers to establish textile reuse and recovery programs is unknown. • It is assumed that there is additional interest and capacity from community partners to support additional drop-off donation bins. • Assume the City would not be providing collection bins. • The outcome of the Clothing Donation Box By-law review is unknown.
Supporting System Requirements for Success:	• Would require a targeted P&E campaign and ongoing education and promotion to inform residents of locations of bins and the types of textiles that are accepted (e.g. non-reusable textiles and other non-clothing textiles). • Requires partnership/collaboration with for- or non-profit organizations who own the bins and operate programs. • May require an update to the City's Clothing Donation Box By-law • Will require sustainable end markets for recycling and reuse of textiles collected.
Potential Outcomes:	• Potential for increased waste diversion of approximately 2.5% (assuming a 50% textile diversion) and extension of Trail Waste Facility landfill life by less than one year. • Potential to reduce residential garbage tonnages by diverting textile material from Trail Waste Facility landfill • Potential for increased participation in textile diversion programs. • Potential to reduce GHG emissions from landfill.

Category:	Program
Measurement:	• Quantitative measurements can take place by monitoring changes in quantities of disposed waste and completing waste composition studies on a regular basis to determine the percentage of disposed waste that is textile waste to monitor performance. Textile materials would need to be defined and consistent in measurement and waste audits. • City could require organizations to report on quantities collected, diverted and disposed.
Case Study #1:	• The City of Vancouver's Zero Waste Centre accepts clothing and other textiles dropped off for both reuse and recycling, as long as they are washed and dry. This includes items that can be worn again or are torn, ripped, full of holes, stained, worn-out or faded, missing buttons, with broken zippers, or singles of paired items. The program has been temporarily suspended as a result of COVID-19. • Textiles collected at the Zero Waste Centre are managed by Diabetes Canada and textiles collected at the City's Zero Waste Drop-off Events are managed by Salvation Army (selected through a procurement process). • The City of Vancouver's Waste Wizard (online search tool) also recommends residents participate in the programs offered at clothing retailer H&M stores (2 bags accepted at a time) and the SPCA's Vancouver branch, which accepts old towels, sheets and bedding for animal pens. • Our Social Fabric (OSF) in Vancouver is a non-profit textile recycling initiative, in operation since 2009. OSF is run by a volunteer Board. They receive donations of textiles, fabric and sewing related supplies from the film industry, theatre, manufacturing, and estate closures. Their team of volunteers sort through the donations and offer them back to the community at reduced prices. They are currently offering on-line purchase (curbside pickup) of fabrics and sewing supplies to make face masks during the COVID-19 pandemic.

Category:	Program
Case Study #2:	• The City of Markham launched a Textile Recycling Depot program in June 2016 by providing waste diversion drop-off bins at 75 locations, including fire halls, community centres and multi-residential complexes. Locations are selected where it is considered most convenient for residents to access and in the case of the fire stations, they had good lighting and 24/7 access and monitoring by fire fighters. No other locations or partnerships were sought for this program. • The City also allows textiles to be dropped off at any of their four neighbourhood recycling depots and provide textile collection bins in multi-residential complexes. The textile recycling program targets all types of textiles including clothing, shoes, accessories, linens, fabrics and household textiles. The City's website mentions that accepted items can be worn, torn, or stained and that single socks and shoes are accepted. • The City has partnered with the Salvation Army to collect textiles from drop-off bins which have that notify when bins are full. The multi-residential bins are serviced by the Canadian Diabetes Association. • In April 2017, Markham banned textiles from curbside collection (supported by its clear garbage bag program), becoming the first community in North America to do so. It can easily monitor the textile ban through the City's clear bag program.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

4B1 – Mobile MHSW Home Collection

Category:	Program
System Overview:	• This option looks at expanding the City's current Municipal Hazardous or Special Waste (MHSW) program to include more convenient and fully accessible home collection of materials. Residents would call to schedule a collection for which there may be a fee. Waste audit data shows that less than 1% of curbside and multi-residential of the total waste sent to landfill consisted of MHSW respectively.[79] This represents less than 2,000 tonnes disposed at the Trail Waste Facility in 2020[80]. • In an effort to keep MHSW material out of the landfill and local waterways and ensure public health and safety, the City currently coordinates the collection of these materials through one-day mobile depot events, which operate through a City contracted service provider. This provides residents with convenient disposal options, however, requires residents to transport materials themselves to the event. There are approximately nine one-day mobile events held each year between April and October, located at various locations across the City. • Residents also have the option to take MHSW items back to retailers that participate in the City's Take It Back! program, which has partners across the city.
Status:	• Proven • Some municipalities have implemented similar programs.
Source of Option:	• Consultant, Consultations
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. Guiding Principles: • Honour 5Rs hierarchy. • Protect the environment.

[79] Current State System Summary Technical Memorandum #1, January 2020.

[80] Based on 2020 curbside and multi-residential tonnage disposed at Trail Waste Facility landfill of approximately 200,000 tonnes.

Category:	Program
Needs Assessment Alignment:	• Aligns with the need to provide enhanced convenience and additional drop-off opportunities for residents to reduce, reuse and recycle. • Also aligns with identifying specific waste streams that can be diverted from landfill disposal and develop new collection and diversion programs to capture these streams.
Individual Producer Responsibility (IPR) Impact:	• Yes. In the absence of final IPR regulations for MHSW, there remains a lot of uncertainty in terms of the regulatory changes will impact the City's current management approach for MHSW materials and what the City's responsibility will be in the future. • It is anticipated that the funding for MHSW materials will change when the provincial MHSW Program transitions to IPR. Funding received for materials designated under the new regulations will be limited to the amount the City is offered by Producers or Producer Responsibility Organizations. Management of and full funding for the proper recycling and disposal of materials not designated under the new regulations will continue to be the responsibility of the City should it wish to continue managing non-designated products. • Once the City has greater clarity on the extent of its role in the collection and management of MHSW under the new regulations, the City will need to prepare for the implementation of IPR. This may require the City to still manage certain materials separately from the producer organized collection system, which could result in a loss in collection efficiency from the current approach and create confusion for residents due to multiple collection systems for various hazardous household materials.
System Consideration:	• Secondary – will be a program to overlay onto core system
Sector Applicability:	• This will apply to the Single Family (SF) and Multi-Residential (MR) sectors.
Environmental Considerations:	• Potential for negligible increase in waste diversion, given that the amount of MHSW being disposed of in the garbage is very small.[81] • May have increased greenhouse gas (GHG) impacts due to additional collection vehicles on the road. • MHSW can leach chemicals into the landfill, which find their way into the leachate. This option may slightly improve the quality of leachate produced at the Trail Waste Facility landfill as less MHSW is being sent for disposal, resulting in reduced treatment requirements. • Protection of local waterways from residents improperly disposing of MHSW materials, such as by pouring materials down sewers and drains.

[81] Based on 2018/19 4-Season Curbside Waste Audit Study and November 2019 Waste Multi-Residential Audit

Category:	Program
Social Considerations:	• This option would allow for more convenient collection of MHSW; however, it requires residents to materials curbside on specific dates and with specific guidelines. • Increased inclusion for residents who do not have a vehicle or means of transportation to bring to mobile events or to Take it Back! retailers. • Option is more convenient for residents, more accessible and inclusive. • If this option has a fee associated with it, it may be cost prohibitive and not accessible to all residents, therefore raising the risk of additional materials making their way into the garbage stream.
Technical/Operational Considerations:	• City would have to provide a new hazardous waste collection system. It could operate the program or contract out this service. • City would need to set up a system to receive and manage appointment bookings. • Requirement for a P&E campaign to promote the collection approach available for these materials, including timelines for collection, what is and is not accepted and how the hazardous materials are to be collected in a safe manner. • This program will need to align with the Province's movement towards an individual producer responsibility (IPR) framework for the management of MHSW.
Regulatory Considerations:	• The program must abide by the Transportation of Dangerous Goods Act Registration with the Hazardous Waste Information Network (HWIN). • Environmental Compliance Approval would be required. • The City's current MHSW program and consideration of future MHSW options will be impacted by the new provincial Hazardous and Special Products (HSP) regulation, which will transition the Provincial Municipal Hazardous and Special Waste Program to an Individual Producer Responsibility (IPR) model, currently slated to start July 1, 2021.

Category:	Program
Financial Considerations:	• Capital costs are expected to be low (<$500K) if the City contracted out this service. Capital costs are also expected to be low (<$500K) if the City chose to provide this service. Potential costs could include a system to manage bookings or making modifications to add the functionality to the City's existing customer service software. If the City undertakes collection themselves, a dedicated vehicle would be required, along with packing equipment and a tracking / booking system, which would be at the higher end of the cost low range. • Annual operating costs will depend on the number of requests received, service provider costs and costs for a P&E campaign to kick-off the program and to develop materials advising residents on the requirements of the program. It is estimated that operating costs would be medium low ($100,000 - $500,000) to medium ($500,000 - $1 million). • Additional staff resources may be required to receive and manage appointment requests.
Unknowns/Assumptions:	• Details of the transition of the MHSW program to IPR are currently unknown, including which materials will be collected by producers or the frequency of collection of these materials. • It is unknown what the level of funding the City may receive from the PROs, and how materials not covered by them would be managed/funded should the City continue providing the service. • Assumes that this option would supplement the MHSW events provided by the City. • The cost estimates assume that it would be a contracted service and not provided by City staff. • Demand for a home collection service is not known, meaning that participation levels are also and would require further study, including market research, to determine demand.
Supporting System Requirements for Success:	• Would require a P&E campaign to inform customers of the new service offering. • Would require a service provider to collect, recycle or dispose of materials, if this approach was taken. • Would require contract management to ensure services are delivered in accordance with terms and specifications, if the service was contracted out. • Coordination with Service Ottawa (311) to ensure additional service requests can be managed with the current system and resources. • Would likely require collaboration with the producer responsibility organizations (PROs).
Potential Outcomes:	• Potential for increased participation in this diversion program by reaching additional residents who cannot easily transport materials to MHSW events. • Limited potential for increased diversion. • Little impact on life of the Trail Waste Facility landfill.

Category:	Program
Measurement:	• Quantitative measurements can be made by reviewing event collection quantities and participation, as well as quantitative measurement of the amount of MHSW diverted from the residential sector. • Waste composition studies can be undertaken to assess which hazardous materials are entering the waste streams.
Case Study #1:	• The City of Toronto and City of Sudbury both offer a Toxic Taxi service for the collection of residential MHSW. This service is designed for residents who cannot deliver these items to depots themselves. Requests for collection at single famillt locations can be submitted online or by calling 311. Requests by multi-family properties need to be made by the landlord. • Once the appointment is made, items need to be placed on the private property by 7:00 am on the scheduled pick-up day. These items need to be placed in a labelled, sealed, non-leaking container and separated based on material types. A minimum quantity of MHSW must be accumulated before an appointment is scheduled to manage program cost.
Case Study #2:	• King County, WA operates a Wastemobile. The Wastemobile travels to communities in the County to provide residents with a place to take their household hazardous waste on a periodic basis. Weekly Wastemobile service is available at a shopping centre every Saturday and Sunday. The County website offers a schedule with details on times and locations for the service.
Recommendation:	• The recommendation for this option is to hold until the impact of IPR for the MHSW program is better known.

4B2 – Expand Number of Existing Mobile One Day Depots for Municipal Hazardous and Special Waste

Category:	Program
System Overview:	• Currently, the City provides Municipal Hazardous Special Waste (MHSW) collection through mobile depot events. Events are held at various locations across the City and are offered between April and October each year. In addition to the event depots, residents are encouraged to return MHSW covered under the current provincial Municipal Hazardous or Special Waste (MHSW) stewardship program to retailers or to participating Take it Back! partners. Some materials have no safe alternatives other than the depot events, leaving residents without options for five months of the year. • Waste audit data shows that less than 1% of the total curbside and multi-residential garbage sent to landfill consisted of MHSW respectively.[82] This represents less than 2,000 tonnes disposed at the Trail Waste Facility in 2020[83]. • The mobile depot events are for residential MHSW only. There are approximately nine one-day mobile depot events held each year and the events are large enough to accommodate site operations and traffic queues. In 2019, the City of Ottawa hosted nine events. Each event was attended by approximately 2,200 vehicles and overall costs to provide these events is approximately $1.3 million per year, with about $425,000 of funding provided through industry stewards. • This option would expand the MHSW collection program to provide additional one-day depot events to increase diversion of MHSW. Hosting additional events throughout the year would provide residents with more convenient options to divert MHSW. Hosting an annual event in each municipal ward is one option that may be considered. Due to the climate in Ottawa, events are not currently able to be held in the winter, due to operational issues related to snow and/or very cold temperatures.
Status:	• Proven • The City currently successfully implements this program. Mobile collection events for MHSW exist in many jurisdictions and can be offered through private or public entities. Similar programs are implemented in the City of Toronto, Ontario, City of Greater Sudbury, Ontario, Wellington County, Ontario and Kent Regional Service Commission, New Brunswick.

[82] Current State System Summary Technical Memorandum #1, January 2020.

[83] Based on 2020 curbside and multi-residential tonnage disposed at Trail Waste Facility landfill of approximately 200,000 tonnes.

Category:	Program
Source of Option:	• Staff, Consultations
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. Guiding Principles: • Protect the environment.
Needs Assessment Alignment:	• Aligns with the need to provide enhanced convenience and additional drop-off opportunities for residents to reduce, reuse and recycle.
Individual Producer Responsibility (IPR) Impact:	• Yes. In the absence of final IPR regulations for MHSW, there remains much uncertainty in terms of how the regulatory changes will impact how the City currently manages MHSW materials and what the City's responsibility will be for managing these materials in the future. • Based on the draft regulations, it is anticipated that the funding for MHSW will change when the provincial MHSW Program transitions to IPR. Funding received for materials designated under the new regulations will be limited to the amount the City is offered by Producers or Producer Responsibility Organizations, should they choose to partner with the City to collect designated items at municipally run events. • Management and full funding for the proper recycling or disposal of materials not designated under the new regulations will continue to be the responsibility of the City, should the City wish to continue managing non-designated products to keep them out of the Trail Waste Facility landfill and the natural environment. • Once the City has greater clarity on the extent of its role in the collection of MHSW under the new regulations, the City will need to prepare for the implementation of IPR. This may require the City to still manage certain materials separately from the producer organized collection system, which could result in a loss in collection efficiency from the current approach, greater costs and create confusion for residents if multiple collection systems are provided by both the City and producers.
System Consideration:	• Secondary - will be a program to overlay onto core system
Sector Applicability:	• The mobile depots apply to the single family (SF) and multi residential (MR) sectors.

Category:	Program
Environmental Considerations:	• Potential for negligible increase in waste diversion given that the amount of MHSW being disposed of in the garbage is very small[84.] • Protection of local waterways from residents improperly disposing of MHSW materials, such as by pouring materials down sewers and drains. • A potential increase in greenhouse gas (GHG) emissions due to additional residents' vehicles delivering materials. To minimize potential emissions, mobile depots should be held in easily accessible locations. • May slightly improve the quality of leachate produced at the Trail Waste Facility landfill as less MHSW is being sent for disposal, resulting in reduced treatment requirements.
Social Considerations:	• Provides residents an expanded service with a safe disposal option for MHSW, reducing the amount of MHSW in the environment which can reduce potential health impacts. • More mobile depot events may result in shorter waiting times for residents compared to current wait times and more convenient days and locations for some residents. • Events held at a regular frequency would shorten the time that residents would need to store materials and avoid improper disposal in the garbage when events are not available.
Technical/Operational Considerations:	• Details on the additional days, such as location and number of events would need to be confirmed, taking into consideration weather and availability of suitable locations. • Availability of suitable locations is extremely limited. Large areas are required for set-up and queuing over a two-day period. • Traffic received on each event day must be restricted in order to safely hold events. • May require partnerships with private sector for new locations. • Staffing would be required for additional events. • May need to review the impacts of hazardous waste on waste, storm and ground water systems in the future, once the management of MHSW transitions to IPR.

[84] [84] Based on 2018/19 4-Season Curbside Waste Audit Study and November 2019 Waste Multi-Residential Audit

Category:	Program
Regulatory Considerations:	• The program must abide by the Transportation of Dangerous Goods Act and collection sites must be registered with Province's Hazardous Waste Information Network. • The City's current MHSW program and consideration of future options will be impacted by the new provincial Hazardous and Special Products (HSP) regulation, which will transition the Provincial Municipal Hazardous and Special Waste Program to an IPR model starting July 1, 2021. • This program will need to align with the Province's move to IPR. • Once the new regulations are finalized and in in effect, the City will have to determine its level of involvement in the collection of MHSW materials, how to collect the materials not included under the new IPR framework, if the final regulations remain largely unchanged from what is proposed in the current draft regulations, and what the overall financial implications will be. This could include a continued mobile depot event-based system, permanent depot(s) or a combination of the two or some other option(s). How these event models can work in combination with producer lead collection model is still unknown.
Financial Considerations:	• Given the system is currently in-place, it is expected capital costs will be none to minimal and in the low range (<$500,000), however this will depend on the new responsibilities outlined as per the new IPR program. • Annual operating costs are expected to increase for mobilization costs such as staffing and equipment, depending on the number of events that are added. Based on the current costs (the cost of nine events held in 2019 was approximately $1.3 million or roughly $150K per event) and depending on the number of events the City would expand to, additional, operating costs are expected to be in the medium/high range ($1,000,000 - $3,000,000) for additional mobile depot events (i.e., adding 15 new events so the program is offered in each of the City's wards). • Under the current regulatory framework, which is set to change beginning July 1, 2021, agreements with Product Care, Stewardship Ontario, and Automotive Materials Stewardship currently fund approximately 34% of the City's MHSW Program cost. The City receives no compensation for mobilization (set-up) costs; which make up 22% of program costs. Additionally, a number of materials collected are not covered by any funding programs. • As of July 1, 2021, the transition to IPR will take place. In the absence of final regulations, the financial implications of the transition are not yet known and what the full implications of expanding the City's current event-based model is also unknown.

Category:	Program
Unknowns/Assumptions:	• Materials covered and funding under the IPR framework for MHSW is unknown. • Assumes contractor will have the capacity to offer additional event days. • Assumes suitable additional depot locations are available.
Supporting System Requirements for Success:	• The expansion of the number of existing mobile depot events is dependent on the new Provincial IPR framework. • Would require a P&E campaign to inform customers of the expanded service offering. • Would require expanded contract management to ensure additional services are delivered in accordance with terms and specifications.
Potential Outcomes:	• Improved flexibility and opportunity for residents to safety dispose of MHSW, diverting those hazardous materials from landfill and waterways. • Enhanced data collection, audits and monitoring to ensure that transitioned IPR materials are not entering the City's waste management system. • Updating of P&E materials to align with IPR transition as program details are confirmed for the designated materials. • New IPR programs have minimum service levels for different sized municipalities. The City has an opportunity to actively promote private sector diversion opportunities created by IPR.
Measurement:	• Quantitative measurements are already implemented at the events currently held and include tonnage or number of items and number of vehicles attending the events. These measurements would continue under this option. • Waste audits can be used to understand which materials are still being disposed in the waste stream. • Potential to collect customer satisfaction surveys to determine convenience and effectiveness of the expanded program.

Category:	Program
Case Study #1:	• The City of Toronto holds Community Environment Days to allow for the safe disposal of MHSW, as well as reusable and recyclable materials. Up to two events are held in all 25 wards from April to October. In 2019, there were 46 events and approximately 354,890 kg of MHSW and 103,710 kg of electronics were accepted through the program, as compared with 692,950 kg of MHSW collected in the City of Ottawa's program. Due to COVID-19, 2020 events were scaled back and set up as drive-through events at the City's seven permanent drop-off depots, located at each transfer station. • MHSW is also accepted year-round at the transfer station depots. In addition to the transfer stations, the City also offers a Toxic Taxi service for the collection of residential MHSW. This service is designed for residents who cannot deliver these items to depots themselves.
Case Study #2:	• The City of Chilliwack, BC holds an annual Household Hazardous Waste Day every October allowing residents to dispose of hazardous household waste. Although this service is provided free of charge, the City asks for a donation to the Salvation Army in the form of cash or a non-perishable food item.
Recommendation:	• The recommendation for this option is to hold until the impact of IPR for the MHSW program is better known.

4C1 – Separate Bulky Waste Collection and Recycling

Category:	Recycling – Bulky Items Management
System Overview:	• This option explores collecting bulky waste separately from garbage. This may facilitate the separation of some items for recycling (e.g., mattresses, scrap metal, furniture, bulky plastics, clean wood, window glass, etc.) or reuse/upcycling, if possible. A fee may be charged for collection of bulky items. Items may be collected at the same frequency as garbage (bi-weekly), on the same day as garbage or on special days at a reduced frequency of collection than is allowed today. Materials that can be recycled or reused will need to be brought to a processing area/s or site/s for further separation/diversion to determine what can be diverted or reused and what is to be sent for disposal at the Trail Waste Facility landfill. • In the current City program, bulky waste includes, but is not limited to bicycles, floor lamps, mattresses, furniture, sinks, toilet bowls, barrels, pool pumps, pool covers and any other discarded materials normally accumulated at residential dwellings. Bulky items exclude appliances and electronics, which are part of the provincial Waste Electrical and Electronic Equipment waste diversion program. • Bulky items set out at the curb are currently collected on a bi-weekly basis with garbage and are included in the six-item limit, which is not proactively enforced, rather enforced on a complaint basis. Because bulky items collected from curbside homes are collected with all other garbage, the City is unable to track tonnages of bulky items collected curbside. • As an alternative to setting out bulky items as garbage, residents can also seek out reuse or recycling options through the City's Take It Back! program. While the program offers many options for a variety of different bulky items, tonnage collected, and whether the items is recycled or reused through this program is not tracked.

Category:	Recycling – Bulky Items Management
System Overview (continued)	• In the 2018/2019 Four Season Curbside Waste Composition Study it was determined that the average participation rate in the City's bulky waste program was 11%. Participation rates were based on the number of households who set out bulky items at least once over the two-week collection period during the waste audits. The average amount of bulky waste setout at the curb noted during the study was approximately 100 kg/household/year, which equates to approximately 30,000 tonnes per year[85]. Bulky items from multi-residential buildings are collected separately from multi-residential garbage, with an estimated 3,300 tonnes collected in 2020[86]. • Unlike other waste that is landfilled, bulky waste tends to be harder to compact (e.g., mattresses), meaning that it takes up more space in the landfill.
Status:	• Proven • Multiple municipalities collect bulky waste separate from garbage to improve efficiency of collection and disposal operations. Separate collection improves efficiency of curbside garbage collection in manual systems, by reducing labour requirements to handle large items, increasing density of waste material in trucks and reducing the time required per stop to optimize routing and reduce vehicle requirements. • Large items cannot be collected in automated cart-based garbage collection systems, which necessitates separate collection of bulky items. Separate collection of bulky waste also improves disposal operations, with higher landfill compaction rates for household garbage and reduced damage and/or process upsets when garbage containing bulky items is sent to a waste processing and treatment facility. • Emerging • There are not many municipalities that specifically collect bulky waste to recycle. Some items that are collected are recycled, while anything that cannot be recycled is landfilled.
Source of Option	• Consultant, Consultations, Staff

[85] Based on 294,000 curbside households.

[86] Based on collected tonnage of approximately 1,900 tonnes between June 1, 2020 to December 31, 2020.

Category:	Recycling – Bulky Items Management
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour 5Rs hierarchy. • Change community values. • Adopt circular economy principles. • Keep waste local.
Needs Assessment Alignment:	• Aligns with the need to identify specific waste streams that can be diverted from landfill disposal and develop new collection and diversion programs to capture these streams. • This option aligns with the short term need to support increased curbside waste diversion performance by increasing participation in the City's residential waste diversion programs. • It aligns with the future need of recognizing the inherent challenges that exist in increasing participation and the waste diversion rate in the multi-residential sector and to actively work with stakeholders in this sector to improve multi-residential waste diversion performance.
Individual Producer Responsibility (IPR) Impact:	• Not at this time. However, the Province has sought feedback from industry on additional materials in Ontario's waste stream that could be managed through producer responsibility programs to maximize diversion. Various stakeholders have indicated opportunities exist for some bulky materials, such as mattresses. While nothing is known at this time, there is potential for the Provincial government to consider some bulky items for future IPR programs.
System Consideration:	• Secondary – will be a policy to overlay onto core system.
Sector Applicability:	• Applicable to waste collected from the Single-Family (SF), Multi-Residential (MR).
Environmental Considerations:	• Reduction in greenhouse (GHG) emissions by diverting some of the collected bulky materials from landfill, such as mattresses and wood, avoiding methane emissions from landfill. • Potential increase in GHG emissions from collection by requiring additional collection vehicles to collect bulky items separate from garbage. • Increased diversion from disposal if some items can be recycled or reused. • Potential for increase in illegal dumping if there are additional costs or wait times due to scheduling.

Category:	Recycling – Bulky Items Management
Social Considerations:	• Will be an additional level of effort for residents to schedule a pickup rather than just placing items at the curb if program structure and frequency of collection changes. • There may be some confusion over the City's program (recycling) versus donation programs offered by community organizations and not-for-profit groups. • If there are new requirements for the City's bulky waste collection (call in to schedule, maximum number of items per year, paid service), this new program will need to be accompanied by an extensive P&E campaign. • Fee for service programs can be viewed as unfair to people with lower socio-economic status. • Residents should be informed of which materials may be recycled and remind them to donate them for reuse whenever possible, which in the waste hierarchy is preferable over recycling or disposal. This can be done as part of the P&E campaign and at the time of booking if a scheduled collection is implemented. • May be an increase in complaints from the aesthetics of more bulky waste at the curb on a frequent basis, depending on whether or not a scheduled collection program is implemented.

Category:	Recycling – Bulky Items Management
Technical/Operational Considerations:	• Would require a procurement process to select a contractor to provide separate collection service for bulky items. • Increased P&E for residents regarding the new program. • A separate bulky item collection program would enable the City to obtain data on materials being collected and diverted from landfill. • Could result in increased illegal dumping due to a shift in programming, which may require enforcement. • May increase waste collection efficiency by increasing the density of materials in the packer trucks (i.e. which could result in fewer trips), reducing time per stop to collect bulky materials, reduced lifting requirements for garbage collection operators and potential to introduce automated garbage collection. • Separate collection and diversion of bulky materials from landfill will help increase landfill compaction rates (higher density of materials) and extend landfill life. • May require a system to schedule appointments and a separate vehicle/s to collect bulky items. • If a fee would apply to the collection of bulky items, the cost for this and how it would be paid for would need to be determined. • Potential increase in calls to customer service. • The new program would need to consider how to handle move outs and deaths. • May require new staff to administer the program, depending on the approach. • Frequency of bulky item collection would need to be determined. • Would need to identify suitable location(s) or establish partnerships with an existing location where the bulky items could be sorted to determine whether they can be recycled, reused or sent for disposal. • Would need to establish partnerships &/or procure services from organizations who are able to reuse or recycle the collected bulky items.
Regulatory Considerations:	• Will require a change to the Solid Waste By-law. Depending on where collected materials are managed, may require an Environmental Compliance Approval (ECA) or an amendment to an ECA (i.e. if located at Trail Waste Facility).

Category:	Recycling – Bulky Items Management
Financial Considerations:	• Capital costs for collection are anticipated to be low to minimal, given curbside collection is contracted out and bulky items are already collected separately under the multi-residential collection contract. Some modifications may be required at the Trail Waste Facility if a sorting area is established to separate items that can be recycled or reused. Capital costs for these modifications are anticipated to be low (<$500K). • Annual operating costs are anticipated to be medium/high ($1-$3 million) to provide collection services, sorting out items that can be reused or recycled and a P&E campaign specific for bulky items. The cost for collection services is based on a pre-determined number of items per household per year. Operating costs may increase if residents are not limited to a limited number of specified items each year. • Operating costs do not include the processing component of bulky item recycling, as the specific material(s) are not known. • May be a reduction of the operating costs for garbage collection with separate bulky materials collection. • May reduce the amount of bulky items sent for disposal, which would result in indirect cost savings due to extended life of Trail Waste Facility landfill. • Depending on when implemented, may require changes to existing collection contracts, which could impact contract costs.
Unknowns/Assumptions:	• Unknown which bulky items will be included in the program and if there will be a per item fee (specific dollar amount per collected item) or an annual maximum number of items that can be collected (e.g. only four large items will be collected each year through a call in service). • Currently, it is unknown what bulky items can be recycled, and if end markets exist for those items exist. If end markets do not exist, it is unknown whether the City's bulky item composition and tonnages can generate and sustain the development of new end markets. • It is unknown if the City has one or more vehicles that could be used for collection or if vehicles would have to be purchased. • It is unknown where/how materials may be managed (e.g. a new facility, a transfer station, at Trail Waste Facility etc.).

Category:	Recycling – Bulky Items Management
Supporting System Requirements for Success:	• Would require amendment of the Solid Waste By-law for acceptable materials. • Would require a P&E campaign. • Coordination with Service Ottawa (311) to ensure additional service requests can be managed with the current system and resources. • May require a partnership with a non-profit organization to manage materials that can be reused or recycled. • Could be aligned with a City-owned reuse centre. • Will require sustainable end markets for recycling and reuse. • Public behavior change required.
Potential Outcomes	• Potential for increased waste diversion. • Potential to extend life of Trail Waste Facility landfill. • Potential to educate residents on reuse of bulky items and donation opportunities. • With bulky waste being collected separately, it will increase the density of materials collected as garbage. That would likely result in a reduction of collection costs for garbage, as increased density would allow more garbage to be collected prior to tipping at the Trail Waste Facility landfill. • Potential to support other waste management system changes, such as automated collection for garbage with the removal of bulky item collection.
Measurement	• There is not a lot of current data on bulky waste collection, including whether items could be recycled or reused, however, a comparison of pre and post program implementation waste tonnages and composition can be completed to understand the overall impact of bulky waste collection. • Total amount of waste collected, recycled, reused and disposed could be tracked.

Category:	Recycling – Bulky Items Management
Case Study #1:	• The City of Toronto recycles mattresses and box springs that are collected as part of its bulky waste collection program. The materials are collected and separated out at a local transfer station. In 2016, the City signed a five-year mattress and box spring recycling contract with Recyc-Mattresses, located in Toronto. If the mattresses are visibly infested with bed bugs or wet or damaged they cannot be recycled and are sent for disposal. • Toronto also recycles ceramic sinks and toilets as part of its bulky waste program. The City contracts the ceramic dismantling to Try Recycling in London, Ontario, who assumes ownership of the delivered ceramics, markets all products and retains all resulting revenues. • The City's oversized items are collected on the same day as garbage and the annual fee charged to residents, based on garbage bin size, covers the cost for unlimited collection and processing of divertible materials, including bulky waste.
Case Study #2:	• Halton Region offers metal and/or appliance curbside collection for single-family homes. This is a scheduled collection, by appointment, through their 311 service. Residents can call, use an online form or email to schedule a collection two to three weeks before items would be collected. When residents call in, they are asked to describe the item, remove all appliance doors and place tall items flat on the ground at the scheduled time of collection.
Recommendation	• It is recommended that the option proceed to the evaluation stage.

4D1 – Temporary Neighborhood Drop-off Depots for Divertible Materials

Category:	Facility/Infrastructure
System Overview:	• This option involves hosting temporary neighborhood public drop-off depots for divertible materials to make waste diversion more accessible and convenient by accepting several types of divertable materials at one location. Types of material accepted may include electronics, textiles, municipal hazardous special waste (MHSW), blue and black box materials, with the potential for expansion over time, based on disposal waste characterization audit results and availability of end markets. • Depots would be set up temporarily in neighbourhood locations on designated dates. The temporary locations could include City parks, community centres, arenas, markets or parking lots. The temporary depots would not have permanent infrastructure, rather, they would use transport vehicles parked on-site to collect the various materials, which would then be transferred to a permanent depot site at the end of day. • The City currently offers temporary drop-off depots through MHSW events, which are held at different locations throughout the City between the spring and fall each year. These have been successful in the past, with high rates of participation. As such, a similar concept can be followed for divertible materials at different locations throughout the City. It is noted that Option 4B2 considers providing additional mobile drop-off depot events specifically for household hazardous wastes (MHSW). • Currently, City residents have access to several drop-off waste diversion programs to further divert waste from landfill, which include: local businesses participating in the City's Take it Back! program, privately operated drop-off depots, the City's MHSW drop-off depot events and the Trail Waste Facility public drop-off area. The distance to the Trail Waste Facility may be a barrier for some residents given the size of the city (2,796 square kilometres). There is also a lack of sites with year-round access for public drop-off within the city for waste streams such as Construction and Demolition (C&D), MHSW, bulky items and other divertible materials. • Waste audit data from the 2018/2019 Four Season Curbside Waste Audit Study indicated that garbage sent to the Trail Waste Facility landfill included material that could be diverted through existing drop-off diversion programs in the community. Textiles, Electronics and Electrical Equipment (EEE) and MHSW represented approximately 7% of the total amount of curbside waste that was sent for landfill disposal. Multi-residential waste sent to the Trail Waste Facility landfill was 5% textiles, 2% EEE and 1% MHSW. As such, there is the opportunity to increase waste diversion through the implementation of temporary drop-off depots throughout the city.

Category:	Facility/Infrastructure
Status:	• Proven • Municipalities in Ontario such as the City of Toronto have developed programs structured to provide temporary drop-off services to residents at different locations throughout their boundaries. These temporary drop-off depots, referred to as Community Environment Days, are used to service different geographic areas within the city, where residents are able to dispose of their waste, recyclables and recoverable materials in containers and bins.
Source of Option:	• Staff
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill • 4. Maximize the recycling of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 10. Make sustainable waste management design an essential part of the city's planning process. Guiding Principles: • Aligns with the guiding principle of keeping waste local.
Needs Assessment Alignment:	• Tied to the need to determine ways to extend the life of the Trail Waste Facility landfill to maximize the life of the asset and plan for new disposal capacity, when required. • Aligns with the need for the City to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. • Also aligns with identifying specific waste streams that can be diverted from landfill disposal and develop new collection and diversion programs to capture these streams.
Individual Producer Responsibility (IPR) Impact:	• Partial impact. • New IPR programs may recover more designated IPR recyclables at the source (e.g. curbside, public drop-off depots). It is noted that IPR programs may also decrease the amount of recoverable material generated through the redesign of packaging materials. • The City may choose to accept IPR materials (e.g., electronics, MHSW, blue box) at drop-off depots if costs for receiving the materials can be recovered from a Producer Responsibility Organization (PRO).
System Consideration:	• Secondary option to system-wide considerations.

Category:	Facility/Infrastructure
Sector Applicability:	• This applies to the Single Family (SF) and Multi-Residential (MR) sectors.
Environmental Considerations:	• Temporary public drop-off depots for divertible material may extend the life of the Trail Waste Facility landfill by diverting materials that can be re-used or recycled. In the case of specific waste streams such as MHSW, the public drop-off depots would encourage proper disposal as it will be a more convenient service to City residents. It is estimated that this option could divert less than 5%of waste from being landfilled. • The Province may require that the temporary public drop-off depots implement measures with respect to the materials being collected (e.g. spill kits, spill containment workstations, etc.). • Temporary public drop-off may reduce the amount of MHSW such as batteries in the environment and disposed in landfills, which can reduce potential environmental impacts.
Social Considerations:	• Additional options to dispose of divertible materials and reusable items would be considered an enhanced service provided to residents, that is also potentially more convenient, with residents not needing to travel long distances to drop-off their divertible waste or hold onto their waste for an extended period of time. • Public concerns with a temporary drop-off depot are expected to be minimal because of the short duration that any site would be used and the local benefit that it would provide.

Category:	Facility/Infrastructure
Technical/Operational Considerations:	• A site selection process would be required to identify suitable locations for temporary drop-off depots. Considerations would include logistics such as travel distance for neighbourhoods, ease of access to the site (walking, cycling and transit friendly to support accessibility), minimum size requirement to accommodate bins/containers/trucks to receive materials, traffic flow and queuing and weather etc. • Analysis of waste generation and audit studies to identify target materials for collection. Could include both divertible and reusable materials/items. • Determine who will be responsible for the management of the materials that are dropped off. Could involve partnerships with local organizations who already manage these materials. • Develop a P&E campaign to advertise the temporary drop-off depots, materials that can be dropped off, locations, and operating schedules (dates and hours). • Traffic flow analysis of each location to identify if the temporary public drop-off depots will introduce any traffic concerns or implications. • Based on the City's previous experience with MHSW events, review required equipment, signage and operating logistics, including site capacity. • If the temporary public drop-off depots are operated by a third-party contractor, a procurement process would be required (i.e. RFP development, contractual documents). Additionally, staff would be required to oversee administration of the contract. • Additional staff (internal or contracted) would be required to support each temporary depot.
Regulatory Considerations:	• The operation of temporary public drop-off depots for divertible materials would likely require operator licensing for mobile operations. • It is noted that further consultation with the Province may be required to determine the required approvals (if any), including any special requirements for the handling and storage of MHSW. • Meeting compliance with City bylaws (e.g. traffic, signs).

Category:	Facility/Infrastructure
Financial Considerations:	• One-time capital costs to acquire equipment required for an event (e.g. vehicles, bins, containers, signage, etc.), which would be used at each temporary drop-off location are likely within the low range (<$10 million). It is noted that the capital costs will depend on the number of waste streams collected and design size for the temporary depots. Use of existing vehicles and equipment may reduce capital costs. It is noted that equipment could be provided by the site operator if operated by third-party contractor. Data management reporting and or software would be required to monitor quantities by material streams and report to the City for diversion tracking. • Annual operating costs for each individual temporary public drop-off depot are likely within the medium/high range ($5 to $10 million) per year. The operating costs will also depend on the types and quantities of divertible material accepted and operating schedule (i.e. number of events offered). Depots that manage MHSW are more costly to operate, given the special handling, transportation and disposal requirements associated with managing this type of waste. • Operating costs would include costs to set up and operate the sites, transportation of materials to processing facilities and ongoing P&E. It is noted that processing costs are unknown at this stage and would be a consideration to determine the materials that are ultimately accepted at the public drop-off depots. Should the materials accepted be limited to divertable materials only, no landfill tipping fees would be required for disposed materials. • Upon transition to full IPR, the City would not be responsible for collection and processing of designated materials in the blue box, electronics and MHSW programs. Costs for the management of these designated materials are the responsibility of the program PROs, however not all blue box, electronics and MHSW materials are included in these designated programs and the costs for management of non-designated materials would be the responsibility of the City, should they wish to collect these materials to divert them from the Trail Waste Facility landfill.

Category:	Facility/Infrastructure
Unknowns/Assumptions:	• At this time, it is unknown how IPR will impact the quantities of recyclables in the garbage stream which could be recovered at these depots and diverted from landfill disposal. • The number of temporary public drop-off depots to be offered is unknown. The minimum number of events should be 30 to reduce traffic and accommodate most areas inside the Greenbelt. • It is unknown which materials would be diverted at the temporary drop-off depots. The type of materials collected would depend on availability of end markets and existing reuse programs in place. • Operations costs range includes temporary depot operations and transportation only. The processing/final disposal costs and waste diversion/operational benefit would need to be estimated to determine if it is feasible or cost effective to receive specific materials at the public drop-off depots. • It is assumed that these temporary events would be held at an accessible and convenient location (e.g. a parking lot) so that the typical suite of approvals required for a permanent facility would not be required.
Supporting System Requirements for Success:	• Completion of a feasibility study to identify sites, materials to be accepted, number of events, capital and operating requirements to implement multiple temporary public drop-off depots within the city. • Assess waste audit and generation data to identify waste streams (divertible materials) that could be diverted from the Trail Waste Facility landfill. • Development of P&E campaign to support the events. • Identify the impact of IPR and how it would affect the materials generated by residents within the City. • Additional staff may be required to plan and coordinate logistics for the events, as well as administer any contracts. • Procurement process for operators if City does not operate the temporary depots themselves. • Temporary drop-off depots could be discontinued if or when permanent public drop-off depots are established. • Will require sustainable markets for recycling and reuse.

Category:	Facility/Infrastructure
Potential Outcomes:	• Extend life of the Trail Waste Facility landfill by approximately one year. This is based on assuming 50 percent diversion of textiles, MHSW and EEE in garbage generated by all sectors, assuming depots are operational in 2025. • Provide residents with additional local and convenient access to public drop-off depots designated to divert materials from landfill disposal. • Increase the City's waste diversion rates. • Increased resident participation in waste diversion programs.
Measurement:	• Implementation of this option would be measurable by tracking diversion rates and tonnages diverted through the temporary drop-off depots. Would also offer the opportunity to track each material type separately. • Implementation of this option would also be measurable based on counting the number of residents dropping off material at each event.
Case Study #1:	• The City of Toronto holds Community Environment days in each of the City's 25 wards. These events operate up to twice per year in each ward and allow for the safe disposal of MHSW and electronic items, and donation of materials such as household goods and clothing for reuse. The main goal is to allow residents to safely dispose of some items that do not belong in the City's Blue Bin recycling or Green Bin organics waste diversion programs. In addition, the events also provide an opportunity to bring specific items for donations to local schools and shelters. These events also provide for face-to-face interaction with residents for additional outreach and education opportunities. • In 2019 a total of 46 events were held with an average attendance of 350 visitors per event. The program was scaled back in 2020 as a result of COVID-19 to seven events at the drop-off depots located at each of the City's seven transfer stations. The 2021 budget proposed a total of 33 events to be held (26 events and one at each of the seven drop-off depots). The 2021 events are currently suspended as a result of ongoing COVID-19 restrictions.
Case Study #2:	• The South East Regional Service Commission, New Brunswick works with Eco360 to operate a Mobile Eco Depot in each region once a month, visiting a different community every week for a period of two days. The Mobile Eco Depots collect waste streams such as appliances, electronic waste, furniture, leaf and yard waste, MHSW and tires from residential waste only. The main goal is to provide residents with a convenient service to divert waste from landfills.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

4D2 – Permanent Neighborhood Drop Off Depots for Some or All Materials

Category:	Facility/Infrastructure
System Overview:	• This option involves establishing permanent neighborhood public drop-off depot(s) to collect materials for reuse, recycling and/or disposal and to make waste diversion/disposal more accessible at convenient locations closer to residential areas. The depot would have limited operating hours and material sorting and depot access would be managed. Only residential waste would be managed at the depots. • The City currently has a small loads public drop-off facility at the Trail Waste Facility, which collects waste streams such as leaf and yard waste (LYW), scrap metal and white goods. The distance required to travel to the Trail Waste Facility may be a barrier for many residents given the size of the city (2,796 square kilometers). • Providing additional permanent drop-off depots that accept similar or all of the same materials as the Trail Waste Facility that are more evenly distributed throughout the city would provide closer and therefore more convenient access for residents. • Currently, materials not accepted at the Trail Waste Facility drop-off facility can be dropped off at local businesses participating in the City's Take it Back! program, privately operated drop-off depots, and drop-off depot events for Municipal Hazardous or Special Waste (MHSW). Accepting additional materials at permanent public-drop-off depots would also provide residents with convenient year-round access. In 2004, the City operated a permanent MHSW depot at the Trail Waste Facility. The depot was opened specific days and times where residents could drop off MHSW. In 2005, the City closed the depot. • Waste audit data from the 2018/2019 Four Season Curbside Waste Audit Study indicated that waste sent to the Trail Waste Facility landfill included material that could be diverted through existing drop-off diversion programs in the community. Textiles, Electronics and Electrical Equipment (EEE) and MHSW represented approximately 7% of the total amount of waste that was sent for landfill disposal. Multi-residential waste sent to the Trail Waste Facility landfill was 5% textiles, 2% EEE and 1% MHSW. As such, there is the opportunity to increase waste diversion through the implementation of permanent drop-off depots throughout the City. The permanent drop-off depots would accept divertible and/or non-divertible materials for convenient access to city residents year-round.

Category:	Facility/Infrastructure
Status:	• Proven • Most large municipalities in Ontario own waste transfer stations, which also offer public drop-off of various items. Municipalities such as the Cities of Hamilton and Toronto, the Regions of Peel, York and Durham operate these facilities. These drop-off depots are used to service different geographic areas throughout their boundaries, where residents are able to dispose of their waste, recyclables and recoverable materials in containers and bins. The City of Winnipeg operates 4R Winnipeg Depots, where residents can drop-off materials that can be recycled, reused, composted or resold.
Source of Option:	• Staff
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill. • 4. Maximize the recycling of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 10. Make sustainable waste management design an essential part of the city's planning process. Guiding Principles: • Aligns with the guiding principle of keeping waste local.
Needs Assessment Alignment:	• Aligns with the need to determine ways to extend the life of the Trail Waste Facility landfill to maximize the life of the asset and plan for new disposal capacity, when required. • Aligns with the need for the City to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. • Also aligns with identifying specific waste streams that can be diverted from landfill disposal and develop new collection and diversion programs to capture these streams.

Category:	Facility/Infrastructure
Individual Producer Responsibility (IPR) Impact:	• Partial impact. • New Individual Producer Responsibility (IPR) programs may recover more designated IPR recyclables at the source (e.g. curbside, public drop-offs). It is noted that IPR programs may also decrease the amount of recoverable material generated through the redesign of packaging materials. • The City may choose to accept IPR materials at drop-off depots. It is not known if costs for receiving the materials can be recovered from a Producer Responsibility Organization (PRO). • The IPR materials impacted may include designated materials in the provincial programs for MHSW, electronics, blue box and tires, if accepted at the new depots.
System Consideration:	• Secondary option to system-wide considerations.
Sector Applicability:	• This will likely apply to the Single Family (SF) and Multi-Residential (MR) sectors.
Environmental Considerations:	• Permanent public drop-off depots for divertible material may extend the life of the Trail Waste Facility landfill by diverting less than 5% of waste from landfill. • This option will likely increase diversion rates within the City and recover higher tonnages of materials that can be re-used or recycled. In the case of specific waste streams such as MHSW, the permanent public drop-off depots would encourage proper disposal as it will be a more convenient service to City residents. • Permanent public drop-off depots may decrease the greenhouse gas (GHG) impacts associated with residential traffic as the public may need to travel shorter distances for waste material drop-off. • The locations of the depot(s) are unknown thus the GHG impacts to transport for waste processing or final disposal (i.e. Trail Waste Facility, recycling facility) are unknown. • The Province may require that these permanent public drop-off depots implement environmental protection measures with respect to the materials being collected (e.g. spill containment measures, portable litter fences to minimize windblown litter, etc.).

Category:	Facility/Infrastructure
Social Considerations:	• Additional options to dispose of divertible materials, reusable and waste items could be considered an enhanced service provided to residents that is potentially more convenient, with residents not needing to travel long distances to drop-off their divertible waste or hold onto their waste for an extended period of time. • Conversely, for residents used to placing divertible materials in the waste stream, this option will require public behavior change. • Indigenous communities with a potential interest in the project would need to be consulted, depending on the location of the proposed public drop-off depot/s. • Public concerns related to increased traffic, litter, noise and odour as a result of new public drop-off depot in their neighbourhood. • Any public concerns with a public drop-off depot would be addressed through appropriate public consultation, defining mitigation measures and social benefits as part of the permitting process.

Category:	Facility/Infrastructure
Technical/Operational Considerations:	• Technical considerations such as assessing geographical, population, waste audit and generation data will likely be required to size the capacity of each permanent public drop-off depot. • Ideally, waste generation data per individual neighborhood would be beneficial and should be assessed to determine the most effective locations to establish new public drop-off depots (i.e. minimize drive time, maximize the number of residents that can use each location). It is noted that the capacity of each public drop-off depot may vary depending on the neighborhood, for example, some locations may require more containers or bays depending on the waste generation and population served) and the size of the site selected for the depot. • Determine who will be responsible for the management of the materials that are dropped off. Could involve partnerships with local organizations who already manage these materials. • Develop P&E campaigns to advertise the public drop-off depots. • Traffic flow analysis of each location including traffic flow within the public drop-off depot and containers. • Siting, environmental and geotechnical studies will be required to determine the most suitable location of the public drop-off depot/s. • Cost benefit analysis is recommended to determine the feasibility of a public drop-off depot within different City locations (i.e. potential revenue from tipping fees, land purchasing costs (if required), payback periods, etc.). • A procurement process would be required for the construction of any permanent public drop-off depot infrastructure (i.e. RFP development, contractual documents). • Consideration of how the depot(s) would be operated (City staff or contractor) and undertaking appropriate steps to procure equipment and identify staffing requirements for a City-operated depot or a procurement process for a contractor operated depot. • Additional staff would be required to run the depots if operated by the City and to complete compliance reports. • Administrative processes would need to be established to ensure that only residential materials are accepted at the depots and not materials from private companies. • Training of staff on safe handling and storage of materials, notably MHSW.

Category:	Facility/Infrastructure
Regulatory Considerations:	• A permanent public drop-off depot will require a new Environmental Compliance Approval (ECA) for air/noise, stormwater and waste. ECA approvals can take up to two years to complete. It is anticipated that the public drop-off depots may need to implement environmental protection measures such as stormwater management, structures to minimize windblown litter and impermeable liners under concrete foundations in areas where waste is collected, to avoid leachate infiltration into groundwater. • Further consultation and approval with the local Conservation Authorities may be required if land needs to be rezoned. • Municipal approvals would be required (land use planning, zoning, site plan).
Financial Considerations:	• Capital costs for each individual permanent public drop-off depot is likely within the medium/low range ($10 to $50 million). It is noted that the capital costs will depend on the number of waste streams accepted along with the size and storage capacity of each site. • Operating costs for each individual public drop-off depot are likely to be within the medium/low range ($1 to $3 million) per year, depending whether it is City operated or by a third-party contractor. In addition, similar to the capital costs, the operating costs will also depend on the number of waste streams collected and the capacity of each location. Operating costs would include costs to provide ongoing P&E. It is noted that processing costs are unknown at this point and would be a consideration to determine the materials that are ultimately accepted at the public drop-off depots. • Upon transition to full IPR, the City would not be responsible for collection and processing of designated materials in the blue box, electronics and MHSW programs. Costs for the management of these designated materials are the responsibility of the program PROs, however not all blue box, electronics and MHSW materials are designated and the costs for the management of non-designated materials would be the responsibility of the City, should they wish to collect these materials to divert them from the Trail Waste Facility landfill.

Category:	Facility/Infrastructure
Unknowns/Assumptions:	• At this time, it is unknown how IPR will impact the quantities of recyclables in the garbage stream which could be recovered and diverted from landfill disposal. • The number of permanent public drop-off depots is unknown. • Assumed studies such as geotechnical, environmental, traffic, waste audits, feasibility will need to be completed to determine the location of the permanent public drop-off depots. • It is unknown which materials would be diverted at the drop-off depots. Materials collected would depend on the results of waste audit studies and the availability of end markets, safe disposal options and/or reuse opportunities. • It is also unknown if hauling materials from the permanent public drop-off areas can be done in conjunction with the development of a future transfer station facility or partnership with a private sector company with transfer station capacity. • Operating cost range includes facility operations and transportation. The processing/final disposal costs and waste diversion/operational benefit would need to be evaluated to determine if it is feasible or cost effective to receive specific materials at the permanent drop-off depots. It is unknown at this time which materials will be accepted at these depots.
Supporting System Requirements for Success:	• Completion of a siting study and/or business case to construct permanent drop-off depots within the city. • Assess waste audit and generation data to delineate waste streams that could be collected at each public drop-off depot. Waste generation and population data will need to be assessed to determine the capacity requirements of the public drop-off depots. • Development of promotion and education campaigns. • Engineering design of the permanent drop-off depots. • Siting and traffic flow studies within the city to determine the feasibility of the permanent drop-off depots throughout various neighborhoods within the city. • Consideration of potential to co-locate drop-off depots with transfer stations for potential efficiencies in site infrastructure and operations. • Identify the impact of IPR and how it would affect the materials generated by residents and businesses within the city, including costs. • Public behavior change required. • Will require sustainable markets for recycling and reuse.

Category:	Facility/Infrastructure
Potential Outcomes:	• Extended life of Trail Waste facility landfill by approximately one years. This is based on assuming 50 percent diversion of textiles, MHSW and EEE in garbage generated by all sectors, assuming depots are operational in 2025. • Provide residents with additional local and convenient access to public drop-off depots designated to divert materials from landfill disposal. • Increase the City's waste diversion rates. • Increased resident participation in waste diversion programs.
Measurement:	• The implementation of this option would be measurable with quantitative and qualitative measures associated with diversion rates and tonnages diverted/disposed through the permanent drop-off facilities. Would also offer the opportunity to track each material type separately. • The implementation of this option will also be measurable based on tracking the number of trips to the depot on an annual basis.
Case Study #1:	• The City of Hamilton has three Community Recycling Centres (CRC) that provide local service in different geographic areas of the city. These facilities are co-located with the City's existing transfer stations, with separate access for CRC and transfer station users. Each facility was designed to accept approximately 8,500 tonnes of materials annually. Recyclable materials are accepted in accessible outdoor bins. Leaf and yard waste material and garbage is also accepted in outdoor bins. • A unique traffic flow was designed to allow for convenient vehicular access to the weigh scales and bins, with separated areas for drop-off of garbage and recyclables. One of the CRCs was also designed with a Reuse Centre to allow residents the opportunity to donate and/or shop for reusable items. Housed in the same building as the Reuse Centre, a Household Hazardous Waste (MHSW) facility accepts MHSW from residents. Two of the CRCs have a customized trailer to accept residential MHSW.

Category:	Facility/Infrastructure
Case Study #2:	• The City of Winnipeg has three 4R Winnipeg Depots where residents can drop-off materials that can be recycled, reused, composted or resold. The 4R Winnipeg Depots support the City's current waste management programs, such as single stream recycling collection, leaf and yard waste collection and composting, and auto-bin or communal bin collection. The advantage of the 4R Winnipeg Depots is that all of the waste management programs are incorporated within the facility. These depots are strategically located to service different locations within the city. The depots were designed following the waste hierarchy principles set out in the City of Winnipeg's Garbage and Recycling Master Plan. A variety of collection systems, such as bunkers, containers, auto-bins and pre-fabricated container systems were selected for each of the different waste streams. • The Brady Road 4R Winnipeg Depot was completed at a cost of $5.13 million in 2016, the Pacific Avenue 4R Winnipeg was completed at a cost of $4.81 million in 2017 and the Panet Road 4R Winnipeg Depot was completed at a cost of $4.81 million in 2018. A cost of $5.45 million is estimated for a fourth depot, which is projected to be constructed by 2024.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

4D3 – Expanded Drop-off Areas for Divertible Materials at Trail Waste Facility

Category:	Infrastructure
System Overview:	• The Trail Waste Facility currently has a small-load public drop-off facility (the Small Loads Facility), located at the west side of the property within the proposed Stage 5 footprint. The Small Loads Facility is comprised of a 12-bay drop-off area and a designated scrap metal/white goods drop-off area. The design includes a multi-use open area in the centre of a raised drop-off platform. • It currently accepts divertible materials including cardboard, glass, metals, plastic, waste electrical and electronic equipment (WEEE), tires, scrap metal, white goods, and leaf and yard waste (LYW), from residents, businesses, and private haulers. The Facility does not currently accept mattresses, C&D materials, polystyrene or textiles. • It is noted that the Small Loads Facility will need to be relocated before the development of Stage 5 of the landfill begins by 2023, since landfilling is expected to start by 2024. • This option considers providing additional drop-off bays for divertible materials at the TWF, focusing on expanding the Small Loads Facility once it is relocated from the proposed Stage 5 footprint.
Status:	• Proven • This option has been proven in municipalities throughout Ontario, including Ottawa. Municipalities such as Halton Region have constructed public drop-off areas with bays allocated for divertible materials such as cardboard, plastics, and other materials. In conjunction with waste management programs and policies, a public drop-off area for divertible materials has decreased the amount of waste landfilled and increased the life capacity of the Halton Regional Landfill.
Source of Option:	• Staff
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill. • 4. Maximize the recycling of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 10. Make sustainable waste management design an essential part of the City's planning process. Guiding Principles: • Aligns with the guiding principle of keeping waste local

Category:	Infrastructure
Needs Assessment Alignment:	• Aligns with the need to determine ways to extend the life of the Trail Waste Facility landfill to maximize the life of the asset and plan for new disposal capacity, when required. • Aligns with the need for the City to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. • Also aligns with identifying specific waste streams that can be diverted from landfill disposal and develop new collection and diversion programs to capture these streams.
Individual Producer Responsibility (IPR) Impact:	• Partial impact • New Individual Producer Responsibility (IPR) programs may recover more recyclables at the source (e.g. curbside, public drop off areas). It is noted that IPR programs may also decrease the amount of recoverable material generated. • The City may choose to continue to accept IPR materials at the Small Loads Facility if costs for receiving the materials can be recovered from a Producer Representative Organization (PRO). Impacted materials currently include MHSW, electronics, blue box and tires.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to waste from: Single Family (SF), Multi-residential (MR), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Public drop-off for additional divertible material would divert more material from the Trail Waste Facility landfill. • This option will likely increase diversion rates and recover materials that can be recycled. • If the City focuses on materials not currently diverted at the Trail Waste Facility (e.g. C&D waste), the estimated diversion rate would be approximately 10%, which may extend the life of Trail Waste Facility landfill by one year. This assumes diversion of 75-85% of residential C&D waste in the garbage stream and C&D waste in "other garbage" received at Trail Waste Facility, starting in 2025. It is based on waste audit data and the assumption that the City continues to receive approximately 14,000 tonnes of C&D at the Trail Waste Facility annually (as reported in 2020) which comprises approximately 33 per cent of the estimated 42,406 tonnes of "Other Garbage" managed at the facility. • Additional bays for divertible materials at the existing Small Loads Facility will likely require an Environmental Compliance Approval (ECA) amendment for the Small Loads Facility.

Category:	Infrastructure
Social Considerations:	• Additional options to dispose of divertible materials would be considered an enhanced service provided to residents that is potentially more convenient. • Public resistance may occur if there is an increase in fees to drop off materials or a fee for some specific items. • The public is also anticipated to support measures to minimize the amount of waste landfilled and increase the site life of the City's largest solid waste management asset, the Trail Waste Facility, especially since it will not negatively impact the public. Implementing a public drop-off area for additional divertible materials demonstrates to the public that the City is attempting to maximize their existing resources. • There is minimal to no health impacts when in compliance with the ECA.
Technical/Operational Considerations:	• Waste audit and generation data will be required to determine the additional material streams and therefore the number of additional drop-off bays required. • Well established end markets or materials brokers/buyers for divertible materials would need to be identified in advance of accepting any item or material stream. • Traffic flow analysis may be required during the planning process to identify any traffic constraints and potential traffic bottlenecks. • Would need to incorporate additional bays into the design of the new Small Loads Facility.
Regulatory Considerations:	• Expanding the Small Loads Facility to increase capacity and provide additional bays for divertible materials will likely require an ECA amendment which could up to two years to complete and secure.
Financial Considerations:	• The capital costs will depend on the number of bays specified for the Small Loads Facility for divertible materials. However, it is expected that the capital costs be within the low range (<$10 million). • For operations, annual costs would likely be slightly higher than the current operations costs of the existing Small Loads Facility. This is since additional bays will be available and the recoverable materials will need to be transported to processing facilities such as the MRF, rather than to the landfill. It is estimated that annual operating cost increase in comparison to the existing Small Loads Facility would be within low range (<$1 million) per year.

Category:	Infrastructure
Unknowns/ Assumptions:	• At this time, it is unknown how IPR will impact the quantities of recyclables and organics in the garbage stream which could be recovered and diverted from landfill disposal. • Assumed that the Small Loads Facility be relocated by 2023 (based on the anticipated Stage 5 construction start date of 2024).
Supporting System Requirements for Success:	• Assess waste audit and generation data to identify additional waste streams (divertible materials) that could be recovered. • Waste generation data will need to be assessed to determine the capacity requirements of the Small Loads Facility for divertible materials (i.e. determine the number of bays required). • Supporting P&E to educate site users on additional materials that can be diverted and any sorting requirements. • Will require sustainable markets for recycling and reuse. • Public behavior change required to sort materials.
Potential Outcomes:	• Extended life of Trail Waste Facility landfill by approximately one year. • Provide residents with year-round access to public drop-off areas designated to divert materials from landfill disposal. • Increase the City's diversion rates. • Increased resident participation in waste diversion programs.
Measurement:	• Implementation of this option would be measurable with quantitative and qualitative measures associated with diversion rates and tonnages diverted through the implementation of the drop-off facility. Would also offer the opportunity to track each material type separately. • The number of customer trips to the depot on an annual basis could be measured.
Case Study #1:	• The City of London operates a public drop-off facility at its W12A Landfill site for both waste and materials that can be diverted from landfill. Materials accepted include household garbage, appliances, blue box materials, brush, cardboard, electronics, scrap metal, tires and wood. There is also a facility to receive Municipal Hazardous and Special Waste (MHSW) at the landfill. • The City also operates three EnviroDepots to provide additional locations where residents can drop off materials. These facilities accept bagged household garbage, MHSW and a range of items for recycling including blue box materials, yard waste, electronics, scrap metal, appliances and tires. Bicycles can be dropped off for repair and reuse. A Goodwill Donation Centre is located at one of the depots (Oxford Street EnviroDepot).

Category:	Infrastructure
Case Study #2:	• The Container Station at the Region of Halton Waste Management Site (HWMS) provides a public drop-off area for residents and small businesses to dispose of or recycle their waste material. Items such as wood, scrap metal, drywall, appliances, electronics, yard waste, paper, cans and bottles, cardboard and tires can be placed in this area in the marked locations. The Container Station is located at the HWMS, where the Region's landfill is located, and is operated by a private contractor at an annual cost of approximately $315,000. • Currently, there are two rows of twenty-two 50-yard bins to facilitate the placement of waste. There are also bins for small items such as eyeglasses, natural corks and hockey sticks. Eyeglasses are collected for a local community organization and are shipped to developing countries. Cork is recycled into new cork products in Oakville. Hockey sticks are used by a local artist for reuse art pieces. Bikes that are in good condition are set aside for removal and refurbishing by a charity group. The HWMS also has a drop off area for MHSW.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

5. Collection and Drop-off

5A1 – Collection of More Materials at the Curb

Category:	Program
System Overview:	• This option includes having the City offer curbside collection of additional materials such as batteries and electronics, light bulbs (some may be considered hazardous waste), wood pallets, textiles, Styrofoam and construction and demolition (C&D) materials such as wood, drywall and asphalt shingles. Collections would be offered periodically throughout the year or could be by appointment. • The collection frequency required would be dependent upon the material, resources required to execute collection, processing, end of life management plans and budget. • There is the potential for the City to implement new recycling programs to increase diversion with respect to waste streams not currently collected at the curb. As new recycling programs are potentially implemented, careful planning needs to occur including the identification of recycling end markets to determine the cost-benefit analysis, potential partnerships and collection options. • The City may decide to charge a fee for separate collection or the cost may be built into overall solid waste management fees charged to customers.
Status:	• Proven • There are some case studies of items such as batteries and C&D materials being collected curbside. Other material types would be considered emerging.
Source of Option:	• Consultant, Consultations
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services Guiding Principles: • Honour the 5Rs hierarchy • Change community values • Adopt circular economy principles • Embrace innovation

Category:	Program
Needs Assessment Alignment:	• Addresses the need to identify specific waste streams that can be diverted from landfill disposal and develop new collection and diversion programs to capture these streams. • Also addresses the need to build on the current systems, services and programs, identify more efficient ways to efficiently collect materials, that are more convenient and accessible to residents and customers.
Individual Producer Responsibility (IPR) Impact:	• Partially – will need to see impact of Individual Producer Responsibility (IPR) Program/ Materials, which currently include Electrical and Electronics (EEE) as well as Municipal Hazardous or Special Waste (MHSW).
System Consideration:	• Secondary – will be a program option to overlay onto core system component.
Sector Applicability:	• This option would apply mostly to the Single Family (SF) sector but could also apply to Multi-Residential (MR), City Facilities (CF) and commercial properties that currently participate in the curbside collection programs, specifically the Yellow Bag Program.
Environmental Considerations:	• Waste audit data from the 2018/2019 Four Season Curbside Waste Audit Study indicates that waste sent to landfill included material that could be diverted. Textiles, EEE and MHSW represented approximately 7% of the total amount of waste that was sent for landfill disposal. • It is likely to see an increase in the capture rate of these materials and an increased waste diversion rate due to the convenience factor of these programs. • If more materials are collected separately, there may be increased greenhouse gas (GHG) emissions due to transportation, as more waste collection vehicles would be required. • Increased capture of hazardous and special wastes can also benefit storm and wastewater systems and drinking water source protection.

Category:	Program
Social Considerations:	• This option would allow for more convenience, given collection of these materials happens at the curb. Residents may have to source separate some materials at the curb, however this is a lower level of effort compared to transporting these materials to a drop-off facility or event. • Additional P&E would be required to introduce new services and ongoing communication would be necessary as a collection program requires residents to place materials curbside on specific dates and with specific guidelines. • Potential to increase accessibility, equity and inclusion for residents who do not have a vehicle or means of transportation to bring materials to a drop-off facility or event. • Potential to impact residents if an additional fee is charged for curbside collection of materials, particularly if residents can manage the material themselves at low/no cost.
Technical/Operational Considerations:	• City would need to identify which materials could be collected separately and if there is a market/processor for those materials. • The Solid Waste by-law would have to be updated. • City would need to decide if materials are collected for a fee and would need to establish the system for payment of these fees. • Procurement process and contract(s) with collectors and processors would be required to ensure materials are collected, processed and diverted properly. • Requirement of P&E campaign to promote the collection of these materials, including timelines for collection, what is and is not accepted and how to place materials at the curb safely. • Collection programs would require enforcement for proper curbside collection. • May require additional staff if an appointment-based collection approach was implemented.
Regulatory Considerations:	• Permit for transportation of dangerous goods for items such as batteries and other hazardous waste may be required, depending on the quantity. • Any programs for IPR designated materials would need to consider requirements of Producer Responsibility Organizations (PRO).

Category:	Program
Financial Considerations:	• Capital costs are expected to be minimal (low <$500K), assuming no collection vehicles are required to be purchased. • Operating costs are expected to be medium to low ($500K-$1M) for a collection program where material is collected once or twice per year. These costs would also be inclusive of P&E and a collection contract. • Operating costs are expected to be medium to high (>$3 million) for a collection service that is provided by a scheduled appointment. Collection fees can be charged to offset the cost of the collection program. • Costs vary depending on the number of collection events that are scheduled, waste hauler contracts and planning and coordination of collection programs. Operating costs may increase if the City also has to manage and recycle these materials. • It is expected that some, but not all of costs may be covered by PROs; however, this would need to be determined. • P&E costs could be in the order of $1-$2.50 per household for a multi-media campaign.
Unknowns/Assumptions:	• Impacts of IPR regulations and the feasibility of offering collection programs for designated materials is unknown. • The impact on diverting additional material from landfill is unknown and will depend on collection frequency and which materials are collected. • It is unknown how the program would be implemented, for example, on specified days each year or by appointment, or if fees would be charged.
Supporting System Requirements for Success:	• Would require an extensive P&E campaign to inform customers of changes. • Would require contracts with waste haulers and material processors, specifying which materials would be collected and frequency of collection. • Require end-markets and processors for materials collected. • Additional staff resources may be required to book appointments if a scheduled collection service is provided. • Would require a booking and dispatching system if service was provided by scheduled appointment. • Would require a method to process fees for collection (if this is the process selected).

Category:	Program
Potential Outcomes:	• Potential for increased waste diversion. • Potential for increased participation in these diversion programs over the traditional self-haul, self-drop off and mobile collection methods.
Measurement:	• Quantitative measurements can take place by reviewing tonnages of material collected and recycled. • Scheduled collection enables the use of the program to be monitored through the number of appointments that are booked.
Case Study #1:	• Durham Region provides curbside collection services to the local municipalities it services for batteries, electronics and porcelain goods. • Batteries are collected at the curb twice a year in the spring and fall and residents are required to put the batteries in clear resealable plastic bags and label the bags (labels provided in the yearly calendars received) and then place the bag on top of the paper blue box on the battery recycling day. In 2019, the Region diverted 33 tonnes of single-use batteries. • Waste electronics and porcelain goods are picked up in participating municipalities by appointment only. Durham Region also provides collection services for batteries, electronics and textiles to most multi-residential buildings serviced by the Region. Participating buildings have a special collection bin for these materials.[87]

[87] Durham Region 2019 Waste Management Report

Category:	Program

Case Study #2:	• Niagara Region has been collecting batteries (standard A, AA, AAA, C, D, 6V, 9V, button batteries and rechargeable battery packs) over a one-week period annually, curbside since 2012. Due to the COVID-19 pandemic, this service was halted in 2020. In a 2019 report to its Council[88], it was noted that:
	  ○ Niagara Region collected 7,142 kilograms of batteries during the one-week period from April 22 to 26, 2019 (21% more than 7,403 kg collected in 2017) and has collected 45,802 kilograms in total since the original pilot program in 2012;
	  ○ Staff is estimating a net cost between $1,816 and $6,887 to continue to operate the curbside battery collection program for 2020, based on continued stewardship funding and the average annual volumes collected; and
	  ○ The batteries collected are recycled at a local battery recycling company.
	• In 2019, the net cost of the battery collection program increased due to increased contractor costs. The gross cost was $13,878, inclusive of P&E costs and funding of $12,990 was expected to offset costs.
	• The Region estimates the volume collected per household at 0.05 kg.

Recommendation	• It is recommended that the option proceed to the evaluation stage.

[88] https://pub-niagararegion.escribemeetings.com/filestream.ashx?DocumentId=4821

5A2 – Expanded Diversion Program at City Facilities and Operations

Category:	Program
System Overview:	• This option reviews the opportunity for the City to implement a standardized recycling and green bin program across all of its facilities and operations. It also reviews the possibility for the City to roll out other waste diversion programs for batteries, cartridges/toners, electronics, office furniture, needle collection and scrap metal in its facilities and operations. These additional diversion programs would be internally facing and not for the public to drop-off items. Ambassadors for these programs would be selected for each facility. • City facilities have a variety of different uses, including administrative buildings, police services, works yards and long-term care facilities and programs would be tailored to the types of users and waste generated in each type of facility. • In 2011, the City undertook an aggressive interdepartmental initiative by aligning waste collection services and waste diversion programs for City facilities with those provided under the residential Solid Waste Services collection contracts, with the goal of increasing operational efficiency and achieving improved waste diversion, as well as providing harmonized service to all City facilities. • This option is tied to option 2B2 - Mandatory Waste Diversion in all City facilities and 3A5 - Develop Corporate Strategies and Opportunities to Increase Waste Reduction, Reuse and Recycling.
Status:	• Emerging • Some municipalities have the recycling and organics from their City facilities collected by a waste hauler or collect these materials themselves; however, there are not many cases of City facilities in either Ontario or Canadian municipalities managing and collecting additional materials (batteries, cartridges/toners, electronics, office furniture, needle collection, scrap metal).
Source of Option	• Staff

Category:	Program
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste; • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste; and • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. Guiding Principles: • Honour the 5Rs hierarchy; • Change community values; • Lead by example; and • Embrace innovation.
Needs Assessment Alignment:	• Addresses the need to identify ways in which City facilities and operations can avoid, reduce and divert more waste from disposal.
Individual Producer Responsibility (IPR) Impact:	• Partially – will likely need to be consistent with Individual Producer Responsibility (IPR) recycling program. Materials impacted could also include Electrical and Electronics (EEE) • Municipalities currently do not know which operational and logistic adaptations will have to be implemented to prepare them for the changes in (IPR) legislation, specifically for the Blue Box program. • At this time, it is not known or expected that waste generated at some City facilities will be included in the IPR program transition.
System Consideration:	• Secondary – will be a program to overlay onto core system.
Sector Applicability:	• This option would apply to City Facilities/Operations (CF).
Environmental Considerations:	• Likely to see an increase in the capture rate of materials and an increased waste diversion rate due to expanded services being provided for certain materials. • May increase greenhouse gas (GHG) emissions as more waste collection vehicles may be required to collect additional waste streams. • Items that may have been disposed and landfilled may now be collected for recycling, which could have positive impacts on air and/or water quality.

Category:	Program
Social Considerations:	• Waste diversion at City facilities would demonstrate social responsibility and lead by example. • Requires a greater level of effort for City staff to use programs, and to change behaviour to divert instead of dispose of waste.
Technical/ Operational Considerations:	• Would require the selection of standardized waste diversion containers and delivery to City facilities. • Would require co-ordination with facilities staff to place containers and install signage and labelling. • Would require initial education of staff on the different programs available at each facility and how to participate in them. • Would require an Ambassador for each site who could be the point of contact for staff on the program. • Would require City to purchase and distribute collection containers and arrange for collection. • Procurement process to arrange for a collection and processing to ensure materials are processed and diverted properly. Could align with other similar contracts the City has in place or future contracts. • Requirement of P&E campaign to internally promote the collection of these materials including timelines for collection, what is and is not accepted and how to have materials collected properly and safely. • Additional staff may be required to manage contracts. • Updates to facility cleaning operations/contracts may be required to ensure staff are trained on any changes to waste and recycling handling practices. • Will require a system for tracking material collected, recycled and disposed.
Regulatory Considerations:	• It is unknown if this option will be directly impacted by IPR.

Category:	Program
Financial Considerations:	• Capital costs are expected to be low (<$500K) but could be impacted if specific bins for all City facilities are required to collect specific materials. It is not expected that specific collection vehicles or other capital would be required. • Operating costs are expected to be medium ($500K - $1M) for additional contracted collection and processing of materials and potential changes required in facility operations relating to waste hauling activities. • Costs will depend on number of collection programs, waste hauler contracts, planning and coordination of collection programs and potential subsidy from existing stewardship programming. • Operating costs could increase above this amount if there are more requirements of the waste diversion Ambassador, or if specific hires are required to develop, plan and implement these programs for City facilities and operations.
Unknowns/ Assumptions:	• It is currently unknown which of the diversion programs would be implemented (e.g. batteries, cartridges/toners, electronics, office furniture, needle collection and/or scrap metal) and how frequently they will be collected (annually, seasonally, quarterly, weekly, etc.). • It is unknown if the City would develop and implement an expanded diversion program themselves or if they would contract out to the private sector. • It is unknown how IPR may impact the implementation of this program, and if funding will be available to offset costs. • It is unknown what container types would be used in an expanded diversion program for recycling and green bin.
Supporting System Requirements for Success:	• Would require an extensive P&E campaign to inform staff of changes. • Would require coordination with waste haulers and material processors, depending on materials collected and the agreed upon frequency of collection. • There would likely be new contracts that would require oversight. This may require additional staff. • Implementation would require coordination and collaboration with facilities management, solid waste and procurement staff, as well as cleaning and facilities staff. • Would require staff to undertake an assessment of the types of materials generated at each facility, the potential to divert these materials, and the best way to collect them.
Potential Outcomes:	• Potential for increased waste diversion by collecting material through new diversion programs. • Potential for increased diversion for existing programs (e.g. organics, EEE).

Category:	Program
Measurement:	• Waste diversion can be measured through tonnes collected for recycling and reductions in quantities of garbage from CF requiring disposal. • Pre and post policy implementation waste composition studies can measure the success of these programs.
Case Study #1:	• The City of Toronto has developed several programs to reduce the environmental impact and costs associated with City operations, and support the achievement of key goals and targets, including Toronto's greenhouse gas reduction target of 80% by 2050. One of these programs is waste management. Waste management initiatives at City-owned facilities were developed to divert waste from landfill, reduce GHG emissions and save money. In 2016, Toronto's largest buildings diverted 90% of waste to landfill (1,297 Tonnes). The way the City achieved this diversion rete was threefold: o Reduce and reuse – paper use and stationary orders were reviewed and highlighted as areas of reduction and reuse; o Council mandated diversion rate of at least 70%; and o No waste recycling program – each facility has centrally located recycling and green waste collection bins that are situated in locations to promote waste diversion.
Case Study #2:	• The Township of Langley (British Columbia) offers expanded collection of film plastics, polystyrene, small appliances, power tools and outdoor power equipment, light bulbs, batteries and electronics at their Langley Event Centre (LEC). These materials are collected from internal LEC operations. When the containers are full, LEC maintenance staff phone the Township waste staff to arrange for a pick-up as product stewardship and other recyclable materials are managed through the Township. Paint and hazardous waste items are taken to the recycling depot by facility staff. Other items like cooking oil and compressor oil are also recycled. These collection programs were in addition to the existing garbage, recycling and compost programs that exist in the LEC. • Custodial staff collect all garbage, recycling and organics from all areas of the facility. They are also responsible for collecting garbage, recycling and organics from facility users so that there is no third-party access to the facility's waste collection room (where bins are stored for diversion and collection). Staff are trained on which bins are designated for each material.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

5B2 - Optibags

Category:	Program/Facility/Infrastructure
System Overview:	• This collection system would require the use of colour coded plastic film collection bags for selected waste streams such as garbage, recycling and source separated organic waste to enable collection of the bags together, in a single truck or receptacle to reduce collection costs and contamination. Customers would sort their waste streams into different coloured bags and place all the bags in a single waste collection receptable such as a bin or cart. An optical sorting facility that has camera/software technology to recognize the different bag colours and materials would sort the waste into different streams for processing. • Opti bags sort various waste and recycling streams at the source, thus capturing more diverted materials and reducing the costs associated with cross contamination and multiple collection truck types. In turn, residents just need one bin or cart and all bags may go in the one cart for one collection day.The bags can be collected via a single multi-residential chute (e.g., Envac, as an example of a vacuum system/chute) or container and placed in a single location for storage until collected. • The heavy-duty colour coded bags are collected and transported with a conventional waste truck to a specialized sorting facility which separates the streams using Optibag sorting technology. The facility may be at a transfer station, at a MRF or at a landfill depending on recommendations of a site feasibility study. At the facility, camera/software technology recognizes bag colour and simple, robust mechanical diverters separate the different coloured bags into separate roll off containers. The sorting facility is fully automated, requiring minimal labour. Each bag colour is viewed as a “fraction” or portion of the waste stream that has been sorted by bags and the equipment can manage up to nine different “fractions”. • This option could also be considered in conjunction with option 5B3 – Vacuum Collection Systems.
Status:	• Proven • This technology is considered proven as it has been in place since 1990. It is primarily located in Europe, however, there has been interest in North America. Currently, there are no optical sorting plants specifically for the Envac Optibag in Canada. Some Ontario municipalities have been considering using the Optibag and vacuum system/chute in Multi-Residential buildings.
Source of Option:	• Consultant

Category:	Program/Facility/Infrastructure
Proposed Strategic Alignment:	Goals: • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Embrace innovation.
Needs Assessment Alignment:	• Aligns with the need to identify more efficient ways to collect materials, that are more convenient and accessible to residents and customers.
Individual Producer Responsibility (IPR) Impact:	• Partially - will depend on the City's future role in recycling collection when the Blue Box Program recycling is transitioned to an IPR program.
System Consideration:	• Core System Component - major way materials are collected.
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• A single inlet or receptacle bin for curbside collection and use of bags (over loose items sorted in 3 to 4 carts or bins) for selected streams can increase ease of disposal for residents. Increased convenience for separating waste streams can increase participation, which will in turn increase waste diverted from disposal. • Improperly sorted materials cannot be enforced at the time of collection, which may result in higher contamination of sorted waste streams. • Bags that are required to be used would be for a single use. May be issues with potential future bans on single-use plastics. • May result in reduced greenhouse gas (GHG) emissions from the anticipated reduction in the number of collection vehicles required (and fuel), as Optibags can be collected together in a single truck. • May result in increased GHG emissions if location of the sorting facility requires a secondary trip to processing or disposal facilities.

Category:	Program/Facility/Infrastructure
Social Considerations:	• Specific bags must be used and/or purchased to use the waste collection system. Potential to impact users who cannot afford to purchase specialized plastic bags. Can be mitigated by City providing bags to residents. • Relies on residents consistently using specialized bags to maintain the program. • Convenient for users as all waste can go into plastic bags and be collected (e.g., drop off) in one location for MR buildings or one bin for SF which can lead to increased participation in diversion programs. As more diversion streams are added, an additional bin or truck would not be needed, just a new bag colour for the user. • Collection in a single truck will reduce impacts associated with collection of waste streams, such as less noise and traffic. • Requires residents to sort materials into bags which may be a higher level of effort compared to the current system. Customers may have limited room to store multiple bags.

Category:	Program/Facility/Infrastructure
Technical/Operational Considerations:	• Application of Optibags can occur on a small-scale, such as at a City facility for collection of linens/towels. • Large-scale applications may also be implemented for the existing curbside and containerized collection waste streams, including garbage, recycling and green bin organics. • New waste streams can easily be integrated into a collection program with the addition of a new bag colour. • Would require retrofitting of an existing processing or disposal facility to accommodate optical sorting of bags or the development of a new specialized sorting facility to sort the bags prior to transfer to a processing and/or disposal facility. • Determine the procurement and service delivery approach for the sorting facility i.e. if it would be a City-owned and operated facility, a P3 or contracted service. • Operation of a sorting facility may be carried out by a contractor or Optibag facility supplier. • Extensive initial and ongoing promotion and education are required for curbside residents, new and existing tenants, property managers/superintendents and janitorial staff to reduce contamination. • Bagged materials would have to be opened before going through the waste diversion processing facilities. • Compaction on the collection vehicles would be reduced on both curbside and multi-residential collection vehicles. Depending on vehicle capacity reduced compaction may increase the number of vehicles on the road or the number of trips. • Optibags may be applicable in the development of the future curbside collection contracts as it can address changes in the way materials are collected and/or curbside levels of service, for example, collecting bulky items separately from garbage or separating leaf and yard waste. • Optibags may be implemented to service the MR sector through the creation of a Multi-Residential Waste Strategy recommending specific policies, programs, and initiatives to support diversion in the MR sector while aligning with the direction of the SWMP.

Category:	Program/Facility/Infrastructure
Regulatory Considerations:	• Provincial Environmental Compliance Approval will be required for a sorting facility. • Additional municipal approvals would be required for a waste management facility to sort the bags prior to transfer to a processing and/or disposal facility. • Anticipate timing and approval costs would be in the order of that required for a MRF. Would require an ECA (waste, air, industrial sewage) for the development of a facility. The ECA and municipal approvals may take one to two years to complete. Costs associated with the regulatory process are anticipated to be <$1M.
Financial Considerations:	Capital costs would include the construction of a new sorting facility. There are potential operating cost savings associated with the reduction in the number of collection vehicles. Collection fleet would be able to collect all waste streams in one type of truck with all coloured bags mixed together. There would not be a need for split load trucks for co-collection nor multiple trucks travelling to each residence. A feasibility study/business case would be required to assess financial implications; however, capital and operating cost considerations include: **Capital Costs** • Installation of optical sorting equipment at receiving processing plant equipped with optical sorting equipment to sort different colours of bags. It is estimated that cost will be in the low to medium range ($10-50 million) if a new facility is constructed. • Provision of containers to residents to manage the multiple bags. **Operating Costs** • Distribution or provision/sale of colour coded bags to residents, if provided by the City. • Promotion and education campaign on how to participate and/or training on the new collection system, targeted to curbside residents, property management staff, janitorial staff and tenants, City staff and Yellow Bag program participants; • Operation of the receiving processing plant, if City owned. • Potential for cost savings through the reduction of the number and types of collection vehicles required since waste streams will be collected together and presorted at its source. • It is estimated that annual operating costs will be in the high range (>$10 million) for a sorting facility in addition to related transportation costs to the facility and processing and disposal costs.

Category:	Program/Facility/Infrastructure
Unknowns/Assumptions:	• The City's role in the collection of the future IPR recycling stream is unknown. • Operating costs for a sorting facility are unknown. • Potential impact on waste collection costs are unknown. • Whether the City or a private operator would process materials. • Assume the City would implement this program for all sectors. • It is assumed that the residual waste stream would continue to be disposal at the existing Trail Waste Facility landfill.
Supporting System Requirements for Success:	• Feasibility study to determine costs and benefits of implementing an Optibag system and how it will integrate with other existing and future programs and facilities that will be implemented. • Implementation of Optibags is dependent on having a sorting facility in place to receive and process material in bags. • Application of Optibags is dependent on the existing contracts/diversion programs and will affect future collection contracts/diversion programs. • The use of Optibags for recycling is dependent on the IPR framework for each sector.
Potential Outcomes:	• Potential for reduced collection costs and reduced contamination based on the Opti bag collection system applied. • Increased convenience for separating waste streams and placement of bagged materials in a single receptacle can increase participation, which will in turn increase waste diverted from disposal. • Additional colours may be introduced to divert new materials, e.g. textile waste.
Measurement:	• Qualitative measurement of success may be based on customer service reviews, such as improved ease of use. • Quantitative measures of success may be assessed based on a reduction in the number of collection trips required, increases in participation in diversion streams and increases in diversion rate.

Category:	Program/Facility/Infrastructure
Case Study #1:	• The Optibag system has been successfully employed in Oslo, Norway for almost 20 years. The coloured bags are provided free of charge to residents and can be picked up in local grocery stores, which was based on agreements with the central grocery chains. The waste bags are placed in the bin or container and then collected with a conventional waste truck and transported to the Optibag plant. The trucks have reduced compression to avoid breaking the bags during collection, transport and emptying. The bags are delivered to one of two Optibag facilities where they are sorted automatically using camera technology that recognizes the colour of the bag. For example, when a green (food waste) bag is detected, a signal is sent which pushes the bag off the main conveyor belt, onto a second belt and then directed to its appropriate container. The containers sorted by each material type are taken to their respective processing sites for further processing. Operating costs are not publicly available; however, the facility processes 180,000 tonnes per year. • Oslo, Linköping, Tromsö, and Södertälje use optical sorting in conjunction with vacuum systems.[89]
Case Study #2:	• The City of Eskilstuna introduced the Optibag system in 2010 to manage the waste for approximately 45,000 residents. Today, the system manages waste from several municipalities and sorts seven waste fractions including: food waste, metal packaging, plastic packaging, paper packaging, newspaper, other household waste and textile. Over time, different materials have been successfully tested to ensure the bags can be recycled (e.g., biodegradable plastics for organics). • The inclusion of textile waste was introduced in 2017 and required no additional capital cost. The new textile diversion program reported nearly 50% of available textile waste was diverted within six months of implementation.[90]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[89] https://optibag.nu/en/portfolio-items/oslo-2/

[90] https://optibag.nu/en/portfolio-items/1694/ , https://optibag.nu/en/textile-waste/

5B3 – Vacuum Collection System

Category:	Facility/Infrastructure
System Overview:	• Vacuum waste collection systems transport waste from ground-level containers to a central collection facility via pneumatic tubes. A large-scale system would require the installation of underground piping from the waste receptacles located in areas such as parks and public spaces (PPS) and at opted-in multi-residential and industrial, commercial and institutional (IC&I) buildings to a centralized collection facility similar to a transfer station. A smaller-scale vacuum collection system may be applied to single buildings or new and existing developments, as well as incorporated into revitalization or renewal projects. For example, in new developments, a series of waste inlets may be installed that consolidates waste at a central location for traditional collection. Trucks are required to transport separated materials from the central collection facility to the processing facility or disposal site. • If an Optibag system, as outlined in Option 5B2, is coupled with the vacuum collection system, the different coloured bags corresponding to different waste streams can be collected via a single chute (e.g., Envac, as an example of a vacuum system/chute). Without Optibags, waste deposited in their respective receptables will stop at a valve that opens into a main pipeline. The valves will open one at a time to allow each stream to flow separately through the main line. This system can be controlled by automated software. Alternatively, more than one pipeline can be constructed for each stream. • This option may require the City to work with developers to implement vacuum collection as part of new multi-residential or IC&I developments. It may also be relevant to City revitalization or renewal projects. Additional consideration will need to be given to couple the system with the Optibag.
Status:	• Proven • This technology is primarily located in Europe, however, there has been interest in North America. Some Ontario municipalities have been considering using the Optibag and vacuum system/chute. A small-scale system that showcases the Envac technology has been installed in La Cite Verte in Quebec City, and manages organics, recyclables and garbage in a high-density mixed-use development
Source of Option:	• Consultant, Staff

Category:	Facility/Infrastructure
Proposed Strategic Alignment:	Goals: • 6. Aspire to achieve 100% GHG emission reductions produced by the City's integrated waste management system. • 7. Support, influence and partner with the Industrial, Commercial and Institutional sector, including multi-residential, small businesses, and the agriculture sector, the Construction & Demolition sector, to reduce, reuse and divert waste in the broader community. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Embrace innovation.
Needs Assessment Alignment:	• Aligns with the need to identify more efficient ways to efficiently collect materials, that are more convenient and accessible to residents and customers.
Individual Producer Responsibility (IPR) Impact:	• Partial - may depend on the sectors from which producers will be required to collect designated materials for recycling.
System Consideration:	• Secondary - will be a program to overlay onto core system.
Sector Applicability:	• Applicable for Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP). • Applicability for these sectors may be restricted to new developments or revitalization and replacement projects only.
Environmental Considerations:	• Waste collection by fleet may be reduced or no longer required. A reduction in emissions through less fleet transportation may be realized, thereby reducing greenhouse gas (GHG) emissions. • Limits overflow of materials from City receptacles in high generating public spaces and parks by increasing capacity. • Diversion rate may increase for MR properties if chute inlets are installed in a more convenient location, making diversion easier for residents. • Waste may need to be placed in plastic bags. May be issues with potential future bans on single-use plastics.

Category:	Facility/Infrastructure
Social Considerations:	• Reduction of impacts related to waste collection vehicles, such as traffic, noise, litter. • The vacuum system is well suited for space-constrained sites, as there is a reduction in the footprint required for housing traditional waste bins. This will increase space for other on-site features, such as available parking and green space. • As storage of waste in containers is no longer required or the number of containers is reduced, odour and vermin may be minimized. • The system is automated and may be operated 24 hours a day without relying on people, vehicles or weather. This may limit excess waste surrounding the container and minimize visual pollution from litter. • Potential to use lower profile containers to minimize safety issues related to obstructed views. Lower profile containers may also increase accessibility for the elderly, children or people with impaired mobility.
Technical/Operational Considerations:	• If materials are initially conveyed to a centralized collection point, transfer of materials to a disposal or processing facility would require collection by trucks. • Collection of large pieces of solid waste, such as bulky items and brush/yard waste is not suitable for vacuum collection systems and would require collection by trucks. • Manual handling of waste is minimized, which will reduce the risk of injury to workers from traditional manual waste collection techniques. • Collection of all three streams in a single pipe is possible using timers to regulate the flow of material. However, there is potential for cross-contamination if the materials are not in bags. To overcome this issue, either bags for each stream or a multi-pipe system is required. • Piped infrastructure will likely need to be installed in City's right-of-way and require City approval for design and location. Reduces the number of trucks required for collection which will reduce GHG emissions. This is in alignment with the City's Climate Change Master Plan. • Vacuum collection systems may be integrated with planned improvements to the City's infrastructure, such as revitalization projects of commercial and residential areas, new private developments or parks and public spaces.

Category:	Facility/Infrastructure
Regulatory Considerations:	• Installation may be affected by the Ontario Building Code, depending on where it is built. • Additional municipal approvals would be required for a waste management facility to collect the waste in a common facility or area for the development. • Larger scale implementation serving multiple developments would likely require a dedicated waste management facility to collect waste and transfer it to processing and/disposal facilities, which would require an Environmental Compliance Approval.
Financial Considerations:	• Capital and operating costs will be dependent on the size of the system installed and the ownership/operating model. An analysis will need to be undertaken by the City to determine which sectors or areas vacuum collection systems are most suitable. • It is estimated that capital infrastructure costs will be in the low to medium range ($10-50 million) for a new development that services multiple buildings and includes a centralized collection facility. Costs and expenses related to the operation of a vacuum collection system will be in the low range (<$1 million) for a district system. Capital and operating cost considerations include: **Capital Costs:** • Installation of corresponding infrastructure would be required and includes, but not limited to: a central collection facility, underground pneumatic piping system, automated software and compatible containers. • If coupled with the Optibag system, installation of optical sorting equipment at receiving processing plant to sort different colours of bags would be required. To benefit from the cost efficiencies, vacuum collection systems are best suited for high density, urban areas. Envac recommends a minimum density of 150 dwellings per hectare and to limit the length of piping to a central collection facility to two kilometres. **Operating Costs:** • Promotion and education campaign on how to participate and/or training on the new collection system, targeted to property management staff, janitorial staff and tenants. • A variety of operating/ownership models exist for this system, which can influence the operating costs. • Operation and maintenance of pneumatic piping system. • Potential for cost savings through the reduction of the number of collection vehicles required.

Category:	Facility/Infrastructure
Unknowns/Assumptions:	• The City's role in the collection of the future IPR recycling stream is unknown. • In the absence of site-specific data, or details on upcoming City revitalization projects or new high density private sector development, it is unknown the number of locations where vacuum collection systems may be installed, as well as the maximum distance a central collection facility would be required to create sufficient vacuum. • Assume this option would be best suited to new developments or revitalizations/renewal projects and not for existing residential areas.
Supporting System Requirements for Success:	• Feasibility study / business case review to determine costs and benefits of implementing a vacuum collection system and how it will integrate with other future waste management programs and facilities that will be implemented, as well as alignment with Council-approved climate change objectives. • Vacuum collection systems may reduce fleet requirements if collection is reduced or no longer required, which will need to be considered in future collection contracts. • Vacuum collection systems for recycling are dependent on the IPR framework for each sector and who is responsible for which materials.

Potential Outcomes:	• This option may increase diversion in MR developments if chute inlets are placed in a more convenient location, such as on each floor or at a common entrance/exit.
	• This option could be combined with Optibags.
	• Potential benefits will be realized from:
	  ○ A reduction in the number of collection trips needed, fuel/energy and GHG emissions due to increased storage capacity;
	  ○ Improved aesthetics and odour/vermin control from storage of waste; and
	  ○ A reduction in space requirements for waste receptacles.

Measurement:	• Qualitative measurement of success may be based on customer service reviews, such as improved ease of use, reduction of litter complaints and improved aesthetics. • Quantitative measures of success may be assessed based on a reduction in the number of collection trips required, reduced fleet fuel/energy and a reduction in the number of complaints related to overflowing waste, odour or vermin for receptacles in parks and public spaces.

Category:	Facility/Infrastructure
Case Study #1:	• Lakeview Village is a proposed mixed-use waterfront development in Mississauga that focuses on the implementation of sustainable technology, including a district energy system and a vacuum collection system for waste. The development is mandated to consider innovations in urban design under the Inspiration Lakeview Master Plan, developed in partnership with the Province of Ontario, Ontario Power Generation and the City of Mississauga. • The Lakeview developers propose to use a network of underground pipes to convey garbage, recyclables and organic waste from mid-rise and high-rise residential properties and IC&I establishments to a central depot facility within the development. The project will also include self-emptying litter bins in parks and open-space areas for garbage. This is estimated to eliminate over 1,000 garbage trucks trips per year. Capital costs are estimated to include $17.2 million for indoor and outdoor waste inlets and infrastructure, $5.5 million for the pipe distribution network and $13 million for a central collection terminal. As part of the development, the waste will be weighed at the source and tie into the Peel Region's movement toward a user pay system. • It is unknown what the status of this development is at this time. (https://mylakeviewvillage.com/wp-content/uploads/2020/09/LakeviewVillage_DE-VW_FINAL.pdf)
Case Study #2:	• Hammarby Sjöstad is a redevelopment pilot project that began in the 1990s that also served as a development to test new technologies. The City of Stockholm led the initiative to include a system of underground vacuum suction chutes to service the development's solid waste needs. Vacuum collection was selected to reduce the on-site presence of waste collection vehicles by 50 percent. The development is serviced by five Envac systems, three stationery and two mobile systems, that collect general waste, food waste, paper and street litter. The system collects approximately 20 tonnes of waste each day from approximately 670 waste inlets and seven litter bins. • A consortium model is used to fund the collection system. Developers formed a company which owns the system, including the pipes, terminal and equipment within the building and provided the upfront capital investment. Each developer has shares in the system depending on their unit holdings. A lower waste collection tariff is charged by the City of Stockholm to all neighbourhoods serviced by the vacuum collection system.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

5B4 – Cart Collection for Curbside Garbage

Category:	Facility/Infrastructure
System Overview:	• Cart collection is the collection of residential garbage, typically in wheeled carts for curbside collection, and can be done through semi-automated or fully automated collection. Carts are either a standard size for all households or there may be an option for varying sizes, depending on the program approach. • Cart based collection systems may be used in combination with pay-as-you-throw (PAYT) to recover costs based on volume of waste collected and to encourage waste diversion. • Important factors when considering the transition to cart-based program are typically related to health and safety considerations, modernization of collection infrastructure (allowing for automated collection, use of RFID/real-time per household data collection, etc.), citizen satisfaction (e.g., ease of use, storage), protection from animals/birds and associated litter. • For the purposes of this option, this would require the City to switch to cart-based curbside collection of garbage using carts. Currently, curbside garbage is collected bi-weekly using customer owned garbage cans or garbage bags and the garbage limit is six items, which are manually collected. • This option is tied to options 2C5 - Pay as You Throw (PAYT) and 5D1 - RFID Technology on Waste Collection Containers.
Status:	• Proven • Many Canadian municipalities (including municipalities in Ontario and those with similar climates to Ottawa) use cart-based systems for the collection of garbage. • The City of Ottawa uses cart-based collection for the Green Bin.
Source of Option:	• Consultant, Staff, Consultations
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste generated by residents and the City as a corporation. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 10. Make sustainable waste management design an essential part of the City's planning process. Guiding Principles: • Protect the environment. • Embrace innovation.

Category:	Facility/Infrastructure
Needs Assessment Alignment:	• Aligns with the need to identify more ways to efficiently collect materials, that are more convenient and accessible to residents and customers.
Individual Producer Responsibility (IPR) Impact:	• No impact. Option applies only to garbage collection. • Depending on whether Producers choose to transition to a larger cart-based system for recycling, compared to the existing bin based system, this could impact overall storage considerations for curbside households. If carts are used for recycling and collection is single-stream, there may be increased contamination due to a misunderstanding of the recycling program, residents using the cart for more than recycling (due to size), etc.
System Consideration:	• Core system component – major change to how materials are collected.
Sector Applicability:	• This option would apply to all sectors receiving curbside collection from the City including Single Family (SF), Multi-residential (MR), City Facilities/Operations (CF), Partner Programs (PP) (e.g. Yellow Bag program).
Environmental Considerations:	• May support increased diversion of recyclable material and organics from the garbage stream. • Anticipated no change in greenhouse gas (GHG) emissions related to collection. Garbage collection routes may be more efficient resulting in fewer collection vehicles resulting in lower GHG emissions, which would be offset by additional trucks required for separate collection of bulky garbage, which cannot be collected in carts. • May be some reduction in overall GHG emissions if more recyclables and organics are diverted from landfill. • Reduced litter is often attributed to cart-based programs (more challenging for animals to get into and reduction in wind-blown material). • The equivalent volume of the garbage cart used could also be applied to the multi-residential garbage allocation for each building to ensure a consistent approach to encouraging waste diversion.

Category:	Facility/Infrastructure
Social Considerations:	• Residents would have to change their behaviour to use garbage carts. Residents in other jurisdictions have commented that the storage of these carts can be challenging, particularly in higher density housing and for some, especially those living in rural communities and have larger properties, the wheeled carts can pose a challenge to move up and down steep/long driveways. Winter conditions can also pose challenge to move carts and place carts safely at the curb (i.e. due to snowbanks). • May pose set-out challenges for residents with mobility or health concerns that cannot move a large garbage cart to the curb for collection. • Fully automated cart collection has very specific spacing set-out requirements. Residents will need to ensure there is enough space on either side of the cart for a mechanical arm to grab the bin, and adequate overhead clearance to lift the cart and empty it into the truck. • Carts look tidier than bags or individual household containers and can also contribute to a reduction in litter. • Carts can improve resident storage of waste as they can hold several bags of garbage in one container, however, indoor storage constraints may be an issue depending on the type of housing unit. • Secure cart lids may reduce issues and concerns with pests and rodents. • Some residents may see this as an increase in level of service in that they would receive a ‘free’ container. • Reduced injuries to collection staff through reduced repetitive strain injuries and minimizing exposure to sharps.

Category:	Facility/Infrastructure
Technical/Operational Considerations:	• The City will have to confirm the approach to be used for carts i.e. whether all households will receive the same size cart or whether it will be tied to a PAYT approach that offers residents the choice of different sized carts. • Municipalities that have implemented cart-based collection systems have often introduced pilot collection programs to test user experience (e.g. cart size, ease of use, storage, placement at the curb, P&E) prior to finalizing the details of a full municipal roll-out. • A move to cart-based garbage collection would require the future collection approach for bulky items to be determined, as they cannot be collected in carts. • Procurement and delivery of garbage carts to approximately 294,000 households. The City will need to determine if this will be done in-house or will be contracted out. • If done in-house, extensive effort by the City to acquire and distribute carts. • Would need to determine of cart maintenance would be done in-house or managed by a third party (i.e. cart replacements and repairs). • The City will need to ensure an adequate supply of replacement carts. These would need to be stored in a secure location. • If multiple cart-sizes are offered, a system will need to be established for residents to indicate their preferred cart-size. Oversight of this will be required, as residents who did not select a cart size would be provided with the “default” size which the resident may not want or require. After a few weeks of participation, residents may realize they want a smaller or larger cart and will require a swap of containers. Co-ordination of this would also need to be done by the City or contracted out to a third party. • Operational considerations may also include the need for a “cart coordinator” who would oversee maintenance issues, repairs, and warranty concerns for the carts. • Will need to determine if semi or fully automated collection will be implemented. • Fully or semi-automated collection vehicles will be required to collect carts, which will require coordination with new contracts or vehicle replacement. • Fully automated cart collection can be challenging in dense inner-urban communities with on-street parking. Some jurisdictions use a mix of semi-automated and fully-automated collection to address these challenges depending on the unique nature of each community. • Could integrate RFID technology on carts for data collection.

Category:	Facility/Infrastructure
Regulatory Considerations:	• No approvals required. • The City would need to amend the Solid Waste By-law to include new provisions for acceptable containers. • May require amendments to the Property Standards By-law.
Financial Considerations:	• Capital costs are expected to be high (>$15 million) for cart purchase and distribution and would include a significant P&E campaign ($2.50 -$5.00 per household) when the program is initiated. Ongoing capital would be required to replace carts when they reach the end of their life cycle (10-15 years). Capital cost increases would be up to 1% higher than current costs. Costs of carts are dependent upon several factors, including the manufacturer, distribution and features required (i.e., animal resistance, locking mechanisms, etc.) and can be in the order of $50-$60 each for a large cart and $30-$40 each for a smaller cart. Capital costs are based on collecting garbage from the approximately 294,000 curbside collection customers. • Operating costs are expected to be medium ($500k - $1 million) and would include ongoing P&E to maintain the program and the upkeep of the carts post-distribution. • Fully automated cart collection only requires one collection operator, reducing contractor staffing requirements for waste collection, which could reduce collection labour costs and therefore collection contract costs. • Fully or semi-automated cart collection systems result in lower costs associated with workplace injuries and Workplace Safety and Insurance Board (WSIB) claims compared to manual collection. • Vehicle maintenance costs may be higher compared to the current rear packer vehicle used due to more complicated vehicle systems on fully automated collection vehicles. • Higher capital costs from increased complexity of vehicles.
Unknowns/Assumptions:	• It is unknown what size of carts will be implemented. • It is unknown if the City would permit additional garbage bags to be placed outside of the cart for collection if residents have excess garbage beyond the cart capacity. • It is unknown if this program would be implemented as part of a PAYT program. • It is unknown what the impact of other options, such as mandatory diversion by-laws, would be on the remaining quantities of garbage requiring collection and the sizes of carts required. • It is unknown how bulky items would be collected. • It is unknown whether semi or fully automated collection would be implemented.

Category:	Facility/Infrastructure
Supporting System Requirements for Success:	• Requires enforcement at the curb by collection staff (i.e. will not collect anything outside the cart itself depending on the policy implemented). • Would need to determine how residents can deal with excess garbage that does not fir into the cart. • Would require a change to by-law. • Would need to purchase and deliver carts, maintain and replace carts. Would require a storage location for spare carts. • May require the establishment of an assisted waste collection service to support residents that cannot move a large garbage cart to the curb for collection. • A fully-automated cart collection program will require an evaluation of bulky item collection given the technology does not currently exist to facilitate automated bulky collection. • Implementation would need to be coordinated with waste collection contract renewals to switch from manual to fully or semi-automated collection, as new or retrofitted collection vehicles would be required. • To achieve increases in diversion, would need to be implemented in coordination with a policy measure(s), such as PAYT, to encourage diversion. • Would require a targeted and on-going P&E campaign.
Potential Outcomes:	• Could increase organics and recycling processing requirements and reduce disposal requirements by diverting more material from disposal, if paired with a collection policy. • Could provide the City with more robust data on household waste generation through the integration of RFID technology on household garbage carts. • Could contribute to extending the life of the Trail Waste Facility landfill (1-2 years). • Could support the introduction of other waste diversion initiatives, e.g. PAYT. • Reduced WSIB claims if fully automated collection is implemented. • Potential to reduce collection costs if fully automated collection is implemented as only one operator is required per truck. • May align with separate bulky waste collection (option 4C1 - Separate Bulky Waste Collection and Recycling).

Category:	Facility/Infrastructure
Measurement:	• May be measured by a reduction in tonnes of garbage disposed if that is the only measure applied. If other policies/options implemented, it is difficult to attribute a reduction in tonnes disposed to cart-based garbage collection alone. • Can also review diversion rate change if there are no other changes in programming. • Market research to assess resident satisfaction. • Reduction in waste collection WSIB claims. • Weight set-out per household and frequency of collection of carts are two metrics that could be reported on if RFID technology is implemented.
Case Study #1:	• The City of Gatineau has a partial PAYT program and uses 120 litre grey carts for bi-weekly garbage collection. A maximum of five surplus bags are permitted to be setout next to the cart on collection day. These bags must be purchased from the City of Gatineau. • The City worked on the implementation of the policy from 2015 to 2018. With implementation, approximately 60% of households were satisfied with the cart size. Limiting the cart size, along with introducing a partial PAYT system with the option to purchase surplus bags is a financial incentive for residents to manage their waste within the 120 litre cart. • Collectors enforce the policy at the curb (including the five-bag limit and type of bag which must be City stamped). The City educates collectors on a continuous basis due to high turnover of staff. If curbside garbage does not meet bag and/or limit requirements, then it is left at the curb. • The biggest concern from residents was what to do with their old garbage cans and containers once the new carts were delivered. The City accepted the containers for free at their two Eco Centres for proper disposal / recycling. Residents are also allowed to use them for surplus recycling or LYW materials. • There has been a noted reduction in inbound landfill tonnage as a result of this program. The City notes an approximate decrease of 10-15% in waste tonnages collected for single-family homes as a result of the cart and PAYT programs.[91]

[91] Communication with the City for another Ottawa project.

Category:	Facility/Infrastructure
Case Study #2:	• The City of Guelph uses fully automated trucks to collect garbage, organics and recycling in a cart-based program serving approximately 50,000 households. The overall drive for the cart-based program was converting the organics program from a bag to a cart program and in 2010 Council approved the recommendation to convert at a minimum, organics to a cart program. Through analysis, the City determined that it was more cost effective to convert all three streams to carts versus converting only one stream. The City transitioned the change over three years and once implemented, reduced the collection fleet by four trucks, resulting in operational savings of over $460,000.[92] • In 2011, the diversion rate was 47%. Following the first phase of cart roll-out the diversion rate was 65% (2012) and 69% in 2013. However, there were a number of accompanying program changes implemented around the same time, which included opening a new organics processing facility, switching all streams to cart-based collection and changing the recycling collection schedule. It is difficult to attribute the increased diversion rate solely to cart-based collection. The City did not note any concerns with collection in the winter months, in fact, it was stated that it can be easier as staff do not need to exit the vehicle and garbage bags, in the past, have frozen to the ground creating litter[93].
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[92] Guelph receives award of excellence for waste collection system - City of Guelph

[93] City of Guelph Solid Waste Staff, Personal Communication, December 8, 2020

5B5 – Clear Bags for Curbside Garbage

Category:	Program
System Overview:	• The City currently accepts curbside garbage in bags (typically black in colour and opaque) and cans/containers. • This collection option requires residents to place garbage in clear/transparent bags at the curb for collection. Typically, one or more smaller opaque bags are allowed to be placed in the clear bags for privacy or a separate black garbage bag is permitted in addition to the clear bags. Either a zero tolerance (material ban) or maximum acceptable limit for divertible materials in the clear bag typically applies. • A bag limit policy may or may not apply. • This option is designed to encourage waste diversion and the disposal of banned items at the curb. • City may allow clear bags to be placed in rigid containers.
Status:	• Proven • A number of municipalities in Canada are using this system, including the City of Markham, Halifax Regional Municipality, and County of Dufferin.
Source of Option:	• Consultant, Consultations, City Councillors, City Staff.
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Facility landfill. • 4. Maximize the recycling of waste. Guiding Principles: • Honour the 5Rs hierarchy.
Individual Producer Responsibility (IPR) Impact:	• Partial impact.
System Consideration:	• Core system component.
Sector Applicability:	• This option would apply primarily to the Single Family (SF) sector but could be applied to City facilities and Partner Programs, such as the Yellow Bag program. • Would be more difficult to apply to the Multi-residential (MR) sector, given the anonymity of individual MR units in disposing of their waste and how waste is collected from this sector.

Category:	Program
Environmental Considerations:	• Potential to see an increase in diversion of recyclables and organics if the option was fully enforced (i.e., collection staff do not collect clear bags containing more than the allowable amount of divertible materials) and sufficient P&E approaches were implemented. • Requiring the use of single-use clear bags may be perceived as contrary to the trend towards reducing/eliminating single-use plastics and items as opposed to the use of a rigid, permanent/reusable container. • Option is not anticipated to change greenhouse gas (GHG) emissions related to collection. • May be some reduction in overall GHG emissions from landfill if more recyclables and organics are diverted from landfill disposal. • May lead to more litter as bags are easier to get into by vermin.
Social Considerations:	• Requires residents/customers to purchase and use clear bags. • Requires retailers to provide adequate stock. • Less equitable option, as some residents not currently using garbage bags may not be able to afford to purchase clear bags. • Enforcement of this option (e.g., collectors leaving bags with excessive divertible materials at the curb) will likely lead to initial public resistance and an initial increase in customer service calls/complaints. • Some residents may oppose this change due to privacy concerns, particularly those with medical issues, however this has been alleviated in other jurisdictions with the allowance of opaque ‘privacy bags’. • Potential need to clean up mess when pets, raccoons or other wildlife rip bags open when they are set out on collection day. • May increase worker safety by enabling the collector to see the contents of the bag and avoid hazardous items (e.g. sharps).

Category:	Program
Technical/Operational Considerations:	• A significant P&E campaign will be required regarding the change in collection bag type. • Depending on enforcement approach, will require more oversight by collection staff to inspect bags and tag and leave behind non-compliant bags, which is likely to increase collection times. Additional support may also be required from the City's Waste Inspectors. • May require additional customer service staff to manage an increase in resident inquiries leading up to the policy implementation, and in the first few months post-implementation. • City would need to work with retailers to ensure sufficient inventory of acceptable bags are available for residents. • Would need educational materials and stickers to be developed for non-complying garbage bag setouts. • City may consider selling clear bags to residents at City Facilities. • City facilities that receive curbside garbage collection would also need to adhere to the policy requiring the City to purchase clear bags as well. • City would need to change the type of garbage bag currently sold to participants of the Yellow Bag program. • Manual collection of bags would still be required. • Would need to accommodate the special considerations program, as the current program allows residents to use an opaque garbage bag for privacy. • Waste collection staff would need to be educated as to the amount of divertible materials allowed in each garbage bag. • May position the City of Ottawa to support the diversion of designated materials from the curbside garbage stream to the appropriate producer-managed waste collection programs.
Regulatory Considerations:	• This option would require an amendment to the Solid Waste By-law.
Financial Considerations:	• No capital costs anticipated as residents would be responsible for purchasing their own bags. • Annual operating costs would be medium/low (e.g. $100-$500K), primarily related to a targeted P&E campaign and enforcement. • The City would need to purchase purchase bags for City facilities. • May increase the quantities of recyclables and organics diverted from disposal, depending on the acceptable threshold for divertible materials. This increase would increase processing costs.

Category:	Program
Unknowns/Assumptions:	• Diversion potential of recyclables from garbage is unknown due to IPR. • It is unknown if the City would implement a bag limit with a clear bag garbage program. If no bag limit were imposed for households complying with program requirements, it may contradict the SWMP's guiding principles of zero waste, waste avoidance and reduction. • Consistency in determining non-compliance could be challenging if a certain level of contamination (e.g., 5-15% divertible materials) is permitted in clear bags to apply in the field for collection staff and/or Waste Inspectors. • It is unknown whether the number of plastic bags going to disposal would increase, depending on whether or not residents use black garbage bags currently, or whether waste placed in rigid containers is loose or bagged. • The number of garbage bags used in City facilities and therefore any cost impact related to changing to clear garbage bags is unknown.
Supporting System Requirements for Success:	• Requires education of residents and enforcement at the curb by collection staff and/or Waste Inspectors. • Would need to determine if a zero tolerance or a maximum allowable percentage of the contents of the clear bag for divertible/banned materials would be in effect. • Would need to determine if a bag limit would be applied in conjunction with the clear bag option. • Would require a change to the City's Solid Waste By-law. • Retailers would need to stock clear bags. • Requires residents to purchase and use clear bags.
Potential Outcomes:	• Could increase capture of organics (3-10%) and recyclables (5-16%) and reduce quantity of waste disposed (3-10%)[94]. • Would contribute to extending the life of the Trail Waste Facility landfill (0-3 years)[95].
Measurement:	• Option would be measured through waste quantities collected by stream, waste diversion rate, per capita waste disposal rates. • Could track the number of clear bags sold.

[94] These percentages are pending confirmation.

[95] This estimate is pending confirmation.

Category:	Program
Case Study #1:	• Halifax Regional Municipality, NS allows 5 clear bags and one dark bag for privacy for single-family homes which are collected every other week. Multi-family buildings up to 6 units have a limit of 3 clear bags and 1 dark bag per unit.[96] When the program was implemented in 2015, a 25% reduction in garbage generated by the residential sector was observed and has been maintained. [97] • Halifax is currently considering a move to a cart-based program, to replace their bag-based program for recycling and garbage, in part due to the contradictory policy of banning plastic shopping bags but requiring clear garbage bags. It is unknown at this time if/when this change may happen.
Case Study #2:	• The City of Markham implemented their clear bag program in 2013. Since implementation, garbage collected every other week must be put in a clear bag. No black, dark, tinted, coloured, or white bags are accepted. Up to four small privacy/shopping bags are permitted for each collection, which must be placed together inside either a clear garbage bag or garbage can (up-to four items). The clear bag policy enforced by Markham imposes no bag limit. At the time of implementation, a total number of 85,000 households participated and a curbside diversion rate of 72% was recorded. Markham achieved a 20% decrease in garbage tonnages in less than a year post-implementation, with results realized almost immediately. [98.] Broken bulky items are picked up on regular clear bag garbage day. There is no special collection appointment or bag tag required for these items. Donation for reuse is encouraged for items in good condition.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[96] https://www.halifax.ca/home-property/garbage-recycling-green-cart/garbage-collection

[97] https://www.halifax.ca/sites/default/files/documents/city-hall/regional-council/200623rc61.pdf?fbclid=IwAR3dRf0hAdPxquuBs2PCsuScl0rV7na9Z9p4E7RpPxRhV-_aI3qyj1ixo9s

[98] https://www.halifax.ca/sites/default/files/documents/city-hall/regional-council/200526rci03.pdf

5B6 – Single Stream Collection of Recycling

Category:	Program/Infrastructure
System Overview:	• This option would see the City switch to single stream (SS) recycling for the remaining customers it services after the Blue Box recycling program is transitioned under Individual Producer Responsibility (IPR). Customers would be able to place recyclable materials into one bin/carts without separating them into fibres or containers (i.e. Blue or Black Bin materials).
Status:	Proven • Many municipalities in Ontario and across Canada use single stream recycling (e.g. City of Toronto, Peel Region, Simcoe County, York Region, City of Winnipeg, City of Gatineau).
Source of Option:	• Consultations, Staff
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 8. Maximize participation by enhancing the accessibility, convenience, consistency and affordability of waste management programs and services. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Utilize the triple bottom line.
Needs Assessment Alignment:	• Addresses the need to identify more efficient ways to efficiently collect materials, that are more convenient and accessible to residents and customers.
Individual Producer Responsibility (IPR) Impact:	• Yes, impacted by IPR. • PROs will be responsible for collection of recycling from single family residences, and potentially some other sectors, including the multi-residential sector. The City's approach to collecting recycling for all other sectors will need to align if it chooses to participate in the IPR system.
System Consideration:	• Core system component – major way materials are collected.
Sector Applicability:	• Likely applicable to Multi-residential (MR), City Facilities (CF), the Yellow Bag program and Parks and Public Space (PPS), however this will only be known once the final Blue Box regulations are issued by the province.

Category:	Program/Infrastructure
Environmental Considerations:	• May increase diversion if system is simpler to use due to fewer sorting requirements. Unlikely to result in changes in greenhouse gas (GHG) emissions from the current baseline system. • May reduce the recyclability of some materials collected due to cross contamination, for example, paper with glass fragments. • May reduce collection requirements compared to separate collection of blue and black box recyclables.
Social Considerations:	• Is a simpler system to use with less effort by residents/customers as less sorting of recyclables is required. • If PROs do not implement SS recycling (i.e. continue with the current dual stream recycling system) it will be confusing for the remaining customers the City services if the City switches to SS recycling.
Technical/Operational Considerations:	• Main considerations are alignment with PRO's system of collection of Blue Box recyclables and the availability of local processing capacity for single stream recyclables. • A cost benefit analysis should be undertaken to determine if the benefit of user convenience and potential reduced collection costs outweigh the increased contamination levels and processing costs associated with single stream recycling programs. • City would need to decide if SS recycling would be collected using existing containers or whether a different type of container would be supplied (e.g. carts), which may be aligned with semi or fully automated collection of other materials to those customers not already supplied with carts. • Would need to consider what materials will be collected through the PRO program. • May result in some collection efficiencies, with collection of a single stream instead of dual stream. • If larger boxes or carts were provided, it opens up the possibility of reducing the frequency of collection.
Regulatory Considerations:	• No regulatory considerations.
Financial Considerations:	• Capital costs anticipated to be low (<$10 million) if City elects to use the same bins and utilizes existing vehicles. • Operational costs expected to be similar to current system, however there may be some cost savings associated with collection as SS collection is a more efficient approach compared to dual stream collection. This savings may be offset by higher processing costs. • Potential for some operational cost savings with collection efficiencies if recycling can be co-collected with other materials. • Revenue may be lower due to commingling of materials, which results in lower quality materials.

Category:	Program/Infrastructure
Unknowns/ Assumptions:	• Local processing capacity, processing fees and revenue for single stream materials is unknown. • Potential impact of lower quality materials being processed (commingled materials may be contaminated with food/liquids and glass, resulting in lower value, less marketability). • Assume the City would collect the same materials as the PROs are collecting. • It is unknown whether recycling will be collected as single or dual stream with IPR. • It is unknown whether a MRF will be developed that can process single stream recycling if that is how PRO's decide to collect that material or if locally available single stream capacity is available. • Assume the same frequency of collection for recycling i.e. once per week.
Supporting System Requirements for Success:	• Existing containers could continue to be used for recycling. Larger boxes or carts could be provided to provide more capacity. Carts would facilitate automated or semi-automated collection. Refer to option 5B4 - Cart Collection for Curbside Garbage. • A P&E campaign will be required to educate customers on new program requirements. • A facility capable of processing single stream recycling would be required. Dual stream facilities like the City currently uses cannot process a mixed material stream. • If the producers decide to use single stream recycling for single family homes, the City's recycling program servicing the remaining sectors should be in alignment with this system in terms of single or dual stream and the types of materials collected to avoid confusion and increased contamination resulting from improper sorting at the source.
Potential Outcomes:	• Potential for increased waste diversion. • Anticipated to result in little change to the life of the Trail Waste Facility landfill. • Potential for increased contamination, leading to decreased quality of saleable materials and increased processing costs compared to dual stream recycling.99 • It may be harder to market materials collected through a single-stream recycling program due to commingling of materials e.g. liquids contaminating fibres and revenues from the same load of recyclables may be lower than those collected through a dual stream recycling program.
Measurement:	• Success of the program can be measured with waste audits, tonnes collected, tonnes marketed, revenue generated and contamination rates.

[99] https://www.container-recycling.org/index.php/issues/single-stream-recycling

Category:	Program/Infrastructure
Case Study #1:	• Most large municipalities in Ontario utilize single stream recycling (e.g. York Region, City of Toronto, Peel Region, City of Guelph, Halton Region). • Additionally, large municipalities like City of Winnipeg, City of Edmonton, City of Calgary, City of Montreal, City of Gatineau, City of Saskatoon also use single stream recycling. • In general, municipalities who use a cart-based system utilize single stream recycling. • Evidence of results vary from municipality to municipality who have implemented single stream recycling for different reasons. Some municipalities have reverted from single stream recycling back to dual stream to increase the marketability of their recyclables. (e.g. Northumberland, Drummond North-Elmsley)
Recommendation:	• Hold for consideration until final Blue Bin regulations are released by the province and the City has clear direction on which programs it will continue to manage versus which programs producers will become 100% responsible for managing. • There will likely be more information available at this time to determine whether producers will implement a dual or single recycling system and how the City should align its recycling program for its remaining customers.

5C1 – Waste Diversion Program in Parks and Other Public Spaces

Category:	Program/Infrastructure
System Overview:	• The City provides garbage collection services in its parks and public spaces including light rail, O-Train and Transitway routes, Business Improvement Areas (BIAs) and sports fields. However, most parks (including dog parks) do not have access to recycling and green bin waste diversion programs and placement of waste diversion bins in other public spaces across the City is sporadic and inconsistent. • The City is currently running a multi-year pilot program to determine the efficiency and effectiveness of rolling out a City-wide parks waste diversion program, including co-locating green bins with recycling and garbage receptacles in select parks across the City. • This option considers implementing a broad-scale, comprehensive waste diversion program, with recycling and/or organics bins in parks and public spaces, across the City. The option would include consistent signage on bins, with the results of the pilot being used to inform any future parks waste diversion program. • This option is tied to 5B1 - In-Ground Collection Containers.
Status:	• Proven • Diversion programs in City parks and other public places are widely implemented in Canada.
Source of Option:	• Staff, Consultations, City Councillors
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 10. Make sustainable waste management design an essential part of the city's planning process. Guiding Principles: • Honour the 5Rs hierarchy. • Lead by example.
Needs Assessment Alignment:	• This option is tied to the need to decide if a comprehensive and consistent public spaces waste diversion program, including recycling and organics diversion, should be implemented.
Individual Producer Responsibility (IPR) Impact:	• Yes - may depend on how Producer Responsibility Organizations decide to collect recycling and if they are collecting from parks and other public spaces.

Category:	Program/Infrastructure
System Consideration:	• Removal of waste from parks and public spaces is a Core System Component.
Sector Applicability:	• This option applies to Parks and Public Spaces (PPS).
Environmental Considerations:	• This option is anticipated to increase the City's diversion rate however, the impact is anticipated to be minimal based on current waste audit data from the parks pilot. • Provision of green bins in PPS can divert organic materials from the garbage stream, thus having the potential to decrease greenhouse gas (GHG) emissions from disposal. • May increase GHG emissions if additional vehicles are required to collect the material and transport it to the processing facility. • May reduce litter from overflowing garbage containers in parks by providing additional capacity with an increased number of bins.
Social Considerations:	• This option allows the general public (residents and visitors) the opportunity to participate in waste diversion programs outside of their homes and improve waste diversion. • A standardized application of waste diversion programs across all sectors promotes waste diversion through consistent messaging and may improve participation in other diversion programs, such as those implemented at home or in City Facilities. • An expanded PPS diversion program across the City can provide all users access to the same diversion programs. • Requires a greater level of effort for users of parks and public spaces to sort materials into the proper container. • Can increase accessibility to diversion programs and depending on the container, can be easier for visitors to use.

Category:	Program/Infrastructure
Technical/ Operational Considerations:	• Review results and outcomes of multi-year parks waste diversion pilot program to determine if a program should be implemented in parks. • Receptacles for additional waste streams may not be warranted or required at every existing garbage receptacle. However, consideration should be given to the stream(s) and placement that will best serve each location. • An inventory of existing receptacles is required to identify which can be repurposed or need replacing. • City would need to undertake a survey of usage of parks and public spaces to identify locations for containers for multiple streams. • City will need to identify how best to locate containers to be in areas of high use by patrons, while ensuring that they are accessible for emptying. • New waste diversion bins, labels and signage will need to be purchased. Emphasis should be placed on consistency of these across all parks and public spaces. Consideration should also be given to in-ground containers, especially in high usage parks. • New or revised collection beats may have to be established, and contracts may need to be revised to accommodate collection of new waste streams. Collection frequencies will also need to be reviewed in light of the addition of new material streams. • Consideration should be given to a P&E program specific to waste diversion in parks and public spaces. • Data from this sector has historically been unreliable and fragmented. Effort will be required to track receptacle locations, collection frequencies and waste quantity and diversion data in order to plan for the implementation of a waste diversion program specific to parks. • It is likely diverted waste collected from PPS will have higher levels of contamination based on existing waste audit data. Depending on receiving processing facilities tolerance for contamination, loads from PPS may be rejected and require landfill disposal. • Consideration needs to be given to the impact that IPR transition may have on recycling programs in both parks and other public space when designing any future waste diversion program, given that there are already many public space waste receptacles installed across the City that provide for recycling of blue and black box materials. • Co-ordination may be required with other City departments, for example, OC Transpo, to ensure consistency of existing waste diversion programs that are in place. • Extensive work is required to develop a data management system for this sector to accurately track collected tonnages and measure program performance.

Category:	Program/Infrastructure
Regulatory Considerations:	Parks and Facilities By-law No. 2004-276 and Use and Care of Roads By-law No. 2003-498 by-law establishes waste regulations for City parks and roads, respectively.
Financial Considerations:	• Significant capital and operating costs would be associated with the provision of receptacles and collection of waste from all of Ottawa's parks and public spaces. While costs to provide existing services are currently incurred, it is anticipated that if a comprehensive and consistent waste diversion program is implemented in City parks and public spaces, there will be incremental costs associated and these may be significant, depending on the design of a future program. • Overall costs will vary depending on the number of new waste receptacles required, if collection will be contracted or completed in-house and the total number of receptacles to be serviced. Capital and operating costs are difficult to estimate at this point in time as details of any future program are unknown. Some cost considerations include:
Financial Considerations:	**Capital Costs:** • Capital costs are related to the procurement and installation of additional waste containers and associated signage. Costs of containers are dependent on the type, size and features of the container. For example, a study carried out for the City's Integrated Street Furniture Program recommended a three stream receptacle that costs $1,581 per unit and the parks pilot bins cost approximately $600 for three large bins, including signage. Other capital costs include utility locates and concrete pads for the bins. • If collection is performed in-house, the City may need to purchase new equipment, such as new vehicles that can efficiently collect materials from these bins or attachments for existing equipment to facilitate emptying of bins. • If half of the current garbage receptacles are replaced with three stream diversion receptacles, capital costs will be in the medium/high range ($3 - $5 million).

Category:	Program/Infrastructure
Financial Considerations:	**Operating Costs:** • Additional costs will be incurred for servicing additional waste receptacles – maintenance, repair, cleaning, disinfection, etc. • Additional costs will be incurred from collecting and processing the materials from the diversion streams, however will be mitigated somewhat by lower landfill disposal costs. • To promote the new programs, additional costs associated with a P&E campaign will be incurred. • Potential to offset program costs through the sale of of recyclable materials, such as aluminum and PET. • Implementation of this option would require a high degree of effort by City staff, followed by a high level of involvement by City staff on operation and maintenance of the program. • Staff will be required to manage the PPS diversion program. If collection is contracted out, a staff member will be required to manage the contract. • Waste audits should be conducted periodically to assess the performance of the program and to inform P&E campaigns.
Unknowns/ Assumptions:	• The final Blue Box regulation has not yet been released by the province. The draft Blue Box regulation indicates that “some public spaces” would be covered through IPR. The uncertainty surrounding the extent of the coverage, in the context of the City, makes it challenging to plan for future PPS diversion programs. As such, the overall capital and operating cost, as well as program design and delivery are unknown at this time. • In the absence of site-specific data, it is unknown how many PPS locations may require additional receptacles to accommodate recycling and green bin programs.
Supporting System Requirements for Success:	• Waste audits may be required to identify the type of waste generated in different PPS. • P&E will be required in terms of promotion and consistent receptacle signage to reduce contamination levels as deemed by receiving processing facilities. • An understanding of how IPR for recycling impacts parks and other public space recycling programs.
Potential Outcomes:	• In 2019, the City collected 1,708 tonnes of garbage and 9.6 tonnes of recycling from PPS, equating to a diversion rate of less than 1% from this sector. • It is anticipated that implementation of waste diversion programs in PPS will contribute minimally to the City’s overall diversion rate.

Category:	Program/Infrastructure
Measurement:	• Program success can be determined through measurement of diversion rate and tonnages collected for each waste stream. • Contamination levels are also another measure that could be tracked and tied to P&E campaigns.
Case Study #1:	• Metro Vancouver piloted a Pet Waste Diversion Project to collect and reduce pet waste sent to landfill and comply with the by-law that bans excrement, other than small amounts of pet excrement that is double bagged and discarded with municipal solid waste and does not exceed either 5% of the total weight of the load or 5% of the total volume of the load. • Three public spaces pet waste collection methods were piloted from September 2011 to April 2012. Of the three options, the dog waste only (DWO) red receptacles proved the most successful, as pet owners were accustomed to depositing bags in garbage. The pilot was expanded to the majority of regional parks where pet waste is found to be a major component of the waste stream, based on waste audit results. In 2015, Metro Vancouver had 60 standard 120L wheeled Ecotainer red receptables in six parks that cost approximately $95 per receptacle. • Bags of pet waste were collected by the contractor on a weekly basis. Vented shipping containers (approximately $2,500) for centralized collection were being purchased for the parks involved. In 2015, Metro Vancouver budgeted approximately $50,000 for the program. • Collection is provided by a contractor who collects the pet waste, cuts the bags open, and delivers the contents to the sewage treatment plant, while sending the leftover bags to the landfill. Centralized collection has lowered the overall program costs, as the contractor previously charged per receptacle being serviced. (Note that costs were proprietary and were not shared). • The DWO pilots showed that there was nearly 0% contamination of non-pet waste in the red receptacles when they were placed directly beside a garbage receptacle. The pilot projected 30 tonnes of diverted pet waste from four parks in 2015.

Category:	Program/Infrastructure
Case Study #2:	• The revised Parks Collection System began in 2010 and was completed in approximately two years. It involved more than 1,600 parks across the City, ranging from small neighborhood parks to large multi-activity locations. The City's program objective was to improve collection efficiencies and reduce rain infiltration, as well as limit animal access, illegal dumping, and worker injury. Existing waste receptacles for both streams (garbage and single stream recycling) were replaced with semi-automated wheeled, 360L carts. Collection switched from manual bag collection to automated lifters, while locked domed-lid carts were introduced to discourage illegal dumping. The semi-automated process that is now in place eliminates the need for a two-person service by allowing for one-person collection and vehicle operation. • The program required no contractual obligations and was carried out by the City's Solid Waste Management Services department. Two dedicated project leads were assigned to direct the transfer of resources, program implementation, and operational monitoring. Operations supervisors were assigned and eventually oversaw operations. Additional funding for the program was acquired through applications to Waste Diversion Ontario's Continuous Improvement Fund. • An ongoing educational campaign includes signage posted at the receptacles listing contact information and acceptable and non-acceptable materials. The wheeled cart costs vary from $70 for a flat lid to $110 for a domed lid. New collection vehicles were selected based on the size of the park and included side loaders with cart lifters but no compaction, and small rear loaders with cart lifters and compaction. It is estimated that the cost per household, based on households paying Solid Waste Utility fees, would be $6 if residents had been charged (2014 operating costs). • The automatic carts resulted in a yearly savings of $250,000, solely by eliminating the need for plastic bag liners required in the old wire basket garbage receptacles. GPS coordinates for receptacles are mapped on paths connecting parks that are close to one another. In some locations, the collection cycle time was reduced from three days to 3.5 hours through a reduction in the number of collection receptacles and the use of a GIS system optimizing collection paths. Diversion rates increased from 14% in 2008 (when the City of Toronto initially began recycling in public parks in 2008) to 22% in 2013. Over the same time frame, recycling contamination rates decreased from 46% to 39%.

Category:	Program/Infrastructure
Case Study #3:	• As part of its Public Spaces Waste Management Strategy, the Township of Langley (Township) conducted a six-month Neighbourhood Pilot Program in May 2017. The pilot included both roadside and parks receptacles. In total, 44 waste receptacles were piloted: 24 three-stream (garbage, recyclables and dog waste) receptacles along roadways, 18 three-stream receptacles in parks and 2 four-stream (garbage, recyclables, organics and dog waste) receptacles in parks. The results of the audit determined that: • For three-stream collection, 48% to 59% of materials were correctly diverted. However, 9% to 14% of divertible materials were incorrectly disposed of (mostly recycling in the garbage), • For four-stream collection, 38% to 55% of materials were correctly diverted. However, 27% to 37% of divertible materials were incorrectly disposed of. • Improvement in sorting success as the pilot progressed, with the dog waste stream showing the lowest rate of contamination, followed by organics, recycling and garbage. When organics was included, contamination (mostly from food scraps) in the recycling stream was also noted to decrease. • Some challenges encountered during the pilot included vandalism, side-effects of binning (people removing refundable bottles and cans but unlocking and leaving receptacle doors open or pulling out bags), overflowing receptacles in high use areas, and waste falling between the stream inserts inside the receptacles. • Given the success of the pilot, the program was expanded to additional parks in 2018 and 2019.[100]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[100] For all case studies - Dillon Consulting Limited. February 2016. Township of Langley: Public Space Waste Management Strategy.
Dillon Consulting Limited. June 2017. Township of Langley, Public Spaces Waste Management Neighbourhood Pilot Program: Waste Composition Study.

5C2 – Use of Alternate Collection Containers in Parks, Public Spaces and Multi-Residential Properties

Category:	Facility/Infrastructure
System Overview:	• The option reviews the use of alternative waste collection containers in parks and public spaces across the City. This could include containers such as in-ground collection, plastic front-end load containers, multi-stream containers, and waste bins with solar compactors to improve collections efficiency and/or aesthetics and is applicable to City parks, including for dog waste, other public spaces. In-ground collection containers could also be installed at multi-residential properties, however this would be at the discretion of property owners/developers. • An in-ground waste collection container refers to a container where waste is stored securely underground and has an above ground opening to deposit waste material. They provide an alternative to traditional waste collection containers (e.g., roll off bins). In-ground waste collection systems are more aesthetically pleasing than the traditional waste collection containers, and can reduce odors, since the waste is stored underground at cooler temperatures and the above ground portion makes these systems easy and safe to use. Depending on the type of in-ground container, it is serviced by either a standard front- end loading collection vehicle or a more specialized vehicle with a hydraulic crane or boom. • Currently, many different types of waste containers are used in parks and public spaces across the City, with approximately 5,400 garbage receptacles requiring collection, some year-round and others on a seasonal basis, typically from May to November. Some of these containers are owned by the City, with others being owned and serviced by the private sector. Frequency of collection is dependent on such factors as the season and frequency of use. Collections are completed on a daily, biweekly or weekly basis and some are seven days per week.

Category:	Facility/Infrastructure
Status:	• Proven • There are several case studies for parks waste collection using alternate collection containers. The in-ground collection container system is currently used by approximately 79 City of Ottawa parks and a small number of multi-residential properties that are serviced under the City's multi-residential collection contract. These containers are also used throughout the City of Ottawa commercially at a variety of different businesses (e.g. malls, restaurants). • Municipalities have installed in-ground containers in areas where there are space limitations for containers or waste collection is not required on a daily basis (e.g., parks and trails). • Collection frequency in high generating areas with limited space (e.g., downtown cores, multi-residential buildings) often require multiple collections per day/week with a traditional garbage container and collection frequency can be reduced with in-ground containers. Containers can also be placed in-ground for collecting dog waste, particularly in high-density multi-residential areas, like Toronto and City parks.
Source of Option:	• Consultant
Proposed Strategic Alignment:	Goals: • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 9. Maximize cost containment, revenue generation and the efficient use of waste management resources to help minimize costs to taxpayers. • 10. Make sustainable waste management design an essential part of the city's planning process. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Embrace innovation.
Needs Assessment Alignment:	• Aligns with the need to build on the current systems, services and programs, identify more efficient ways to efficiently collect materials, that are more convenient and accessible to residents and customers.
Individual Producer Responsibility (IPR) Impact:	• Partial – may depend on how Producer Responsibility Organizations decide to collect recycling and if they will be responsible for collecting from parks and public spaces.
System Consideration:	• Secondary - will be a program to overlay onto core system.

Category:	Facility/Infrastructure
Sector Applicability:	• This option would apply to the Multi-residential (MR) and Parks and Public Spaces (PPS) sectors.
Environmental Considerations:	• May reduce frequency of collection, leading to reduced greenhouse gas (GHG) emissions from collection vehicles and can optimize collection routing based on when bins typically require collection. • Potential to integrate in-ground storage containers with diversion initiatives e.g., separate collection of dog waste in parks. • Limits vermin from accessing materials and dispersing litter. • Limits overflow of materials from City receptacles in high waste generating public spaces and parks by increasing storage capacity.
Social Considerations:	• In-ground containers can reduce the ground space required for housing traditional bins and increase space for other features, such as available parking and green space. • As in-ground containers are located underground, waste remains cool which reduces odour and vermin issues. The larger storage capacity may limit excess waste surrounding the container and minimize visual pollution from litter compared to smaller sized bins which may overflow. • Potential to reduce collection vehicle traffic and noise from less frequent emptying of containers (both in-ground and solar powered). • Potential to use lower profile containers to minimize safety issues related to obstructed views. Lower profile containers may also increase accessibility for the elderly, children or people with impaired mobility. • In-ground containers are more esthetically pleasing that front end load (FEL) bins. • Convenience level may be lowered if in-ground containers can only be placed in a parking lot and cannot be placed along a park pathway or middle of the park.

Category:	Facility/Infrastructure

Technical/ Operational Considerations:	• Changing waste collection container types in parks would require significant effort to overhaul the existing system of 5,400 garbage containers and to potentially add more waste diversion containers.
	• Considerations for each container type (footprint, underground specifications, container placement and locations, etc.) would need to be planned out prior to the removal of old containers and installation of new containers. The placement of new containers may or may not be the same as existing containers.
	• Some containers require specialized equipment to empty the contents.
	• Inground containers require full size collection vehicles to empty the contents, therefore these containers must be placed in a very accessible area such as a parking lot and cannot be placed in the middle of a park or along a pathway.
	• The City may wish to consider encouraging the use of in-ground collection containers for new multi-residential or intensification projects, as appropriate, to address space and aesthetic issues.
	• Waste Containers with Solar Compactors:
	  ○ Reliable operation of solar charging and compactor operation during the winter (e.g., reduced sunlight, colder weather environments) would need to be confirmed.
	  ○ Would need to undertake a cost benefit analysis to determine if solar compaction leads to collection efficiencies.
	  ○ Maintenance requirements would need to be confirmed.
	• Potential integration with bin sensor technology.

Category:	Facility/Infrastructure
Technical/ Operational Considerations:	• The application of in-ground containers can easily occur on a small-scale initially, such as in a single building or park. However, a larger scale application may also be integrated with existing or new collection programs, such as at City parks and other public spaces where waste is collected by the City. Certain considerations must be given prior to implementation such as: ○ Containers cannot be placed in areas with a high-water table; ○ Container installation may not be possible if there are interferences by underground infrastructure (i.e., water, wastewater and utilities); ○ Containers need to be serviceable by standard front end loading collection vehicles, which are the vehicles that currently used by the City for multi-residential collection; ○ The deep collection system may require a unique collection approach involving the use of a hydraulic crane or boom to lift out the bags of stored materials; and ○ Containers must be in a location that is accessible by a waste collection vehicle and there must be sufficient space above the container so that the bag or sleeve can be lifted up. Some municipalities have indicated success at using a vacuum truck to extract organic waste (e.g., Toronto). ○ Due to accessibility, if the contents of an inground container for divertible material is once contaminated, it cannot be cleaned out and the contents cannot be recycled; it is disposed of as garbage. ○ Maintenance and repairs on in-ground systems are often more expensive than for standard FEL containers. ○ Inground systems are often more challenging to collect. ○ Bulky item collection for multi-residential collection would need to be addressed separately. ○ Maintenance and cleaning services can be provided by the City or contractors; • Mechanical collection of containers may reduce the risk of injury to workers from traditional manual collection techniques. • With respect to development of new buildings, partnerships with the City's Planning department would provide an opportunity to update existing waste management standards for new development applications for inclusion of such containers for properties with space limitations.
Regulatory Considerations:	• May require municipal approval and adherence to the Ontario Building Code and/or Fire Code, depending on the types of containers and where it is installed.

Category:	Facility/Infrastructure
Financial Considerations:	• Costs depend several factors, including the selected container type and brand, who is installing the system and who is operating the system. Capital and operating cost considerations for installation in parks and other public spaces include: **Capital Costs:** • The costs to purchase new containers depends on the container selected and the number required for purchase. • Specialized equipment and or collection vehicles may need to be purchased. Anticipated costs are unknown. • Capital costs of containers are dependent on the type, size and features of the container and can range from $1,000 to $5,000 per container. Specialized equipment and/or vehicles may need to be purchased. Supply and installation of a 3,000L capacity Molok brand container is approximately $8,000 (not including concrete or asphalt work around the bins). • Capital costs are considered in the low range (<$10 million) but would range based on a variety of factors as indicated above. **Operating Costs:** • The operating costs are expected to be medium to high ($1-$3 million) and would include P&E for any new programs, maintenance and cleaning of containers, coordination of container placement and the installation of any new receptacle. These costs would vary based on the collection efficiencies for some of the suggested containers. • Increased costs to service additional recycling/Green Bin containers could be offset by reduced collection costs for public space garbage containers. • Maintenance costs are significantly higher for in-ground containers than standard FEL containers. • The City of Burlington, ON has installed Molok containers in many parks (for garbage and recycling). The estimated cost for site work, supply and installation of two bins is $20,000. City maintenance staff empty the containers which requires a crane truck to lift out the inner liners.[101] • Costs for the installation of alternate waste collection containers at multi-residential properties would be at the sole expense of the property owner/developer.

Category:	Facility/Infrastructure
Unknowns/ Assumptions:	• The draft Blue Box regulation indicates that "some public spaces" would be covered by producers, therefore the City's role in the collection of the recycling stream is unknown at this time. This uncertainty makes it challenging to plan for parks waste collection and diversion programs at this time. • In the absence of site-specific data, it is unknown the number and specific location of all waste containers in parks and public spaces that this option would apply to. • The performance of solar compactors in cold weather climates is unknown.
Supporting System Requirements for Success:	• Review of current collection logistics (vehicles, staffing, collection frequency) and infrastructure (container type, volume and location) to establish a baseline for assessing potential efficiencies. • Container selection should be considered in coordination with any expansion of public space recycling (Option 5C1). • A procurement process would be required to select vendors of containers and collectors of material. • The City would need to review the existing programs at parks to identify high traffic areas which could benefit from placing new in-ground containers.

Potential Outcomes:	• This option is unlikely to increase diversion or result in a reduction in waste generation.
	• Potential benefits will be realized from:
	  ○ A reduction in the number of collection trips needed due to increased storage capacity;
	  ○ Improved aesthetics and odour/vermin control from in-ground storage of waste; and
	  ○ A reduction in space requirements for waste receptacles.

Measurement:	• Qualitative measurement of success may be based on customer service reviews, such as improved ease of use, reduction of litter complaints and improved aesthetics. • Quantitative measures of success may be assessed based on a reduction in the number of collection trips required, reduced fleet fuel/energy and a reduction in the number of complaints related to overflowing waste, odour or vermin for receptacles in parks and public spaces.

[101] Personal communication with City of Burlington staff, January 2021.

Category:	Facility/Infrastructure
Case Study #1:	• To help divert more waste from landfills and provide opportunities to recycle, compost, and dispose of dog waste in public spaces, the Township of Langley developed the Public Spaces Waste Management program. The program installs multi-stream waste receptacles in select Township parks, trails, and other public areas. The new bins selected were all Envyrozone receptacles. These bins were selected because of their size and ergonomic collection option. The bins provide consistency between the municipal curbside collection program and bins found in Township facilities. Dog waste collected from Public Spaces bins is separated from bags before being processed at a wastewater treatment plant operated by the Regional District. At the plant, the waste is treated until clean water, biosolids (used in fertilizer), and methane gas are produced. The methane is captured and used to run the facility. • In 2015, Township Council approved a Litter and Illegal Waste Management Strategy. The strategy has a three pillar approach focused on Education, Enforcement, and Infrastructure. Infrastructure, such as waste receptacles, is critical to the Litter and Illegal Waste Management Strategy due to projected growth in the Township and the increased use of public spaces. • In 2017, the Township conducted a Public Spaces program pilot project using 44 new multi-stream receptacles in the Walnut Grove community. The pilot project was in effect until September 2017, when waste characterization studies, visual audits, and public and staff feedback were compiled in order to evaluate and gauge the effectiveness of, and response to, the pilot program. Following this evaluation, receptacles remained at these locations and a review to expand the pilot was initiated. • At the time of the pilot, there were over 700 garbage receptacles throughout parks and roadways in the Township. Until the pilot project, there were no options for organics diversion or paper and containers recycling, only limited options for refundable beverage container recycling in public spaces. • A report on the pilot project identified the program as overwhelmingly positive and successful: both staff and the public appreciated the design of the bins and the opportunity to dispose of materials correctly, especially pet waste. Sorting accuracy by the public was found to be acceptable, and in the fall of 2017, Council permitted expansion of the program, supporting the vision to rollout the bins across the Township. • Following the pilot where the Township installed 44 multi-stream bins as a pilot, the program was approved to expand. The first expansion phase occurred in mid-2019 and began with 38 more bins installed. Phase 3 continued to see expansion to the remaining neighborhoods. This rollout of new Public Spaces bins brings the Township closer to its diversion commitment of 80% by 2020. [102]

Category:	Facility/Infrastructure
Case Study #2:	• Some condos in Toronto have installed containers to collect dog waste. It is estimated there are 230,000 dogs in Toronto and the average urban condo has seven dogs per floor, each dog producing about 340 grams of dog waste daily. • The underground containers can hold up to 500 kilograms of dog waste, reduce odour and the impact on nearby garbage containers. The material is emptied by a vacuum truck and disposed of at a waste-to-energy facility.
Case Study #3:	• The City of Cambridge, Massachusetts is planning to deploy nine 150-gallon new BigBelly bins for parks and public spaces. These are a hands-free, solar-powered waste receptacle that was used for garbage and diversion programs[103]. The aim is to address specific waste management needs for individual city neighborhoods. • Strategic placement of the bins will support the City's goals of reducing solid waste by 30% by 2020, and 80% by 2050, and its Net Zero Climate action plan. • The City has purchased four WIFI equipped hands-free multi-stream compactors ($12,500 each) and five hands-free multi-stream waste compactors ($6,000 each). The total project budget is $80,000.
Recommendation	• It is recommended that this option proceed to the evaluation stage.

[102] Langley, BC Public Spaces Waste Management pilot program (govlaunch.com) and Dillon Consulting Limited. February 2016. Township of Langley: Public Space Waste Management Strategy. Dillon Consulting Limited. June 2017. Township of Langley, Public Spaces Waste Management Neighbourhood Pilot Program: Waste Composition Study.

[103] City of Cambridge, https://pb.cambridgema.gov/pb4bigbelly

5D1 – RFID Technology on Waste Collection Containers

Category:	Program / Infrastructure
System Overview	• Radio Frequency Identification (RFID) chips are used for tracking service performance and improving waste collection services and determining fees for some types of pay-as-you-throw (PAYT) collection services. • RFID tags come in a variety of types and sizes depending on the required function. Passive RFID tags are powered by the RFID reader which is used to read the information stored on the tag. Active RFID tags are powered by an internal battery and can be used to track real-time location and status. As active RFID tags send a signal, they can be read from further away via Bluetooth. Similarly, WIFI-based tags contain WIFI radios that transfer data via WIFI. • A RFID chip is embedded in a waste collection container or bin, which enables data to be transmitted to the collection vehicle at the time of collection or uploaded through a web-based application. RFID equipped receptables are commonly attached to existing municipality supplied containers or bins. Attaching RFID tags to resident owned receptacles is not implemented by municipalities as bins need to be uniform to ensure they are properly read by the system. • RFID bins are typically used in conjunction with vehicle systems such as GPS and/or weigh scales. Depending on the type of RFID tag and vehicle system used, data can be used for waste container management for live tracking the collection of waste, providing data and statistics on waste generation rates, weight or volume of waste collected, waste densities and/or diversion and sensing when containers are near capacity or highly odorous and issuing an alert to the collection operator. • GPS data on the collection vehicle's location and movements can also be used for optimizing waste collection operations in terms of routing, live tracking of waste vehicles, identifying potential issues/incidents through taking pictures and tracking locations and driver information. This can be achieved using the RFID tags associated with a specific customer address that can be recorded by the RFID reader at collection. Alternatively, collection vehicles can be outfitted with a GPS tracking device that is integrated with the RFID system. This service requires collection vehicles outfitted with at least semi-automated collection technology, GPS and wireless communication modules on both the vehicle and customer bins. • RFID cards/tags can also be issued to individuals and used for weight or volume-based fees for multi-residential PAYT systems. Each unit is supplied with an RFID tag/card to identify themselves prior to placing waste into a chute, where it is measured by weight or volume via an integrated weight scale or by scanning the dimensions.

Category:	Program / Infrastructure
System Overview	• Application of a RFID system provides the option to implement other technologies to optimize collection, including adding bin sensors and solar compaction to collection infrastructure. Implementing a RFID system would also expand data collection and monitoring. • Implementation of this option will require the City to equip containers with radio-frequency identification (RFID) capabilities to gain information about collection services and performance and ensure systems are in place to capture the information on vehicles or programs.
Status:	• Proven • Use of RFID technology for waste collection containers is proven in many municipalities.
Source of Option:	• Consultant, Consultations
Proposed Strategic Alignment:	Goals: • 9. Maximize cost containment, revenue generation and the efficient use of waste management resources to help minimize costs to taxpayers. • 10. Make sustainable waste management design an essential part of the city's planning process. 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Embrace innovation.
Needs Assessment Alignment:	• Aligns with the need to identify more efficient ways to collect materials, that are more convenient and accessible to residents and customers.
Individual Producer Responsibility (IPR) Impact:	• No impact. Can be implemented for materials not collected by the Producer Responsibility Organizations.
System Consideration:	• Secondary - will be a program to overlay onto core system
Sector Applicability:	• Available for all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).

Category:	Program / Infrastructure
Environmental Considerations:	• Allows for measurement of waste generation by stream, diversion program participation rates using weigh scale and GPS data, which will allow the City to concentrate their education efforts to certain areas. • Data gathered could allow the City to develop focused P&E campaigns, which may increase diversion rates. • Optimization of route operations may decrease greenhouse gas (GHG) emissions due to collection route efficiencies. • Additionally, RFID systems can be used to track the fullness of containers, which can be used to reduce the frequency of collection, which may also decrease GHG emissions from collection.
Social Considerations:	• RFID can provide data and statistics for each customer such as waste generation rates, weight of materials collected, waste densities and/or diversion rates. Some residents may be interested in this information, however other residents may have privacy concerns. • If a PAYT system was introduced in conjunction with RFID, it could provide additional data for billing purposes, since customer specific data is generated. • More efficient operations lead to improved service for customers, including missed stops and driver performance. • Fewer collection vehicles may improve public safety if RFID system measured bin filling level or if route optimization studies determine fewer trucks are necessary. • Results of RFID readings may require residents/customers to improve sorting practices.

Category:	Program / Infrastructure
Technical/ Operational Considerations:	• City would need to rely on an external cloud-based platform to manage data. • RFID can provide data and statistics for each customer, including waste generation rates, weight of materials collected, participation rates, waste densities and/or diversion rates. • Allows municipalities to track which customers generate the most garbage and/or are not setting out expected quantities of recyclables and/or organics. This can allow municipalities to tailor their P&E efforts. • Can provide feedback on program performance to different customers. • RFID systems may be introduced alongside new collection programs, such as PAYT and bag limits. For example, bag limits may be enforceable at multi-residential properties if each unit is supplied with an RFID tag/card to identify themselves prior to placing waste into a chute where it is measured by weight or volume via an integrated weight scale or by scanning the dimensions. • Would need to install RFID hardware and software on collection vehicles – either retrofitting existing vehicles or including as a requirement in collection contracts. • Additional staff may be required to interpret and analyse the data that is collected. • The technology must be able to operate in the cold winter climate of Ottawa.
Regulatory Considerations:	• None anticipated.

Category:	Program / Infrastructure

Financial Considerations:	• Capital cost for implementation for both curbside and containerized collection may be in the medium/high range ($3-5 million). For containerized collection only, it is estimated capital costs may be in the medium range ($1-$3 million). Capital costs would include:
	  ○ Installation of corresponding infrastructure includes, but is not limited to the RFID reader (varies in cost from $1,000 - $3,000 per vehicle), installation of the reader, RFID tags for bins and software.
	  ○ RFID tags can cost anywhere from $0.10 to $50, depending on the type of tag that is being used, the application and the volume of the order.
	  ○ Additional costs would be required to purchase standardized carts for garbage for automatic or semi-automated collection.
	  ○ Capital costs could be reduced if RFID tags are placed on bins / carts at the time of order/purchase versus putting them on after they are already in use.
	  ○ Additional costs will be incurred to train collections staff on the operating system and software.
	• Costs and expenses related to the operation of a system wide RFID system will be in the low ($<100K) to medium-low ($100K - $500K) range. Costs depend on the sector applied to, the complexity of the system, who is installing and operating the system. Operating costs would include:
	  ○ Ongoing software license costs, replacement RFID tags for lost bins and general maintenance.
	  ○ Additional staff resources will be required to manage and support data collection and management.
	• Optimization of collection routes can lead to a reduction in waste collection costs, however payback periods may be a few years depending on the technology used and capital expenses.
	• Additional staff resources may be required for database management and analysis.

Unknowns/ Assumptions:	• It is unknown if City will move to cart-based curbside garbage collection. • It is unknown what type and how many bins/carts would be provided with an RFID tag.

Category:	Program / Infrastructure
Supporting System Requirements for Success:	• Feasibility study/business case review to assess potential collection efficiencies, costs and benefits of implementing RFID technology and how to integrate data with other existing information systems. • Implementation may require support from the City's Information Technology staff. • RFID systems will require input from collections staff and collection vehicles will need to be retrofitted with RFID hardware and software, which will need to be considered in collection contracts. • RFID systems may be integrated with existing bins/containers or installed on new containers. • RFID systems may be introduced alongside new collection programs, such as PAYT or introduction of a cart-based collection system. • RFID integration with recycling is dependent on the IPR framework for each sector and who is responsible for which materials.
Potential Outcomes:	• Collection of data to improve collection logistics and customer service. • Collection of data to monitor program performance, including participation and set out rates. • The opportunity to tailor P&E efforts, which may increase diversion rates. • May support a PAYT approach and RFID tags may simplify PAYT billing.
Measurement:	• Success of the RFID system can be measured through qualitative means, such as staff and customer surveys, to determine ease of operation and improved customer service. • Success of the RFID system can be measured through quantitative means; however, it depends on the application of the technology. For example, if RFID systems are used to optimize collection routes, the City can measure reduced fuel consumption.

Category:	Program / Infrastructure
Case Study #1:	• In 2012, the Region of Peel awarded a contract for the design and delivery of a radio-frequency identification (RFID) waste collection reporting system for the Region's multi-residential and IC&I collection services to over 700 multi-residential buildings and 1,000 IC&I locations. The technology roll-out began with a pilot test in the fall of 2013, which concluded in spring of 2015. • The pilot tested the hardware and software functionality of the equipment as well as the design and distribution of a report card communication approach. Each front-end bin was provided with an RFID tag, which was recorded along with the weight of the bin every time it was collected. The data was recorded in a centralized database and the data was used to monitor and analyze the waste diversion activities of each building. • A report card template was tested which would provide the building owners/property management feedback on their waste diversion versus garbage disposal efforts. After the pilot test period, the system was deemed successful and approval was granted to move to the full-scale implementation phase in April 2015. • Analysis of data between July 2016 and March 2017 showed that condominium buildings performed better than rental buildings and other types of properties. • High and low performers were identified through a ranking list by their diversion rate. Low performers were to receive a focused P&E approach. • The system also has the capability to integrate with a billing system should this direction be deemed desirable in the future. • Peel Region's cost to implement the program was $1.33 million and included: pilot ($297,655); tag installation (2013-2015) at 700 multi-residential buildings (5,000 in front-end bins and 6,900 carts) and 1,000 IC&I locations; full-scale implementation, support and maintenance ($1,028,673).[104]
Case Study #2:	• In 2019, the City of Prince George, BC, outfitted approximately 23,000 existing curbside garbage collection carts with RFID tags. The RFID technology was combined with the City's existing onboard cameras to identify broken, overflowing and missing cart to help address related missing pick-up complaint calls. The system includes a monitoring board, allowing collection staff to track and photograph missed collections, switched carts and improperly disposed of materials. • Funding for the RFIDs came out of the Prince George's Capital Expenditure Plan with the system costing approximately $10 per tag per cart and $65 for a mid-sized replacement cart.

[104] http://thecif.ca/projects/documents/566.4-Peel_Final_Report.pdf and http://www.peelregion.ca/council/agendas/2016/2016-06-16-wmsac-agenda.pdf

Category:	Program / Infrastructure
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

5D2 – Undertake a Review of the Yellow Bag Program

Category:	Program/Policy
System Overview:	• Under the Universal Program Review in 2004, the City ceased collecting waste from small businesses. Subsequently, the Yellow Bag Program was created as a user pay program to provide waste diversion services to small businesses, which no longer had access to them. It is a registration-based curbside collection program for garbage, recyclables and organics for small business that do not generate large amounts of waste. There are approximately 485 commercial business registered in the Yellow Bag Program. • Participating business must purchase special yellow bags for garbage from participating Home Hardware retailers or the City of Ottawa Client Service Centers. Businesses can offset costs by using the City's recycling and organics programs, which are provided at no charge. They can set out up to 16 bags of garbage, 15 boxes of recycling, three green bins and up to 15 leaf and yard waste bags/bundles. • Under this option, the City would undertake a review of the Yellow Bag program, including eligibility requirements and impacts on Individual Producer Responsibility (IPR) for the recycling portion of the program.
Status:	• Proven • The City of Ottawa already runs this program successfully. This program is also successfully run in other Ontario municipalities. It is common to provide collection services for small businesses where waste can be collected in conjunction with curbside waste collection programs.
Source of Option:	• Staff, Consultations

Category:	Program/Policy
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste; • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste; • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services; • 9. Maximize cost containment, revenue generation and the efficient use of waste management resources to help minimize costs to taxpayers; • 10. Make sustainable waste management design an essential part of the City's planning process; and • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Change community values. • Utilize the triple bottom line.
Needs Assessment Alignment:	• This option is tied to the need to identify more efficient ways to efficiently collect materials, that are more convenient and accessible to residents and customers.
Individual Producer Responsibility (IPR) Impact:	• Partial. The recycling portion of the program may be impacted by IPR, however details will not be available until the final Blue Box regulations are released.
System Consideration:	• Secondary – will be a program to overlay onto core system.
Sector Applicability:	• This option would apply to the Industrial, Commercial and Institutional (IC&I) sector.
Environmental Considerations:	• Encourages waste diversion by providing the service in a cost effective manner. • Likely to lead to higher waste diversion rate in the IC&I sector. • Provides service with no increase in greenhouse gas (GHG) emissions, as the collection trucks are servicing the businesses along existing routes.

Category:	Program/Policy
Social Considerations:	• May result in IC&I waste collectors losing some customers and revenues. • There may also be a behaviour change required as some waste diversion practices may not currently be in place with new businesses who join the program. • No perceived impact to public health and safety. • May result in loose garbage being stored outside, rather than in waste bins; potentially leading to increased litter and potential vermin.
Technical/ Operational Considerations:	• Would require staff to undertake the program review. • Requires collaboration and engagement with IC&I sector (current, former and future Yellow Bag participants) to understand current issues with the program, including current limitations on eligibility. • May require City to identify additional locations that could be serviced and integrate them into collection routes.
Regulatory Considerations:	• May require a change to the Solid Waste By-law, which would require Council approval.
Financial Considerations:	• There are no capital costs expected as a result of the review. Additional capital costs may be incurred as a result of the recommendations of the review. • Operating costs related to the review would be low (less than $100,000). • Future operating costs as a result of the recommendation of the review may be impacted. For example, costs related to the supply of new containers, a P&E campaign to promote the program or impacts of IPR.
Unknowns/ Assumptions:	• Based on the draft regulations for the Blue Box Program Transition (as of November 2020), it is unclear whether producers will be responsible for the collection of materials from small businesses currently being serviced by the City through the Yellow Bag program. • It is unknown what level of involvement the City will have in the provision of collection and processing services for the Yellow Bag program given IPR, including the costs to collect and process recycling if this service is not provided by producers. • It is not known what, if any, program changes will be required as a result of the program review.
Supporting System Requirements for Success:	• Staff to undertake the review. • A more inclusive program to service the waste management needs of small businesses in Ottawa.

Category:	Program/Policy
Potential Outcomes:	• Could increase overall volumes of material requiring collection, processing and disposal, which the City does not currently manage.
Measurement:	• Tracking number of businesses registered in the program and the number of Yellow garbage bags purchased. • Could undertake customer satisfaction surveys if any changes are made to the program.
Case Study #1:	• The City of Markham provides garbage, recycling, Green Bin services to Business Improvement Areas (BIAs) and businesses on residential collection routes. In order to receive collection services on residential routes, businesses must meet residential curbside collection requirements. Businesses in BIAs receive extra old corrugated cardboard collection once per week. All multi-residential and commercial/institutional locations that receive City collection services must source separate their waste into the three streams – recyclables, organics and garbage. Collection services are governed by By-Law 32-95 - A By-Law To Establish And Maintain System For The Collection And Disposal Of Refuse In The Town Of Markham. • The City of Markham provides free recycling and organic waste collection to public, private and Catholic schools and churches throughout the city. Markham has provided one-time grants to schools to set up the infrastructure ($2,500 grant per school to 10 schools per year). Businesses need to comply with curbside limits/requirements in the by-law.
Case Study #2:	• The City of Guelph offers weekly organic and bi-weekly garbage and single-stream recycling to IC&I customers (outside of the BIA) as an opt-in service. All businesses that receive automated cart collection services must participate in the source separation programs in order to receive service, as per the City's waste management by-law (2019) - 20392. In the case of the downtown core, businesses receive collection of all three streams six days a week (Monday through Saturday). • Over the years, the City has been extending its services to include other small businesses (e.g., strip malls), cafeteria waste from some industrial buildings, and while the City doesn't provide service to public and private school boards, it does provide service to alternative schools (e.g. private schools). • Since the waste management By-law does not set boundaries for which IC&I establishments can receive City collection services, the City is undergoing an assessment of eligibility criteria used by other similar jurisdictions for providing services to businesses, with the intention of setting its own eligibility criteria for City collection services. • The City no longer provides medical waste collection to medical clinics and dental offices that receive City collection services.

Category:	Program/Policy
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

5D3 – Identify Curbside Collection Efficiencies

Category:	Program
System Overview:	• The City would undertake a curbside collection efficiency study, including a business case review, to determine contract requirements in advance of the future curbside collection contract being awarded. The study would consider costs, servicing the collection needs of a growing City and how to reduce greenhouse gas (GHG) emissions related to collection of waste. The study could include exploring: • The feasibility of a reduced collection week e.g. 4-day collection; • Night-time/early morning collection to avoid traffic; • Single stream versus co-collection of material; • Collection of waste from mixed use areas (residential and small business) e.g. Byward Market; • The use of/need for transfer station capacity; • The feasibility and cost implications of separate collection of leaf and yard waste (LYW), considering the future processing technology for organics post-2030; • The feasibility of decentralized LYW processing; • The use of semi or fully automated curbside garbage cart collection; • Separate collection of bulky items; and • Opportunities to leverage technology to enhance operations through data collection. The study could also include exploring options related to reducing the GHG impact of the curbside collection fleet.
Status:	• Proven • While the study would be unique to Ottawa, other municipalities have undertaken service reviews to assess the efficiency of their waste collection services.
Source of Option:	• Staff, Consultations

Category:	Program
Proposed Strategic Alignment:	Goals: • 6. Aspire to achieve 100% GHG emission reductions. • 8. Enhance accessibility, convenience, consistency and affordability of waste management programs and services. • 9. Minimize costs to taxpayers. • 11. Collaborate with external stakeholders, including industry and other levels of government, to advance waste management practices. Guiding Principles: • Protect the environment. • Embrace innovation. • Utilize the triple bottom line.
Needs Assessment Alignment:	• Aligns with the need to identify more efficient ways to efficiently collect materials, that are more convenient and accessible to residents and customers. • Improving collection efficiencies will help to reduce transportation related GHG emissions associated with waste management.
Individual Producer Responsibility (IPR) Impact:	• Partial. It is unknown how producers will collect recycling and if any efficiencies can be realized by the City in partnering/contracting with Producer Responsibility Organizations (PROs) for the collection of recycling.
System Consideration:	• Secondary - will be a study that is tied to a core system component.
Sector Applicability:	• Applicable to waste collected under the curbside collection contract from Single Family (SF), Multi-residential (MR), City Facilities/Operations (CF) and Partner Programs (PP).
Environmental Considerations:	• Identifying more efficient ways to collect material is not expected to result in increased waste diversion. • May result in reduced GHG emissions associated with collection of waste if more efficient collection results in fewer vehicles or reduced transportation distances.
Social Considerations:	• May need to conduct some market research or consultations on specific elements of the study to better understand needs or feedback from residents and other stakeholders on specific ideas. • Semi or fully automated collection will likely lead to improved health and safety for Waste Collection operators.

Category:	Program
Technical/ Operational Considerations:	• Would require staff time to identify the scope of study, and either identify staff to conduct study in-house or procure a consultant to conduct the study. • City may need to include new collection requirements into future procurement processes and contract documents for curbside collection. • May need to co-ordinate certain portions of the study with other City departments, such as Fleet Services. • City may need to discuss capacity with local private sector transfer station owners. • City may need to do some pilot studies to evaluate how changes such as collection from mixed use areas may work. • Some aspects of the study would need to be coordinated with current or future studies, for example, the future organics processing technology study, in order to fully understand future curbside collection requirements.
Regulatory Considerations:	• No regulatory considerations required to conduct a study.
Financial Considerations:	• Would be a one-time cost for conducting the study – anticipated to be low (<$500,000).
Unknowns/ Assumptions:	• The exact scope of the study is currently unknown and needs to be confirmed, ideally once details of the IPR transition of recyclables are known. • Given the uncertainty as to whether the City will be responsible for the collection and processing of Blue and Black Bin materials from non-residential sources such as City facilities and those businesses participating in the Yellow Bag program, the need for collection of these materials is currently unknown. • The date of the subsequent curbside collection contract being tendered is unknown, meaning that the date that this study would have to be completed is currently unknown and would have to be confirmed.
Supporting System Requirements for Success:	• City may need to procure outside assistance to conduct the study. • Confirmation of the details of IPR transition for Blue Box recyclables.

Category:	Program
Potential Outcomes:	• The outcome of the study would be to identify potential approaches that could realize efficiencies related to the collection of curbside waste. • Depending on the scope of the study, potential individual outcomes could include: • Optimizing the number of collection vehicles on the road (increase or decrease) required to provide curbside waste collection services. • Using transfer stations to reduce travel time for collection operations once a route is completed or a truck is full. • Using transfer stations to realize efficiencies for other waste management system components, such as landfill operations or transfer of materials to processing facilities. • Streamlined waste collection in multi-use areas. • An increase or decrease in GHG emissions from the future curbside waste collection system.
Measurement:	• Evaluation criteria to assess collection efficiencies would need to be developed for the study and could include measures such as net cost (increase/decrease), customer service benefits, ability to maintain or increase waste diversion, impact on GHG emissions.
Case Study #1:	• The City of Guelph examined waste collection efficiencies in 2017 as part of a business services review[105] of their waste management operations. The purpose of the review was to compare the current waste management system to comparator municipal services and determine if the service delivery approach exceeded or was in line with comparator municipalities or if changes needed to be made. • The findings indicated that the City of Guelph met or exceeded service levels compared to the other applicable municipalities in all but one waste service element (i.e. the MRF) included in the scope of the review. Collection operations were better than other comparator municipalities. • The City has been implementing the approved recommendations coming out of the service review. Recommendations specific to collection operations included: extending the lifecycle of the waste collection (packer) trucks from seven to ten years to achieve optimal economic life and provided an opportunity for future capital budget; increased service levels for leaf and yard waste collection during the growing season and continuing to phase in the approved service expansion to multi-residential properties.

[105] Solid Waste Resources Business Service Review Final Report, May 28, 2018. https://guelph.ca/wp-content/uploads/council_agenda_052818-1.pdf#page=82

Category:	Program
Case Study #2:	• The District of Muskoka improved curbside collection efficiencies through the use of GIS technology, which enabled them to move from a manual system of route maps and have accurate information about stops. The municipality undertook a Continuous Improvement Fund project in 2015[106] to meet several needs, including improving contract administration and having accurate data on customers and services received to justify costs and services received. • Baseline data sets used for solid waste operations (routes, property and service level) are now available for use on the municipality's Geographic Information System (GIS) and a system is in place to update the data as development occurs and data is regularly updated. Data is used for day-to-day contract management and also for collection contract procurement. Availability of accurate data on collection points improves the competitiveness of bids.
Recommendation:	• It is recommended that this option proceed to the evaluation stage.

[106] GIS Collection Point and Service Level Mapping, District of Muskoka, 2016 https://thecif.ca/projects/documents/820-Muskoka_Final_Report_Revised.pdf

6. Organics Management

6A1 - Aerobic Composting

Category:	Facility/Infrastructure
System Overview:	• Aerobic composting is a naturally occurring process where organisms break down organic material in the presence of oxygen. Different types of aerobic composting technologies exist, including aerated windrow, aerated static pile, and in-vessel composting and the type is often dependent on the feedstock being processed (e.g., food waste, leaf and yard waste (LYW)) and the required quality of the end-product. • Many municipalities collect food waste separately from leaf and yard waste (LYW) so that the smaller volume of food waste can be processed in a smaller and more efficient processing facility, with LYW typically composted in open windrows. Additionally, some composting systems, such as accelerated in-vessel tunnel composting have issues with processing LYW with food waste because of the high nitrogen content of LYW and the potential to generate odours. • This option explores the development of an aerobic composting facility to process household organics (e.g., food waste, soiled paper products, diapers, pet waste). • These facilities require a tipping floor and pre-processing/ screening technology to remove contaminants, mechanically breakdown organics, and mix incoming feedstocks. Odour management systems (e.g., biofilters, negative pressure building envelope) are also required. • There are a number of different procurement approaches that the City could consider, including the City owning and operating a facility, entering into a public private partnership (P3) agreement, or contracting out the processing. • LYW could be collected and processed separately and is not considered as part of this option - refer to Option 6B1 – Separate Composting of LYW.
Status:	• Proven • Aerobic composting is a cost effective and proven approach to process household organics and LYW. • Various types of aerobic composting facilities are widely used across municipal, agricultural and industrial applications, and is the City's current approach to processing all of its Green Bin material. • The City's current organics processor uses an accelerated in-vessel tunnel aerobic composting technology to process household organics and LYW. • The City currently uses outdoor aerobic windrows to process separately collected LYW.

Category:	Facility/Infrastructure
Source of Option:	• Consultant, City Staff, Consultations
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 5. Maximize the recovery of materials and energy. • 9. Minimize costs to taxpayers. Guiding Principles: • Honour the 5Rs hierarchy. • Keep waste local.
Needs Assessment Alignment:	• Tied to the need to confirm the City has sufficient organics processing capacity prior to 2030 and, secure capacity beyond 2030. • Tied to the future Green Bin processing capacity needs and the need to consider potential options to manage future quantities of LYW, both in the short and medium term.
Individual Producer Responsibility (IPR) Impact:	• Partial, as the impact of compostable packaging is unknown at this time. • There may be new types of compostable packaging, such as compostable coffee pods, that may impact the composition of incoming feedstock and the amount of processing and processing time required. How the feedstock will be impacted is unknown at this time.
System Consideration:	• Core system component
Sector Applicability:	• Applicable to organic waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Creates a product (compost) for beneficial reuse and closes the soil nutrient cycle. • Option does not contribute to the City's climate change goals, as it does not allow for the capture and conversion of biogas to generate renewable natural gas (RNG) to displace fossil sourced natural gas on the gas grid. • Facility will be required to operate in compliance with Environmental Compliance Approval (ECA), including air pollution control systems that comply with provincial emission and environmental requirements.

Category:	Facility/Infrastructure
Social Considerations:	• Depending on where a new facility is located, there may be community interruption with increased traffic, noise and potential odours. This would need to be addressed through an appropriate siting process and mitigative measures. • There may be some resistance initially to the final location of a new composting facility. • Potential for public concerns about air quality and health impacts. • Potential to generate short- and long-term jobs as part of constructing and operating a new facility. • Minimal to no health impacts anticipated when in compliance with ECA.
Technical/ Operational Considerations:	**Collection System** • Collection contracts would need to be revised to provide separate collection of LYW from Green Bin materials, which may impact the amount of greenhouse gas (GHG) emissions from collection operations. **Aerobic Composting** • Option will require a detailed business case and feasibility study, including waste stream analysis to confirm potential for successful outcomes and potential markets for finished compost. • Will require an analysis of procurement and management approaches (i.e. Design-Bid-Build, Design-Build, Design-Build-Operate, contract private services etc.). • The City may have to undertake a planning and siting process, procurement, approvals, implementation, operation and maintenance of a facility, depending on the procurement approach taken. • Potential challenges with processing compostable products and packaging through aerobic composting. Depackaging/debagging equipment may be required prior to the composting process to break open bags and packaging. Screening equipment is required to remove contaminants, either pre or post the composting process. • The target organic feedstock may depend on the type of aerobic composting technology used. Feedstock materials typically include food waste, biosolids, agricultural waste and animal manure. Some facilities can also process organics in plastic bags, diapers, pet waste and sanitary products, depending on the processing equipment (breaking/screening) and end markets. The screened contaminants would be disposed of in the landfill. • Tied to the future Green Bin processing capacity needs, the City needs to consider potential options to manage future quantities of LYW, both in the short and medium term.

Category:	Facility/Infrastructure
Regulatory Considerations:	• A multi-media Environmental Compliance Approval (ECA) is required from the province for a Waste Disposal Site (Processing), Air and Industrial Sewage. The ECA, as well as other approvals (e.g., municipal approvals for land use planning, zoning, and site plan) may take one to two years to complete and would be in the low cost range (<$1 million). • Land use planning (e.g., Official Plan, Zoning, Site Plan) approvals would be required for a new facility, depending on the site. • Management of food and organic waste from SF will continue to be a municipal responsibility under the Ontario Food and Organic Waste Policy Framework and Policy Statement. Through this framework, the province has set targets for waste reduction and resource recovery of food and organic waste of 70% for single-family dwellings in urban areas by 2023 and 50% for multi-residential buildings by 2025. • In September 2020, the province clarified the types of organic waste to be managed. Food waste, inedible parts of plants and animals from food preparation and pet food waste shall be included; soiled paper products, coffee filters, tea bags, compostable coffee pods and compostable bags should be included; and managing diapers and pet waste is encouraged. The province also encouraged municipalities and organic waste processors to update existing or adopt technology that could process compostable products and packaging. • This option is In line with the province's direction as part of the Food and Organic Waste Framework to "increase the use of innovative technologies", "recover resources from food and organic waste", "support resource recovery infrastructure", and "prohibit disposal of organic waste". The Framework also speaks to supporting beneficial uses which promote soil health, crop growth and enhance carbon storage.

Category:	Facility/Infrastructure

Financial Considerations:	• Depending on the type, size, capacity and incoming feedstock of the facility, the capital and operating costs can vary. In 2017, a study was completed for the City of Ottawa[107] that assessed various collection, feedstock and processing costs of organics. The study indicated the following estimated processing costs based on 2015 cost estimates:
	  ◦ Aerated Static Pile (covered);
	  ◦ Estimated Capital Cost: $210 - $490 / tonne annual capacity; and,
	  ◦ Estimated Operating Cost: $25 - $85 / tonne processed.
	  ◦ Enclosed Aerated Static Pile (tunnel);
	  ◦ Estimated Capital Cost: $285 - $665 / tonne annual capacity; and,
	  ◦ Estimated Operating Cost: $50 - $110 / tonne processed.
	• Enclosed Channel, Agitated Bed;
	  ◦ Estimated Capital Cost: $255 - $595 / tonne annual capacity; and,
	  ◦ Estimated Operating Cost: $45 - $105 / tonne processed.
	• For reference, the City is currently paying approximately $128/tonne to process Green Bin organics at the Convertus facility.[108]
	• If the City achieves its target of 100% capture of organic waste as identified in the City's Energy Evolution Strategy, a facility capable of managing up to 156,000 tonnes of household organics by 2052[109] would be required (based on projections of household organics), with some additional tonnage required for amendment.
	• Based on this required capacity and the above costs, it is estimated that the capital costs of a facility of this size could range from medium/low ($10-$50 million) to medium/high ($100-$200 million) and the operating costs could range from medium ($3-$6 million) to high (>$10 million).

[107] Dillon Consulting Limited. August 2017 Task 3 Technical Memorandum - Assessment of Collection / Feedstock Scenarios and Processing Options

[108] Technical Memorandum No. 1 - Current State System Summary, Ottawa Solid Waste Master Plan, City of Ottawa, January 2020.

[109] Based on 100% capture of household organics from projected tonnes of garbage and the household organics generated from SF, MF and CF, (based on 2019 tonnes and composition and Long-Term Waste Management Needs Technical Memorandum forecast).

Category:	Facility/Infrastructure
Unknowns/ Assumptions:	• Time required to have a new facility operational is approximately 5-7 years, from time of approval to proceed with the project, based on aerobic and anaerobic organics facilities developed in Ontario. • Variables include factors such as the availability of a suitable site, facility design, procurement method (tender, design/build), permitting and approvals, and construction time. • Uncertainty around future regulations regarding organics (i.e., potential ban on organics from landfill) and compostable packaging, which may impact quantities available for recovery from the waste stream, as well as the feedstock. Depending on outcomes of more detailed study that will determine appropriate procurement approach. • The procurement approach is unknown at this time. • It is unknown whether a private sector operator would want to compete in an environment where another private sector operation is already in business. • The City would need to identify a suitable location for a facility, ideally located in an industrial area of the City with comparable uses, or near the Trail Waste Facility. • The level of public input and opposition during the siting process and development of a new facility is unknown. • At this time, it is unknown how IPR, or other federal or provincial initiatives will impact the composition of the feedstock or quantities of organics in the garbage stream which could be recovered. • Unknown if/when the Province will implement a ban on the landfill of organics. Currently reported to be 2030. • Unknown if/when the Province will introduce regulations to support the 50-70% food and waste recovery targets. • The impact of future food waste reduction initiatives that could lower the amount of material requiring collection and processing is unknown. • Procurement model for development of a facility is unknown, as well as the ability/appetite to partner with other municipalities to fund and develop a facility. • Limited data on quantities of organic material collected from certain customers and the resulting uncertainty on potential quantities to be managed in the future.

Category:	Facility/Infrastructure
Unknowns/ Assumptions:	• Many existing aerobic composting technologies have challenges with processing organic products and packaging, such as compostable food containers, plastic bags, diapers, and residual contaminants within the organics. With industry trends leaning to more compostable packaging being generated, as well as the Province's increased emphasis on the need for municipalities to accept compostable packaging, such as bags and coffee pods, if the processing technology cannot process these compostable items, more residual will end up requiring disposal, which can impact the capacity at the Trail Waste Facility landfill. • Availability of non-municipal sources of funding to support this option is unknown. • It is unknown if the City would include diapers, pet waste and sanitary products, which result in significant quantities of plastic waste requiring disposal.
Supporting System Requirements for Success:	• Option will require a detailed business case and feasibility study, including waste stream characterization and tonnage estimate analysis to confirm potential for successful outcomes. It will also need to consider LYW and how it will be collected and processed. • Depending on facility location and number of processing locations, use of waste transfer stations may be required to support efficient collection operations. • Markets for outputs of organics processes are required (compost). • Disposal facilities are required for some materials (e.g., residual, inerts (e.g. bones, rocks)). • Resident participation in green bin program waste program to support necessary diversion.
Potential Outcomes:	• A City-owned facility would ensure full control over a core component of the City's waste management system, reducing risks associated with reliance on contracted facilities (e.g., availability, cost increases, program changes). • Aerobically digested organics can produce unrestricted use compost or restricted use compost, such as non-agricultural source material (NASM). • This facility would serve to extend processing capacity once the City's contract with Convertus expires in 2030. • It is noted that aerobic composting would not contribute to the City's climate change goals as it does not allow for the capture and conversion of biogas to renewable natural gas.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes received, processed, residual and compost generated.

Category:	Facility/Infrastructure
Case Study 1:	• GFL Environmental Inc. (GFL) owns and operates the Eastern Ontario Waste Handling Facility (EOWHF) in Moose Creek ON, which includes an aerobic composting facility. The process consists of mechanically agitating the materials in enclosed channels with the use of forced aeration. The facility is designed to process up to 120,000 tonnes per year and the initial facility development capital costs (2009) ranged from $12 to $14 million (excluding material transfer, curing).[110] • Some Ontario municipalities use this facility to process their organics, such as York Region and Prince Edward County. Material from York Region includes plastic bags, pet waste, diapers and hygiene products.
Case Study 2:	• The City of Calgary, AB commissioned its 48,400 square metre aerobic composting facility in 2017 to process food and yard waste collected through its green bin program. The product is first shredded in the receiving area and then loaded into the composting vessels. The material is pasteurized for three days, then aerobically composted. The whole composting process takes approximately 60 days to complete. • The facility processes up to 145,500 tonnes per year, noting that 100,000 tonnes is municipal organics received from the green bin program and 45,000 tonnes is municipal dewatered biosolids received from the City's Bonnybrook wastewater treatment plant. • Facility capital costs were $143 million (2015) and annual operating costs are approximately $12 million per year.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[110] GFL Environmental | Moose-Creek Eastern Ontario Waste Handling Facility

6A2 - Anaerobic Digestion (AD)

Category:	Facility/Infrastructure

System Overview:	• Anaerobic digestion (AD) is a biological process where bacteria break down organic matter without oxygen to produce biogas and solids (digestate). The biogas can be used as fuel for boilers, be converted into electricity, and can be upgraded to Renewable Natural Gas (RNG). RNG can replace conventional natural gas derived from fossil fuel. It can be injected into the natural gas distribution or transmission systems, reducing the amount of fossil natural gas needed. The digestate can be used directly as a soil amendment or to produce a compost product.
	• Depending on the application, typical feedstocks include sewage sludge, municipal food waste, other household organics (e.g., soiled paper products, diapers and sanitary products, pet waste), food industry waste, and/or agricultural waste. Leaf and yard waste is typically not suitable for anaerobic digestion due to its low biogas yield potential.
	• These process facilities require a tipping floor and pre-processing/screening technology to remove contaminants, mechanically breakdown organics to produce a slurry for digestion, and mix incoming feedstocks. Odour management systems (e.g., biofilters, negative pressure building envelope) are also required.
	• This option explores the use of AD technology to process household organics (e.g., food waste, soiled paper products, pet waste), as well as diapers and sanitary products.
	• This option could produce a renewable source of energy, aligning with the City's Energy Evolution Strategy Renewable Natural Gas Strategy project objectives and 100% greenhouse gas (GHG) reduction target in the City's Climate Change Master Plan.
	• Under this option, leaf and yard waste (LYW) would be collected and processed separately and is not considered as part of this option. Refer to Option 6B1 – Separate Composting of LYW and 6B2 – Gasification of LYW.
	• This option is tied to the City's Energy Evolution Strategy, which through the Organic Resource Recovery Strategy requires the following:
	  ○ 100 per cent of organic materials be diverted from all landfills within the city's boundaries by 2024;
	  ○ All organic waste generated within the city's boundaries be routed to anaerobic digestors or gasification by 2030; and
	  ○ 100 per cent of organic materials generated within the city's boundaries be diverted from landfills by 2040.

Category:	Facility/Infrastructure
Status:	• Proven • Various types of anaerobic facilities are widely used across agricultural and industrial applications. Anaerobic digestion is used for municipal organic waste in Europe and the United States and is used in Canada by the Cities of Toronto and Surrey. • Most anaerobic digestion facilities use biogas as fuel for boilers, or to be converted to electricity. RNG upgrading technology is quickly emerging within this sector with increasing fuel prices making this option more economically viable.
Source of Option:	• Consultant, Staff
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 5. Maximize the recovery of materials and energy. • 6. Aspire to achieve 100% GHG emission reductions. • 9. Minimize costs to taxpayers. Guiding Principles: • Honour the 5Rs hierarchy. • Embrace innovation. • Keep waste local.
Needs Assessment Alignment:	• Addresses need to secure organics processing capacity beyond 2030. • Tied to the need to determine what energy recovery technology/ies or approaches will be employed to recover as much organics waste as possible form the waste stream and create renewable energy from organic waste. • Aligns with the City's Energy Evolution Strategy direction by considering technology that can work towards having all organic waste generated within the city's boundaries being routed to anaerobic digestors or gasification by 2030. • Would be a component of the Organics Resource Recovery Strategy project and achieving the organic waste diversion targets outlined in the Energy Evolution Strategy.

Category:	Facility/Infrastructure
Individual Producer Responsibility (IPR) Impact:	• Partial, however the direction the province is moving with respect to compostable packaging and source separated organics programs is unknown at this time. Packaging and contaminant removal would need to be considered in facility design. This pre-processing technology is available to manage packaging and contaminants. • There may be new types of compostable packaging, such as compostable coffee pods, which will impact the composition of incoming feedstock and the amount of processing and processing time required. How it will be impacted is unknown at this time.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to organic waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Contributes to the City's climate change goals as the biogas can be used to generate RNG (preferred option) or electricity. • GHG emissions from trucking logistics and distance for the material will likely change, however the exact impact would be unknown until site is selected. • Creates a product (liquid soil amendment or compost product) for beneficial use and closes the soil nutrient cycle. • Has the potential to reduce the amount of GHGs produced by displacing fossil fuels.
Social Considerations:	• Depending on where a new facility is located, there may be community interruption with increased traffic, noise and potential odours. This would need to be addressed through an appropriate siting process and mitigative measures. • There may some resistance initially tied to not allowing LYW to be placed in the Green Bin. Additional education and potentially enforcement may be required to facilitate this behavioural change. • Potential to generate short and long term jobs through the construction and operation of a new waste management facility. • Minimal to no health impacts anticipated when in compliance with Environmental Compliance Approval (ECA). • There may be potential social support as this option supports the City's Climate Change Plan.

Category:	Facility/Infrastructure
Technical/ Operational Considerations:	**Collection System** • Collection contracts would need to be revised to provide separate collection of LYW from Green Bin materials. **Anaerobic Digestion** • Waste audits would have to be conducted to determine the quantity of organic material available. • Need to determine current and future processing requirements, for example, tonnes to be processed and feedstock composition, for example, whether or not diapers would be included. • The City would have to decide which service delivery approach it wants to take, for example, whether or not to enter into a public private partnership (P3) agreement, contract out the processing or own and operate the facility. • If the City was to operate its own facility, additional staff to operate and maintain the facility would be required. • Staff would need to be trained in how to operate and maintain the facility. • The City would require a planning and siting process, procurement, approvals, implementation, operation and maintenance of a facility. • Packaging and contaminants in the feedstock would need to be considered in facility design. • Potential challenges with processing organics and removing contaminants/packaging through anaerobic digestion. • The target organic feedstock may depend on the type of anaerobic digestion technology used. Feedstock materials typically include food waste, biosolids, agricultural waste, and animal manure. Some facilities can also take diapers, pet waste and sanitary waste depending on the processing equipment (breaking/screening) and end markets. • Would need to identify end market(s) for digestate finished compost and/or biogas. Digestate can be land applied or mixed with compost to create a finished product. • Would need to confirm infrastructure requirements for transporting RNG into the existing natural gas grid. • Partnerships will be required for the sale and distribution of RNG. • Facility will be required to operate in compliance with an ECA, including air pollution control systems that comply with emission and environmental requirements.

Category:	Facility/Infrastructure
Regulatory Considerations:	• An Environmental Compliance Approval (ECA) is required from the Province for a Waste Disposal Site (Processing) and Air. Potential for an ECA for Industrial Sewage, depending on where the facility is located and whether there are any outdoor operations. • The ECA and other approvals (e.g., municipal approvals for land use planning, zoning, and site plan) may take one to two years to complete. and would be in the low cost range (<$1 million). • Land use planning (e.g., Official Plan, Zoning, Site Plan) approvals would be required for a new facility, depending on the site. • Management of food and organic waste from single family homes will continue to be a municipal responsibility under the Ontario Food and Organic Waste Policy Framework and Policy Statement. Through this framework, the province has set targets for waste reduction and resource recovery of food and organic waste of 70% for single-family dwellings in urban areas by 2023 and 50% for multi-residential buildings by 2025. • In September 2020, the Province clarified the types of organic waste to be managed. Food waste, inedible parts of plants and animals from food preparation and pet food waste shall be included; soiled paper products, coffee filters, tea bags, compostable coffee pods and compostable bags should be included; and managing diapers and pet waste is encouraged. The Province also encouraged municipalities and organic waste processors to update existing or adopt technology that could process compostable products and packaging. • Option is In line with the Province's direction as part of the Food and Organic Waste Framework to "increase the use of innovative technologies", "recover resources from food and organic waste", "support resource recovery infrastructure", and "prohibit disposal of organic waste". The Framework also speaks to supporting beneficial uses of the digestate which promote soil health, crop growth and enhance carbon storage. The policy also encourages maximizing use of energy captured from anaerobic digestion facilities and promoting end products like renewable natural gas.

Category:	Facility/Infrastructure

Financial Considerations:	• Depending on the size and application, anaerobic digestion facilities can range significantly in capital costs.
	• If the City achieves its target of 100% capture of organic waste, a facility capable of managing up to 156,000 tonnes per year of household organics by 2052 would be required, based on projections of household organics and garbage[111].
	• It is estimated the capital costs for a facility of this size, including receiving, material processing and odour management, will be medium ($50-$100 million) to medium/high ($100-$200 million) and the annual operating costs could range from medium/high ($6-$10 million) to high (>$10 million), not including revenue from the sale of RNG or other outputs.[112] A 2017 study completed by Dillon Consulting indicated the following estimated processing costs (2015 dollars), excluding any revenues:
	  ○ Estimated Capital Cost: $480 - $1,120 / tonne annual capacity; and,
	  ○ Estimated Operating Cost: $60 - $140 / tonne processed.
	• The net operating cost of an anaerobic digester can range significantly depending if the biogas is used in heating/ electrical applications and used to produce renewable energy (e.g., generate electricity, produce steam or upgraded and converted into renewable natural gas) The 2017 study completed by Dillon Consulting estimated potential revenue from using biogas to generate electricity to be $15-$37 per tonne of organic waste processed and was based on renewable energy contracts at that time. A feasibility study would be required to update potential revenues estimates based on how the biogas will be utilized and current energy pricing.
	• Use of biogas as RNG would require upgrading the gas to remove contaminants and moisture and transporting the compressed gas to the property line to connect to the natural gas grid. Costs are estimated to be in the range of $5-$7 million based on recent costing for projects in Ontario and Alberta and would include the membrane upgrader, hydrogen sulfide scrubber, condenser, piping, blowers, control panels, small building to house equipment, easements and interconnections.

[111] Based on 100 capture of household organics from projected tonnes of garbage and the household organics generated from SF, MF and CF, (based on 2019 tonnes and composition and Long-Term Waste Management Needs Technical Memorandum forecast).

[112] Based on Dillon Consulting Limited. August 2017 Task 3 Technical Memorandum - Assessment of Collection / Feedstock Scenarios and Processing Options.

Category:	Facility/Infrastructure
Financial Considerations:	• The cost of separately collecting household organics and LYW would be in addition to the above cost estimates. • A promotion and education campaign would be required to promote any changes in materials accepted in the green bin program. Costs will depend on the extent of change required and could range from $1 to $2.50 per household. • There may be additional costs associated with the separate collection and processing of LYW. These costs would be influences by the processing technology used, for example, outdoor composting or gasification. • Potential working relationships or partnerships with other municipalities could be explored to offset capital and/or operating costs. There may be interest from other municipalities who are seeking to develop similar facilities to meet the expected Provincial food waste diversion regulatory requirements and achieve climate change targets.

Category:	Facility/Infrastructure
Unknowns/ Assumptions:	• Time required to have a new facility operational is approximately 5-7 years, from time of approval to proceed with a project, based on aerobic and anaerobic organics facilities developed in Ontario. Variables include factors such as the availability of a suitable site, facility design, procurement method (tender, design/build), permitting and approvals, and construction time. • The level of public input and opposition during the siting process and development of a new facility is unknown. • The City would need to identify a suitable location for a facility, ideally located in an industrial area of the City with comparable uses or close to the Trail Waste Facility. • At this time, it is unknown how IPR, or other federal or provincial initiatives will impact the quantities of organics in the garbage stream which could be recovered. • Unknown if or when the Province will implement a ban on the landfill of organics (currently planned for 2030). • Unknown if or when the Province will introduce regulations to support the 50-70% food and waste recovery targets. • The impact of future food waste reduction initiatives that could lower the amount of material requiring collection and processing is unknown. • Limited data on quantities of organic waste collected from certain customers and the resulting uncertainty on potential quantities to be managed in the future. • The procurement model for the development of a facility is unknown, as well as the ability/appetite to partner with other municipalities to fund/develop a facility. • Availability of non-municipal sources of funding to support this option is unknown. • Many existing anaerobic digester technologies have challenges with processing organic products and packaging, such as compostable food containers, plastic bags, coffee pods, and food packaging With more emphasis on reduction of single-use plastics, an increase in single-use compostable items may occur, which will likely end up in Green Bins. If the processing technology cannot process these compostable items, more residual will end up requiring disposal, which can impact the capacity at the Trail Waste Facility landfill. • The feedstock and technology type has not been confirmed. It is unknown if the City would include diapers, pet waste and sanitary products, which result in significant quantities of plastic waste requiring transport and disposal at the Trail Waste Facility landfill.

Category:	Facility/Infrastructure
Unknowns/ Assumptions:	• Unknown what gas infrastructure requirements would be and whether these would be available or need to be developed. • Unknown surrounding the potential energy users and revenue streams from the sale of electricity, RNG. • Unknown surrounding the potential uses and markets for solids generated from the process. • It is unknown how the City will process LYW, which would need to be collected separately from household organic waste. Refer to Option 6B1 – Separate Composting of LYW and 6B2 – Gasification of LYW.
Supporting System Requirements for Success:	• Separate collection and processing of LYW. • Option will require a detailed business case and feasibility study, including waste stream characterization and tonnage estimates analysis to confirm potential for successful outcomes. • Site selection, engineering design, procurement, construction and commissioning of a new processing facility. • Markets for outputs of organics processes are required (digestate, biogas). • Disposal facilities are required for some materials (e.g., residual, inerts (bones, rocks)). • Depending on facility location and number of processing locations, use of waste transfer stations may be required to support efficient collection operations. • Diversion of organics from garbage will impact the amount of landfill gas generated at Trail Waste Facility landfill and may impact the choice of technology for organics processing. • Increased resident participation in green bin program to support necessary diversion to anerobic digestion and separation of LYW from Green Bin organics.

Category:	Facility/Infrastructure
Potential Outcomes:	• The biogas that is produced can be converted into RNG, thermal and/or electrical energy. To varying degrees, these three outputs can contribute to achieving the City's climate change goals. • A City-owned facility would ensure full control over a core component of the City's waste management system, reducing risks associated with reliance on contracted facilities (e.g., availability, cost increases, program changes). The facility operation could be contracted out to reduce potential risks to the City, including operating and maintaining the facility and marketing of the end use products. • Anaerobically digested organics can produce unrestricted use compost or restricted use compost, such as non-agricultural source material (NASM). • This facility would serve to secure processing capacity once the City's contract with Convertus expires in 2030.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes received, processed, biogas generated, residual and amount of digestate generated. • Revenues from the sale of biogas and digestate could be measured on an annual basis. • Amount of GHG's offset or reduced could be measured annually.
Case Study 1:	• The City of Toronto has two wet (low-solids) AD facilities (Dufferin and Disco Road) that process the organics collected through the Green Bin Organics program. The Dufferin AD facility processes 55,000 tonnes per year and the Disco Road facility processes 75,000 tonnes per year. Organic materials can be placed in plastic bags and include food waste, soiled paper products, pet waste and diapers. Green Bin materials are unloaded at the facility tipping floor, pre-processed to remove plastic bags and contaminants and the remaining material is sent to anaerobic digesters. Digester solids are transported to an off-site aerobic composting facility to create compost.
Case Study 1:	• Currently, the biogas is used as fuel for their boiler system, however it will be upgraded to create RNG that can be injected directly into natural gas pipelines, or as alternative fuel like compressed natural gas (CNG). The City is in the process of installing equipment to produce RNG at the Dufferin AD facility, in partnership with Enbridge Distribution Inc. The fuel will be used to power its collection trucks, helping the City move toward its Long-Term Waste Management Strategy goal of zero waste and a circular economy.[113]

[113] A Closed Looped Approach to Managing Residential Organics, C. Khan, Influents Magazine, Fall 2020, Page 26 https://www.kelmanonline.com/httpdocs/files/WEAO/influentsfall2020/index.html#

Category:	Facility/Infrastructure
Case Study 2:	• The City of Surrey, BC manages its organic waste at a dry AD facility that produces biofuel. The Surrey Biofuel Facility[114] began operation in 2018 and can process up to 115,000 tonnes per year of organic waste from household and commercial sources. The facility produces biogas, which is upgraded and used as fuel for Surrey's waste collection fleet, and compost from the solids. • The City owns the facility and it is operated by Convertus. A design, build, finance and operate procurement process was utilized and the 25-year contract was awarded in 2014. Facility construction costs at that time were $67.6 million – the Canadian government contributed $17 million. Annual operating costs are not publicly available. • The City is contracted to provide a minimum of 57,000 tonnes per year and Convertus is obligated to produce a minimum of 120,000 gigajoules of biogas annually. • The facility is sized to process organics from surrounding municipalities. [115]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[114] Surrey Biofuel Facility overview - https://www.surrey.ca/services-payments/waste-collection/surrey-biofuel-facility/about-surrey-biofuel

[115] 28 Days Later: Waste to Fuel | Biomassmagazine.com

6A3 - Animal Feed Production Using Food Waste

Category:	Facility/infrastructure
System Overview:	• This option involves processing food waste into animal feed or other feed by-products. Food waste would be heat treated, dehydrated, and either mixed with dry feed or fed directly to animals. Insects can also be used to process food waste into animal feed or other products, such as black soldier flies. • There are a number of different procurement approaches that the City could consider, including the City owning and operating a facility, entering into a public private partnership (P3) agreement, or contracting out to processing industries. • This option requires a very clean stream of food scraps. No paper, plastic contaminants, residual contaminants, or leaf and yard waste (LYW) is acceptable. Material from facilities that generate food waste, such as cafeterias, could be accepted. • This option would not include non-food waste (e.g. tissue/towelling, leaf and yard waste or compostable products and packaging), making the current Green Bin program household organics an unsuitable feedstock.
Status:	• Not Proven • Although proven and used for food waste products from food processing facilities, its has been used on a limited scale for municipal food waste. Industrial producers use food waste products from food processing facilities to create animal feed. This is a cleaner stream of food waste and typically consists of single ingredients. An example is food processing facilities that chop and bag lettuce. The food waste products, such as lettuce trimmings and stem would be used as animal feed.
Source of Option:	• Consultant, Consultations
Proposed Strategic Alignment:	Goals: • 5. Maximize the recovery of materials and energy. • 7. Support, influence and partner with industrial sector. • 11. Collaborate with external stakeholders, including industry. Guiding Principles: • Honour the 5Rs hierarchy. • Protect the environment. • Adopt circular economy principles. • Embrace innovation. • Keep waste local.

Category:	Facility/infrastructure
Needs Assessment Alignment:	• Addresses the long term need to secure organics processing capacity beyond 2030. • Increases waste reuse opportunities.
Individual Producer Responsibility (IPR) Impact:	• Partial, as the impact of compostable packaging is unknown at this time. • These facilities are only able to process very clean food waste.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to clean food waste from Single Family (SF), Multi-residential (MR), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Creates product (animal feed) and closes the waste management cycle, supporting the circular economy. • Option does not contribute to the City's climate change goals as it does not allow for the capture and conversion of biogas to renewable natural gas (RNG).
Social Considerations:	• Depending on where a new facility is located, there may be community interruption with increased traffic, noise and potential odours. This would need to be addressed through an appropriate siting process and mitigative measures. • Potential for public concerns about odours and traffic. • Potential to generate short- and long-term jobs as part of constructing and operating a new facility. • Minimal to no health impacts anticipated when in compliance with Environmental Compliance Approval (ECA).

Category:	Facility/infrastructure
Technical/ Operational Considerations:	• The target organic feedstock may depend on technology used and end market requirements. This requires a very clean stream of food scraps and would require a separate collection system. Feedstock such as LYW, diapers, pet waste and sanitary waste could not be used in the application. Plastic bags used to bag organic material would need to be separated from the organics as they are not accepted as feedstock. • The City would need to continue its Green Bin program, however not all material currently accepted could be accepted by such a facility (e.g., tissue/toweling, acceptable fibres, LYW, plastic bags, pet waste). A separate collection system and processing is required for all non-food waste. • Some applications require pre-consumer feedstock, such as in food production or preparation. Others can handle a clean stream of post-consumer food waste only, not including other compostable materials, pet waste, etc. • Would need to identify an end market for finished animal feed product. LYW, diapers, pet waste, sanitary waste, and contaminants not suitable for animal feed would require disposal in landfill.

Category:	Facility/infrastructure
Regulatory Considerations:	• A multi-media Environmental Compliance Approval (ECA) is required from the Province for a Waste Disposal Site (Processing), and Air. • Potential for an ECA for Industrial Sewage, depending on where the facility is located and whether there are any outdoor operations. The ECA and other approvals (e.g., municipal approvals for land use planning, zoning, and site plan) may take one to two years to complete. • Land use planning (e.g., Official Plan, Zoning, Site Plan) approvals would be required for a new facility, depending on the site. • Animal food production is regulated by the Canadian Food Inspection Agency (CFIA) and approvals would be required to market and sell any products to be used as animal feed products or ingredients. • Management of food and organic waste from single family homes will continue to be a municipal responsibility under the Ontario Food and Organic Waste Policy Framework and Policy Statement. Through this framework, the province has set targets for waste reduction and resource recovery of food and organic waste of 70% for single-family dwellings in urban areas by 2023 and 50% for multi-residential buildings by 2025. • In September 2020, the Province clarified the types of organic waste to be managed. Food waste, inedible parts of plants and animals from food preparation and pet food waste shall be included; soiled paper products, coffee filters, tea bags, compostable coffee pods and compostable bags should be included; and managing diapers and pet waste is encouraged. The Province also encouraged municipalities and organic waste processors to update existing or adopt technology that could process compostable products and packaging. • Option is in line with the Province's direction as part of the Food and Organic Waste Framework to "increase the use of innovative technologies", "recover resources from food and organic waste", "support resource recovery infrastructure", and "prohibit disposal of organic waste". The Framework also speaks to supporting beneficial uses which promote soil health, crop growth and enhance carbon storage.

Category:	Facility/infrastructure
Financial Considerations:	• Depending on the type of facility/technology, size, capacity and incoming feedstock of the facility, the capital and operating costs can vary. Capital costs for a 90 tonne/day facility are estimated to be medium/low ($10-$50 million). Operating costs are estimated to be medium ($1-$3 million) for an 80 tonne/day facility.[116] • A significant promotion and education campaign would be required to ensure only food wastes are collected. • The ECA and other approvals (e.g., municipal approvals for land use planning, zoning, and site plan) would be in the low-cost range (<$1 million). • Financial viability would require a market for end-products.

[116] Based on a facility located in Santa Clara, CA, see case study below for additional details.

Category:	Facility/infrastructure
Unknowns/ Assumptions:	• Option will require a detailed business case and feasibility study, including waste stream analysis to confirm potential for successful outcomes. • The level of public input and opposition during the siting process and development of a new facility is unknown. • The City would need to identify a suitable location for a facility, ideally located in an industrial area of the City with comparable uses. • Time required to have a new facility operational is unknown and will vary depending on factors such as the availability of a suitable site, facility design, procurement method (tender, design/build), permitting and approvals, and construction time. • At this time, it is unknown how IPR, or other federal or provincial initiatives will impact the quantities of organics in the garbage stream which could be recovered. • Unknown if or when the Province will implement a ban on the landfill of organics, currently planned for 2030. • Unknown if or when the Province will introduce regulations to support the 50-70% food and waste recovery targets. • The impact of future food waste reduction initiatives could lower the amount of material requiring collection and processing is unknown. • Lack of data on quantities of food waste collected from certain customers and the resulting uncertainty on potential organic quantities to be managed under this option in the future. • Procurement model for development of a facility is unknown, as well as the ability/appetite to partner with other municipalities to fund/develop a facility. • Availability of non-municipal sources of funding to support the project. • Unknown on potential markets for animal feed and other by-products. • Unknown what approvals may be required and if end-products would receive approval (e.g. from CFIA).

Category:	Facility/infrastructure
Supporting System Requirements for Success:	• Ensuring food waste is separated at source with very few contaminants would be required. • Option will require a detailed business case and feasibility study, including waste stream characterization and tonnage estimates analysis to confirm potential for successful outcomes. • Alternative processing facilities would be necessary to process other types of organic waste, including LYW. • Engineering design and construction of a new processing facility. • Markets for outputs are required (e.g., animal feed). • Disposal facilities are required for some materials (e.g., residual). • The City may need to partner with the technology provider, and likely would not develop/operate the facility due to the proprietary nature of the process (i.e. for black soldier flies). An alternative could be to contract out the processing to a third-party. • Depending on facility location and number of processing locations, use of waste transfer stations may be required to support efficient collection operations. • A separate organics collection system and processing facility would still be required for all non-food waste organics.
Potential Outcomes:	• This processing technology does not produce renewable energy, therefore does not contribute to achieving the City's climate change goals. • Animal feed product created from organic food waste.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes received, processed, residual and products generated.
Case Study 1:	• Sustainable Alternative Feed Enterprises (SAFE), Santa Clara, CA - This 91 tonne/day facility takes food waste from single family residences. A pre-processing stage is used to remove contaminants and mechanically breakdown the feedstock, then materials go through a dehydrator, a sterilizer, and an extruder press. In addition to the extruded feed pellet, water and clean fats, oils and grease are extracted. The product can be fed to non-ruminant animals (cats, dogs, pigs, etc.). For a 50,000 tonne/year facility, approximately 9,000 tonnes of animal feed would be produced annually. • The capital costs for the facility were approximately $13 million CAD ($10 million USD). Annual operating costs are about $102/tonne CAD ($79/tonne USD).

Category:	Facility/infrastructure
Case Study 2:	• Enterra Feed Corp.[117] opened its first insect-based food waste processing facility in Langley, B.C. in 2014 and recently opened another in Calgary, AB in 2020.[118] The company was the first in Canada to receive regulatory approval to produce animal food ingredients from black soldier flies. The facility processes 130 tonnes/day of food waste and agricultural byproducts from food processors using black soldier fly larvae. Black soldier flies grow very quickly in controlled conditions and convert the food waste into protein and fat. Outputs of the facility include whole dried larva sold as bird/chicken treats or as an ingredient in pet foods/animal feed, protein meal made from the larva, an oil product made from the larva and an organic fertilizer from the manure or “frass” from the larvae.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[117] https://enterra.com/about/

[118] https://www.cbc.ca/news/canada/calgary/british-columbia-alberta-fly-larvet-bug-insect-pet-food-plant-1.5878726

6A4 – Co-digestion of Sewage and Organics at ROPEC or Co-location of Anaerobic Processing Facility for Organics at ROPEC

Category:	Facility/infrastructure
System Overview:	• This option explores the co-digestion/co-location of a new anaerobic digester to process household organics at the City's Robert O. Pickard Environmental Centre (ROPEC) wastewater treatment facility, which currently uses anerobic digestion (AD) to process sewage sludge. • Household organic waste includes food waste, soiled paper products and pet waste materials collected in the City's green bin program, as well as diapers. • Household organic waste would be mixed with municipal sewage sludge and anaerobically digested at ROPEC to produce biogas, which can be used in boilers, upgraded into renewable natural gas (RNG), or combusted to create electricity. The process also produces biosolids, which can be land applied as a fertilizer. • Co-digestion of household organic waste in wastewater treatment facilities can be a viable option to utilize existing assets where capacity exists in these plants, as major modifications to the facility are generally not necessary, except to add receiving, pre-treatment and feed equipment for the household organic wastes.[119] • The City is currently undertaking a Biogas Optimization Study, which is exploring the opportunity to generate additional biogas through the processing of the City's green bin organic waste at ROPEC. Preliminary results from the Study have indicated that, given the future wastewater treatment needs to manage population growth in Ottawa, the amount of green bin household organic waste expected to be managed by the City over the next 30 years, and potential risks associated with process upsets at ROPEC from co-digestion of organics, that co-location of an independent digester at ROPEC to process green bin organics, either with on-site or off-site pre-treatment would be the optimal option for future consideration by the City. • Co-location could offer many benefits, including existing in-house staff expertise in AD technology operations, facility maintenance and management, pre-existing environmental compliance approvals for the acceptance of organics and the ability to centralize biogas conversion technologies at a location currently producing and upgrading biogas to generate renewable energy. It also offers the advantage of having the site for a future facility already identified.

[119] https://www.ec.gc.ca/gdd-mw/3E8CF6C7-F214-4BA2-A1A3-163978EE9D6E/13-047-ID-458-PDF_accessible_ANG_R2-reduced%20size.pdf

Category:	Facility/infrastructure
System Overview:	• In support of this option, the City could also consider allowing the use of independent in-sink grinding and disposal units to make organics diversion more convenient for some residents, such as those living in multi-residential buildings or for small businesses such as restaurants. Organic material disposed of in these units would enter the City's sanitary sewer system and be directed to ROPEC for processing with sewage sludge. • Leaf and yard waste (LYW) is typically not suitable for anaerobic digestion due to its low biogas yield potential. As such, LYW would have to be collected and processed separately and is not considered as part of this option. Refer to Option 6B1 – Separate Composting of LYW and Option 6B2 – Gassification of LYW.
Status:	• Proven • Proven technology for sewage treatment. Emerging technology for co-digestion of sewage sludge and household organics jointly.
Source of Option:	• Consultant, City Staff, Consultations
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. • 5. Maximize the recovery of materials and energy. • 6. Aspire to achieve 100% GHG emission reductions. • 9. Minimize costs to taxpayers. Guiding Principles: • Honour the 5Rs hierarchy. • Adopting circular economy principles. • Embrace innovation. • Keep waste local.

Category:	Facility/infrastructure
Needs Assessment Alignment:	• Addresses the long term need to secure organics processing capacity beyond 2030. • Tied to the need to determine what energy recovery technology/ies or approaches that will be employed to recover as much energy as possible form the waste stream and create renewable energy from this waste. • Aligns with the City's Energy Evolution Strategy direction by considering technology that can work towards having all organic waste generated within the city's boundaries being routed to anaerobic digestors or gasification by 2030. • Would be a component of the Organics Resource Recovery Strategy project outlined in the Energy Evolution Strategy.
Individual Producer Responsibility (IPR) Impact:	• Partial, however the direction the Province is moving with respect to impact of compostable packaging and source separated organics programs is unknown at this time.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to organic waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Co-digestion would produce Non-Agricultural Source Material (NASM), which requires land application. • Has the potential to reduce the amount of greenhouse gas (GHG) emissions by displacing fossil fuels. • GHG emissions from collecting green bin material may change, as the current organics processing facility is more centrally located and would require LYW to be collected separately from other green bin household organic waste. • Option contributes to the City's climate change goals, as it allows for the production of biogas and subsequent use or purification to RNG. Note: the emission reduction contribution from making electricity with biogas is much smaller than conversion to RNG. • If organic material is conveyed via the City's sanitary sewer system, this may have the potential to reduce GHG emissions associated with the current approach of collecting and transporting green bin material using vehicles.

Category:	Facility/infrastructure
Social Considerations:	• There is potential for nuisances due to increased truck traffic and odour from trucks transporting green bin material. • There may be some resistance initially tied to not allowing LYW to be placed in green bins. Additional education and potentially enforcement may be required. • If in-sink disposal units were permitted as a way to manage organic waste, promotion and education on acceptable materials and proper use of units to avoid blocked pipes would be required.
Technical/ Operational Considerations:	**Collection System** • Determination as to whether in-sink disposal units would be allowed in all homes or just multi-residential homes. Consideration could also be given to allowing restaurants to use in-sink disposal units. • Allowing the use of in-sink disposal units would require an assessment of impacts on the wastewater collection system (e.g., capacity, potential for blockages, combined sewer overflows and impacts on maintenance) and wastewater treatment plant capacity to handle additional volumes of wastewater with a higher solids content. • Collection contracts would need to be revised to provide separate collection of LYW from green bin materials.

Category:	Facility/infrastructure
Technical/ Operational Considerations:	**ROPEC** • The City has experience with operating and maintaining the ROPEC wastewater treatment facility. • Need to determine current and future processing requirements foe green bin organics, for example, tonnes to be processed and feedstock composition, for example, whether or not diapers would be included. • Waste audits would have to be conducted to determine the availability of organic material available to be processed at ROPEC. • Would need to confirm the findings of the Biogas Optimization Study with respect to co-location of a separate organics processing facility on the site and undertake a feasibility study to identify requirements and determine if the site is able to meet these requirements. • Determine how a green bin/sludge co-digestion process could be integrated into the ROPEC wastewater treatment facility if co-location is deemed not feasible. • The preferred approach would need to be integrated into the ROPEC Master Plan. • Would have to undertake a planning, design, procurement and approvals process to implement any ROPEC modifications to accommodate the processing of green bins organic material and integrate into the facility operation and maintenance, including consideration of increased truck traffic and a new unloading zone for organics. • Facility modifications will be required to operate in compliance with the ROPEC Environmental • Compliance Approval, including air pollution control systems that comply with emission and environmental requirements. • Potential challenges with processing compostable products and packaging through anaerobic digestion. Compostable products and packaging and other contaminants in the feedstock would need to be considered in pre- and post-processing facility design. • The quantity of Non-Agricultural Source Material (NASM) generated that requires storage, handling and disposal would likely increase. • The City would need to identify end market(s) for finished products, including NASM and RNG and digested materials. • Additional staff may be required to operate and maintain a co-located facility.

Category:	Facility/infrastructure
Regulatory Considerations:	• An amendment to the ROPEC Environmental Compliance Approval (ECA) would be required to expand the facility to process green bin materials. • An amendment to Sewer Use By-law would be required to allow the use of in-sink disposal units. • Management of food and organic waste from single family homes will continue to be a municipal responsibility under the Ontario Food and Organic Waste Policy Framework and Policy Statement. Through this framework, the Province has set targets for waste reduction and resource recovery of food and organic waste of 70% for single-family dwellings in urban areas by 2023 and 50% for multi-residential buildings by 2025. • In September 2020, the MECP clarified the types of organic waste to be managed. Food waste, inedible parts of plants and animals from food preparation and pet food waste shall be included; soiled paper products, coffee filters, tea bags, compostable coffee pods and compostable bags should be included; and managing diapers and pet waste is encouraged. The Province also encouraged municipalities and organic waste processors to update existing or adopt technology that could process compostable products and packaging. • This option is in line with the Province's direction as part of the Food and Organic Waste Framework to "increase the use of innovative technologies", "recover resources from food and organic waste", "support resource recovery infrastructure", and "prohibit disposal of organic waste". The Framework also speaks to supporting beneficial uses of the digestate, which promotes soil health, crop growth and enhance carbon storage. The policy also encourages maximizing use of energy captured from anaerobic digestion facilities and promoting end-products like renewable natural gas. • Consideration should be given to the Province's Food and Organic Waste Policy Statement under the Resource Recovery and Circular Economy Act, 2016, which encourages municipalities to consider co-management of biosolids.

Category:	Facility/infrastructure
Financial Considerations:	• Depending on the type and quantity of incoming feedstock and the scale of upgrades necessary at ROPEC, the capital and operating costs will vary. Based on preliminary results of the City's Biogas Optimization Study, capital upgrades required to ROPEC to co-locate a new digester to process the City's food waste portion of the green bin organic waste are estimated to be medium ($50-$100 M), which is dependent on the design capacity of the new digester system and the annual tonnage received. The incremental operating costs are estimated at approximately $4M per year[120]. • If the City achieves its target of 100% capture of organic waste, a facility capable of managing up to 1564,000 tonnes per year of household organics by 2052 would be required, based on projections of household organics and garbage. • Potential revenue streams from an anaerobic digester can range significantly depending if the biogas is used in heating/ electrical applications. The ROPEC wastewater treatment facility could utilize the energy generated from the facility to reduce its energy costs. This option could also provide a potential revenue stream if biogas is upgraded and converted into a renewable energy commodity that is sold. • Use of biogas as RNG would require upgrading the gas to remove contaminants and moisture and transporting the compressed gas to the property line to connect to the natural gas grid. Costs are estimated to be in the range of $5-$7M, based on recent costing for projects in Ontario and Alberta, and would include the membrane upgrader, hydrogen sulfide scrubber, condenser, piping, blowers, control panels, small building to house equipment, easements and interconnections. • A promotion and education campaign would be required to promote any changes in materials accepted in the green bin program, such as the removal of LYW and the acceptance of compostable products and packaging. • A separate promotion and education program would also be required if residents were permitted to use in-sink disposal units for food waste. • There may be additional costs associated with the separate collection and processing of LYW.

[120] Assumes approximately $80 per tonne based on a large-scale food waste wet AD facility and a projected quantity of food waste in the green bin organic waste stream in 2030 is 53,000 tonnes. This cost is dependent on total quantity of feedstock and the $ per tonne value increases for smaller scaled facilities. The costs do not include any biogas utilization CAPEX or OPEX and are based on the results of our Technical Memorandum #1 – Review of Additional Biogas Production Options

Category:	Facility/infrastructure
Unknowns/ Assumptions:	• Assume household organic waste will be digested at ROPEC, but not LYW. • How household organic material would be transported to ROPEC is not known at this time i.e. via sanitary sewer, vehicles or a combination of both. • Where separately collected LYW would be processed is not known. • Limited data on quantities of household organic waste collected, resulting in uncertainty of potential quantities to be managed in the future. • At this time, it is unknown how IPR, or other federal or Provincial initiatives will impact the composition of the feedstock or quantities of organics in the garbage stream which could be recovered. • Unknown if/when the Province will implement a ban on the landfill of organics. Currently reported to be 2030. • Unknown if/when the Province will introduce regulations to support the 50-70% food and waste recovery targets. • The impact of future food waste reduction initiatives could lower the amount of material requiring and processing is unknown. • Many existing anaerobic and co-digestion facilities have challenges with processing compostable products and packaging. With more emphasis on the reduction of single-use plastics, an increase in single-use compostable items may occur, which will likely end up in Green Bin programs. If the processing technology cannot process these compostable items, more residual will end up requiring disposal, which cost and GHG emissions. • Unknown who would utilize the biogas generated and what the potential revenue streams would be from the sale of electricity or RNG. • Unknown what the impact of including household organics would be on the NASM currently produced at ROPEC, from a quality and quantity perspective and what potential uses and end markets would be. • It is assumed that unused land at the ROPEC site could be used to expand infrastructure as required to meet co-digestion requirements. • Time required to have ROPEC facility modifications operational is unknown. Variables include factors such as the complexity of the facility design upgrades, procurement method (tender, design/build), permitting and approvals, and construction time. Shortened timeframes may be possible with use of an existing site with an ECA. • Availability of non-municipal sources of funding to support this option is unknown.

Category:	Facility/infrastructure
Supporting System Requirements for Success:	• Separate collection and processing of LYW. • Completion of ROPEC Master Plan and the Biogas Optimization Study. • Completion of a study on total trucking distances for a more detailed comparison between locating at ROPEC in comparison to more centralized location. • Potential requirement for use of transfer stations to enhance collection efficiencies. • Completion of a feasibility study and/or business case to confirm feedstock and processing requirements for co-digestion of green bin materials and sewage sludge and site-specific requirements to integrate the process into the ROPEC operations. • Completion of a feasibility study and/or business case for co-location of an organics processing facility at ROPEC. • Completion of a feasibility study and/or business case and pilot testing of garburator use for managing organic waste stream as a supplementary option to Green Bin organics program. • Markets, infrastructure and resources for outputs of organics processes are required (digestate, NASM and biogas). • Engineering design and construction of facility modifications.
Potential Outcomes:	• Use of a City-owned facility to process household organics would ensure full control over a core component of the City's waste management system, reducing risks associated with reliance on contracted facilities (e.g., availability, cost increases, program changes) and also possibly benefit ROPEC operations. • Anaerobically co-digested organics and sewage sludge would produce a NASM product that needs to be land applied. • This facility would serve to extend replace processing capacity once the City's contract with Convertus expires in 2030. • It is noted that this option would contribute to the City's climate change goals as the anaerobic digestion process allows for the capture and conversion of biogas to RNG and reduce non-renewable energy used at ROPEC and through potential export of RNG to reduce community emission. • The biogas produced could be used on-site e.g. boilers (heat) and co-generators (electricity), potentially reducing operating costs. • Increased sanitary sewer maintenance requirements if in-sink disposal units are used.

Category:	Facility/infrastructure
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes of household organic material received, processed, digested material generated, as well as quantities of residual waste, biogas, heat, electricity and RNG produced.
Case Study 1:	• The Greater Lawrence Sanitary District (GLSD) wastewater treatment plant (WTP) located in North Andover, Massachusetts co-digests food waste and biosolids using anaerobic digestion to produce energy. GLSD serves approximately 168,000 households and hauled septage disposal from five municipalities at a single WTP. • The facility has a capacity of 378 megalitres per day (MLD) and currently treats approximately 197 MLD (52 million gallons per day). The methane produced is converted to electricity to be used for the plant's combined heat and power needs. Modifications to accept food waste at the wastewater treatment plant were made following the completion of a feasibility study in 2013. Process changes included the addition of two organic waste receiving tanks, an additional digester and energy recovery equipment.[121] • The City of Cambridge, Massachusetts recently (2018) implemented a curbside organics collection program and uses a facility owned by Waste Management Inc. in Boston to process organics using the WM CORe® process to convert food waste into a slurry which is delivered to the GLSD WTP. Waste Management Inc. has similar food waste pre-processing facilities in New York and Los Angeles.

[121] https://www.glsd.org/wp-content/uploads/2020/10/GLSD-Featured-in-NEWEA-Journal-Fall-2020-1.pdf

Category:	Facility/infrastructure
Case Study 2:	• The City of Stratford, ON is currently working on a renewable natural gas project at its Water Pollution Control Plant (WPCP). The City will combine their green bin organics with their sewage sludge and anaerobically digest the product. The biogas harvested from this process would be upgraded into renewable natural gas and injected into the grid. In January 2020, the City of Stratford approved the upgrading of the existing WPCP to allow co-digestion and production of renewable natural gas utilizing organic material, including options for sorting product at other facilities. It is estimated that the site would accept up to 20,900 tonnes per year of solid organic waste and 5,000 tonnes per year of liquid organic waste. • Stratford does not currently have a local pre-processing plant to prepare the organics and are currently reviewing the options to process onsite and processing at other facilities Pre-processing off-site would result in additional truck traffic to haul the now liquid waste to the WPCP. Based on design flows, this would require six trucks/day to the site vs the proposed three trucks/day delivering unprocessed solid waste.
Case Study 2: (continued)	• The total cost of the project is currently estimated at $22.7 million (2020). The City of Stratford received a grant from the Province of Ontario for a total of $5M, which would contribute to the upfront cost for facility upgrades. The grant was awarded for this proposed project because of the greenhouse gas emission reductions it generates, diversion of waste from landfill, and the offsetting of utilizing fossil fuel derived natural gas. Revenue would be generated from receiving tipping fees from waste providers, as well as from the sale of the RNG. A revenue sharing arrangement would also need to be finalized with the City's partners. • The preferred partnership model for the project is a Municipal Services Corporation, with the City of Stratford and the Ontario Clean Water Agency (OCWA) as the partners.122
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[122] https://www.stratford.ca/en/inside-city-hall/renewable-natural-gas.aspx

6A5 - On-Site Organics Management

Category:	Program

System Overview:	• City would support on-site management of organic waste by residents to help reduce the amount of material collected and managed by the City through its waste management programs. On-site management of organic waste could be supported through policies and by-laws that permit on-site activities and be supported through promotion and education.
	• A number of approaches could be used to manage organic waste at the source, depending on the type of organic waste that the site is generating and the level of effort the property owner is willing to expend.
	• On-site management of organics can include:
	  ○ Backyard aerobic composting to produce compost for use in gardens;
	  ○ Vermicomposting using insects or worms to decompose organic waste (e.g., household organics, leaves) into compost;
	  ○ Feeding food waste to animals (e.g., chickens, pigs, goats); and
	  ○ In-home personal composters (e.g. dehydrators and accelerated compost making units).

Status:	• Proven/Emerging • Backyard compositing, vermiculture and feeding food waste to animals are proven approaches to manage food waste on-site. Many municipalities sell backyard compost units at a discounted price to encourage management of fruit, vegetable and yard wastes, however, this is typically done when municipal collection programs are not provided. Some offer education programs on how to compost at home, including building compost units. • Municipal programs that support individual sustainability, food security and urban agriculture (e.g., gardening, permitting urban chickens) are emerging.
Source of Option:	• Consultations

Category:	Program
Proposed Strategic Alignment:	Goals: • 3. Maximize the reuse of waste generated. 8. Maximize participation by enhancing the accessibility, convenience • 9. Minimize costs to taxpayers. • 10. Make sustainable waste management design an essential part of the City's planning process. Guiding Principles: • Honour the 5Rs hierarchy. • Adopting circular economy principles. • Keep waste local.
Needs Assessment Alignment:	• Provides opportunities for waste reduction and reuse by residents. • Would be a component of the Organics Resource Recovery Strategy and achieving the organic waste diversion targets outlined in the Energy Evolution Strategy.
Individual Producer Responsibility (IPR) Impact:	• Not impacted by IPR.
System Consideration:	• Secondary – will be a program to overlay onto core system.
Sector Applicability:	• Applicable to organic waste from all sectors on a site-specific basis, depending on type of waste generated and availability of space on interested properties: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Diversion potential will be property specific and is likely minimal. • Unlikely to result in changes in greenhouse gas (GHG) emissions from the current baseline system, as collection will still be required for organic wastes that can't be reduced or managed at the source. • May be nuisance issues (e.g., vermin, noise, odours) and impacts to air/water quality if on-site systems are not properly managed. • Outputs can be used as a soil amendment.

Category:	Program
Social Considerations:	• Only property owners with sufficient space would be able to participate. • Participation would be voluntary. • May be of interest to property owners striving to be more sustainable and reduce their environmental impact or those with gardens that have a use for compost. • May be public resistance to permitting urban agriculture (e.g., urban chickens) and potential for community interruption with increased noise (e.g., rooster crowing), vermin, smells, etc.
Technical/ Operational Considerations:	• Main level of effort would be associated with development, implementation and enforcement of supportive programs, policies and by-laws. • Promotion and education would be required to support the program that is developed. • City may need to partner with an organization to supply backyard composters or vermiculture kits or find a means to sell or distribute them, if this approach was taken.
Regulatory Considerations:	• In urban and suburban areas of the City not zoned for agricultural purposes, the keeping of domestic farm animals and fowl such as horses, donkeys, mules, cattle, goats, swine, chickens, ducks and geese is currently prohibited. • By-laws would need to be amended or developed and approved by Council, e.g., property standards, zoning, to permit small scale urban agriculture. • Larger scale systems may require permits and approvals and would be the responsibility of the property owner.
Financial Considerations:	• Minimal to no capital costs would be required and would be the responsibility of the property owner. • Operating costs for promotion and education programs and policy/by-law development would be low (<$100,000) to medium low ($100,000-$500,000), depending on the type of program that is provided. • May have an impact on enforcement staff to inspect or address complaints.

Category:	Program
Unknowns/ Assumptions:	• Level of interest by property owners is unknown. • It is assumed that any capital and operating costs for on-site systems would be the responsibility of the property owner. • Unknown if/when the Province will implement a ban on the landfill of organics. • Unknown if/when the Province will introduce regulations to support the 50-70% food and waste recovery targets. • It is unknown if the community would support re-zoning urban and suburban areas to support the keeping of domestic farm animals such as chicken, pigs and goats.
Supporting System Requirements for Success:	• Collaboration with other City departments in development of by-laws. • Approval from Council to amend by-law to allow the keeping of domestic farm animals. • Promotion and education would be required to raise awareness about options to manage organic waste on-site. • A green bin collection program would still be required.
Potential Outcomes:	• Composted organics would be used on individual properties. • Reduction of food waste at the source could lower the amount of organic material requiring collection and processing. • Onsite management of organic waste could contribute to a reduction in community GHG emissions.
Measurement:	• Difficult to measure, as material would no longer be managed by the City. • May see a reduction in quantities of green bin organics collected which would be reflected in waste audits.

Category:	Program
Case Study 1:	• The City of Edmonton, AB, operates a Master Composter Recycler[123] program to train volunteers to teach others about composting and the City's waste diversion programs. Volunteers receive 40 hours of free training about the City's programs, composting and vermicomposting. Master Composter Recyclers are required to provide 35 hours of volunteer time. • The City provides resources about backyard composting and vermicomposting on its website. • The City also has an urban hens programs.[124] Applicants must complete an urban hen keeping course that is approved by the City, and it is recommended that sites have support from a recognized mentor. Prior to submitting an application, neighbours must be notified and neighbours have two weeks to respond to the City with any concerns. Applicants must obtain a Provincial premise ID and a hen keeping license. Once an application has been processed it is sent to development review and applicants must apply for an urban garden permit and a residential electrical permit if the coop will have electricity. • The City also provides curbside collection of food scraps collected weekly from spring through fall and bi-weekly during winter months. Leaf and yard waste can be put in the food scraps cart, as long as the lid can close, and is also collected seasonally (spring and fall), with two collections provided in each season.

[123] https://www.edmonton.ca/programs_services/volunteer/master-composter-recycler-course.aspx

[124] Urban Hens Program: City of Edmonton

Category:	Program
Case Study 2:	• The City of Hamilton, ON sells backyard composters for $35 plus HST at municipal service centres. The City provides some resources to assist with backyard composting on its website. • Interested residents have been trying since 2012 to implement a pilot project for urban hens. Most recently, in 2020, a motion to study a pilot project was again defeated. Issues such as odour, neighbourhood disputes, lack of support for livestock in an urban area and health concerns were cited as reasons for not pursuing the pilot project.[125] • The City has a weekly green bin organic waste collection program for household organic waste, including food waste, and separate weekly leaf and yard waste collection from late March to early December. Leaf and yard waste is not accepted in the green bin.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[125] eSCRIBE Minutes (escribemeetings.com)

6B1 – Separate Composting of Leaf and Yard Waste

Category:	Facility/Infrastructure
System Overview:	• Leaf and yard waste (LYW) is currently collected either in the Green Bin, for processing at the City's contracted organics processing facility (Convertus), or bagged and bundled LYW is separately collected during peak periods for processing at the City's outdoor composting facility on Barnsdale Road. It is also accepted for drop-off at the Trail Waste Facility, where it is transported to the Barnsdale site for composting. • This option reviews processing all LYW separately from all of the other organic material that is accepted in the City's Green Bin program. Under this option, all LYW would be setout separately from the green bin and be collected and processed separately from the other organics material placed in the green bin. • LYW could be processed at the City's existing outdoor windrow composting facility on Barnsdale Road or at another location/s. • This option could be implemented prior to or when the Convertus contract ends in 2030. • Based on estimates of projected tonnages, approximately 67,000 tonnes of LYW will require management in 2052[126].
Status:	• Proven • Separate collection and composting of LYW at the Barnsdale Road outdoor windrow composting facility is a proven method for the City to manage this material. • Municipalities have traditionally managed LYW separately from household organics. LYW can be easily composted outdoors with minimal technology to produce a high-quality compost at a low cost. The City has been composting LYW in outdoor windrows since the early 1990's. • Some municipal Green Bin programs allow small quantities of LYW as part of their Green Bin programs, however, continue to manage the bulk of their LYW separately to reduce capital and operating costs. LYW volumes fluctuate seasonally and can cause operational upsets at organics processing facilities when managing peak volumes, carbon-nitrogen ratios etc.
Source of Option:	• Staff

[126] Based on 2019 tonnes and composition and Long-Term Waste Management Needs Technical Memorandum forecast.

Category:	Facility/Infrastructure
Proposed Strategic Alignment:	Goals: • 5. Maximize the recovery of materials and energy. • 9. Minimize costs to taxpayers. Guiding Principles: • Honour the 5Rs hierarchy. • Utilizing the triple bottom line to balance environmental sustainability, City and community desires, and fiscal responsibility. • Keep waste local.
Needs Assessment Alignment:	• Tied to the future Green Bin processing capacity needs, the City needs to consider potential options to manage future quantities of LYW, both in the short and medium term. • Addresses the short term need to secure organics processing capacity prior to 2030 and secure capacity beyond 2030. • Composting LYW at the Barnsdale Road outdoor composting facility does not address the need to recover energy and the Energy Evolution Strategy Renewable Natural Gas strategy project.
Individual Producer Responsibility (IPR) Impact:	• None.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to LYW waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Separate collection of LYW could result in an increase in greenhouse gas (GHG) emissions. • Any processing site or facility will be required to operate in compliance with the applicable requirements under O. Reg. 101/94: Recycling and Composting of Municipal Waste. • Compost would be generated from the processing of LYW.
Social Considerations:	• There may be some resistance initially tied to not allowing LYW to be placed in green bins. Additional education and potentially enforcement may be required. • Residents may be able to obtain the compost that is created for free or a nominal fee.

Category:	Facility/Infrastructure
Technical/ Operational Considerations:	**Collection** • The current curbside collection contract provides for separate collection of LYW for ten weeks per year. Collection contracts would need to be revised to provide additional weeks of separate collection of LYW from green bin materials. **Outdoor Windrow Composting Facility** • The City has experience with aerobically composting LYW at the Trail Waste Facility and Barnsdale Road facility. • The 9-hectare Barnsdale site is large enough to manage future quantities of LYW, however it would require upgrades to the composting area to optimize the use of the available space to accommodate additional LYW to meet future processing needs and provide a good operational surface for windrow turning. • The site is operated by landfill staff and additional staff may be required in the future to process additional LYW. • Optimizing the use of the existing composting area would allow the site to continue operating under permit by-rule requirements under O. Reg. 101/94, without triggering the need for an Environmental Compliance Approval. • Under current operations, there is no requirement for facilities for staff or stormwater management and it is assumed that this would continue. • Would need to determine if one or more composting sites would be required. This work could be carried out as part of Option 5D3 – Collection Efficiencies Study. • Some LYW is required at the current Convertus facility to support the in-vessel composting process. This requirement will be in place until 2030. • If anaerobic processing technology will be used to process the City's organics after 2030, then LYW will need to be processed separately. • A cost benefit analysis that considers the cost of both separate collection and processing of LYW will need to be undertaken to determine the overall benefit of this option. While costs to process LYW outdoors are lower than the cost to process LYW with household organics at Convertus, the costs to separately collect LYW are likely significant.

Category:	Facility/Infrastructure
Regulatory Considerations:	• The City is currently required to collect and compost LYW under O. Reg. 101/94: Recycling and Composting of Municipal Waste, under the Environmental Protection Act. • The City must also adhere to the permit by rule requirements under under O. Reg. 101/94.
Financial Considerations:	**Collection of LYW** • Increased collection costs associated with additional separate collection of LYW. • Collection cost increases may be offset by lower processing costs at the Barnsdale Road facility, compared to processing costs at Convertus. • Promotion and education related to the need to separate LYW from other green bin materials accepted in the Green Bin program. **Outdoor Windrow Composting Facility** • Capital costs to expand the Barnsdale Road composting facility are expected to be low (<$10 million) and are estimated to be between $9-$10 million. These costs would be for the installation of a composting pad to facilitate turning operations and upgrades to the existing composting area to more efficiently manage the anticipated tonnage of approximately 67,000 tonnes per year of material. These costs would include design, site works, base preparation, storm/ground water management controls and installation of a concrete pad. • Annual operating costs are expected to be low (<$1 million). • Sale of the finished compost could be used to offset the costs of collection and processing. • Separate collection of LYW will reduce the capacity requirements of a future organics processing facility for household organics, hence reducing capital costs for such a facility. • Would result in lower processing costs at current organics processing facility if more LYW was re-directed to outdoor windrow composing.
Unknowns/ Assumptions:	• It is assumed that additional weeks of separate curbside collection of LYW are required. • It is assumed there is sufficient space at Barnsdale to process more LYW. • It is unknown if there are other suitable locations across the City that would be suitable as future outdoor windrow composting sites. • It is unknown how much, if any, LYW the current or future source separated organics processing technology may be required as amendment for processing operations.

Category:	Facility/Infrastructure
Supporting System Requirements for Success:	• Will require a detailed business case to determine overall cost implications, considering additional costs associated with an increase in the number of weeks LYW would be collected separately and reduced processing costs from sending LYW to a dedicated outdoor composting facility (either Barnsdale or a new site/s). • Expansion of the Barnsdale Road outdoor composting facility within the current operating footprint would need to be reviewed to ensure setbacks from public-right-of ways are maintained. Expansion of the site could be staged to allow operations to continue as long as possible under permit-by-rule approvals. • This work would need to be undertaken in coordination with current and future organics management options, including anaerobic digestion of organics, which is not capable of processing LYW. • Will require coordination with other curbside collection system studies and future changes being considered as part of the Solid Waste Master Plan. • Resident participation to separate LYW from household organics.
Potential Outcomes:	• Additional weeks of separate collection of LYW allows the City more control of where LYW tonnages are processed and therefore processing costs. Lower LYW processing costs if additional LYW is processed at a dedicated outdoor windrow composting facility compared to current operation of sending it to Convertus for processing. • Potential for increased collection costs related to separately collecting all LYW. • Supports anaerobic processing technology option and the opportunity to work towards the City's climate change goals when considered in conjunction with anaerobic digestion.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes received and processed, tonnes of compost produced and revenue generated from the sale of compost.
Case Study:	• Collecting and processing LYW separate from green bin materials is a common practice by municipalities to limit quantities of organic materials that require processing at organics processing facilities, typically at a higher cost. • Many of these facilities compost LYW separately from household organics at a separate outdoor LYW processing facility. • Examples include Halton Region, Peel Region, Niagara Region and the cities of Toronto and Hamilton.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

6B2 – Gasification of LYW

Category:	Facility/Infrastructure
System Overview:	• Currently, leaf and yard waste (LYW) is either collected with Green Bin setouts for processing at the City's contracted organics processing facility (Convertus) or separately collected during peak periods for processing at the City's outdoor composting facility on Barnsdale Road. • This option reviews the City developing a gasification facility to process LYW either prior to or when the existing processing contract ends in 2030. • Gasification involves converting solid or liquid carbon-based wastes into a gas at high temperature without combustion. The process converts solid organic material under controlled conditions of partial oxidation into fuel gases and other by-products. The fuel gas that is produced is known as syngas. Syngas primarily consists of carbon monoxide, hydrogen, methane, and other hydrocarbons. In some gasification processes, carbon dioxide and nitrogen gas can also be produced. • Syngas could be converted to renewable natural gas (RNG), aligning with the City's Energy Evolution's Renewable Natural Gas Strategy goal of using biogas and power to gas to generate RNG to displace fossil sourced natural gas on the gas grid. • Under this option, LYW would be collected and processed separately from Green Bin organics. • Based on estimates of projected LYW tonnages, approximately 67,000 tonnes of LYW will be available and require management in 2052[127].
Status:	• Emerging • Gasification is an emerging technology to recover energy from municipal waste, as described in Option 7A4 – Emerging Technologies. • As mentioned in the City's Energy Evolution Strategy, "the use of gasification with organic waste for the manufacturing of RNG is not a common technology today", particularly for LYW.
Source of Option:	• Staff

[127] Based on 2019 tonnes and composition and Long-Term Waste Management Needs Technical Memorandum forecast.

Category:	Facility/Infrastructure
Proposed Strategic Alignment:	Goals: • 5. Maximize the recovery of materials and energy. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Embrace innovation. • Keep waste local.
Needs Assessment Alignment:	• Aligns with the need consider potential options to manage future quantities of LYW, both in the short and medium term. • Aligns with the need to determine what energy recovery technology/ies or approaches will be employed to recover as much organics waste as possible form the waste stream and create renewable energy from organic waste to assist the City in achieving its climate reduction targets. • Would be a component of the Energy Evolution Strategy Organics Resource Recovery Strategy project and aligned with achieving the City's target of having all recovered organic waste generated within the City's boundaries routed to anaerobic digestors or gasification by 2030.
Individual Producer Responsibility (IPR) Impact:	• None.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to LYW waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Separate collection of LYW would likely result in an increase in greenhouse gas (GHG) emissions due to a requirement for more collection vehicles. • Gasification is not currently considered as diversion for managing waste or organic waste in Ontario. • Has the potential to reduce the amount of GHGs produced by displacing fossil fuels.

Category:	Facility/Infrastructure
Social Considerations:	• There may some resistance initially tied to not allowing LYW to be placed in Green Bins. • Additional education and potentially enforcement may be required. • Additional collection vehicles on the road may be seen as contradictory to the City's Climate Change goals. • There may be social benefit from the community knowing that gasification of these wastes is fighting climate change. • Depending on where a new facility is located, there may be community interruption with increased traffic and noise. This would need to be addressed through an appropriate siting process and mitigative measures. • Potential to generate short and long term jobs through the construction and operation of a new waste management facility. • Indigenous communities with a potential interest in the project would need to be consulted. Resistance from these communities would be expected if a facility has the potential to impact their traditional territory and land uses.

Category:	Facility/Infrastructure
Technical/ Operational Considerations:	**Collection System** • Collection contracts would need to be revised to provide separate collection of LYW from Green Bin materials. **Gasification** • The technology is not yet proven at a commercial scale. • Moisture content, calorific value and a homogeneous feedstock are important technical considerations. LYW may not be an appropriate feedstock due to its high moisture content. • Most facilities need a homogeneous feedstock, which requires pre-processing (e.g., shredding). • LYW is a seasonal feedstock, so the City would need to supply material year-round or shut down the facility during non-peak LYW season. Materials could be stockpiled in order to provide year-round operation, however some portion may naturally decompose when stored. • The City could consider supplementing the residential LYW with LYW from its forestry operations or other sources as needed. • May need to consider seasonal operation due to gas grid capacity limitations. For example, the grid has more capacity in the winter than summer. This would necessitate the stockpiling of LYW, which could pose a fire risk and some portion may naturally decompose. • The City would have to undertake a planning and siting process, procurement, approvals, implementation, operation and maintenance of a facility. • The level of effort for developing a facility is dependent on the procurement approach (e.g., design, build, operate). • Potential for increased operational and maintenance requirements associated with these types of facilities as the technology is more complex compared to the current approach of operating an outdoor windrow composting facility. • Training level of personnel required to operate a plant (e.g., specialized training such as stationary engineers). • A pipeline connecting the facility to the natural gas grid would be required. • Depending on the process, outputs may include a syngas, ethanol, light oil, a medium fuel equivalent to diesel, and a heavy oil, all of which would need stable markets.

Category:	Facility/Infrastructure
Regulatory Considerations:	• As there are no such facilities in Ontario, it is difficult to predict what approvals may be required. Gasification is defined as thermal treatment of waste under Ontario Regulation 101/07 – Waste Management Projects and would make the approval process comparable to that for a Waste to Energy facility. • An Environmental Screening Process (ESP) would be required. An ESP may take approximately two years and be in the low/medium cost range ($1-$3 million). • Depending on the level of public opposition, the ESP approval could be elevated to an Environmental Assessment. • A multi-media Environmental Compliance Approval (ECA) for waste and air would be required and the facility would be required to operate in compliance with the ECA. • Other approvals (e.g. municipal approvals for land use planning, zoning, and site plan) may take one to two years to complete and would be in the low/medium cost range ($1-$3 million). • There may be restrictions on the amount of LYW that can be stockpiled prior to processing. • The City is currently required to collect and compost LYW under O. Reg. 101/94 - Recycling and Composting of Municipal Waste, under the Environmental Protection Act.

Category:	Facility/Infrastructure
Financial Considerations:	**Collection of LYW** • It is anticipated that this option would have increased collection costs associated with separate collection of LYW. • Variability in LYW quantities based on growing season, disease, storm damage, etc. may affect amount of feedstock available for a gasification facility. • Large storage area potentially required, with resulting land requirements. • Promotion and education of collection changes. **Gasification Facility** • Separating out LYW from household organics will reduce the processing capacity requirements of a future organics processing facility, therefore potentially reducing capital costs for that facility. • Capital costs are highly dependent on facility design (technology) and capacity and are expected to be high (>$200 million) for a facility sized to manage 67,000 tonnes per year of LYW. • An Environmental Screening Process (ESP) would be in the low/medium cost range ($1-$3 million). • Costs for other approvals (e.g. municipal approvals for land use planning, zoning, and site plan) would be in the low/medium cost range ($1-$3 million). • Operating costs and fuel revenues are currently unknown. It is difficult to get accurate estimates of operating costs as there are very limited examples where gasification has been applied to LYW or a comparable feedstock. • The City would need to manage LYW to provide a year-round supply to the facility, which may increase operational costs. Seasonal operation of the facility would also have implications on operating costs. • Many operating gasifiers are privately owned/operated facilities and information on costing is considered proprietary and unavailable. • Overall costs capital and operating costs will be significantly higher than the current approach to processing separately collected LYW i.e. aerobic composting.

Category:	Facility/Infrastructure
Unknowns/ Assumptions:	• It is assumed that a separate collection system would be required for LYW. • Unknown if gasification would be permitted as a way to manage LYW (as per O. Reg. 101/94). Additionally, the Ontario Food and Organic Waste Policy Statement does not currently allow food and waste recovery targets to be achieved through recovery of energy, without concurrent recovery of nutrients. • The level of public input and opposition during the siting process and development of a facility is unknown. • It is unknown if there are any properties within or near the City that would meet all the criteria required for a new site (i.e., geotechnical characteristics, environmental sensitivity, allowable setbacks, etc.). • It is unknown how or if outputs could be used or marketed. Products produced will depend on facility configuration and production cost and markets. • Unknown if enough LYW will be generated to make a stand-alone facility financially viable or if partnerships with private industry producing biomass waste will be required. • Year-round capacity of gas grid to accept RNG produced from this process would need to be confirmed. • Timeframe to develop a facility is unknown as this type of facility has not been previously developed in Ontario. If the project was considered to be similar to an energy from waste facility, the expected timeframe from initiation of a project to facility operation would be over 10 years, based on the most recent facility developed in Ontario (Durham-York Energy Centre) as outlined in Option 7A3 - Mass Burn Incineration (Direct Combustion).
Supporting System Requirements for Success:	• Option will require a detailed business case and feasibility study in coordination with other organics management options, including tonnage estimate analysis to confirm potential for successful outcomes. • Coordination with other future collection system changes being considered by the City. • Markets for outputs of the gasification process is required. • Resident participation in leaf and yard waste program to support necessary diversion to gasification process.

Category:	Facility/Infrastructure
Potential Outcomes:	• LYW is seasonal and volumes fluctuate, making process control more difficult (e.g., managing peak volumes, odours). • Generate renewable fuels from waste, which can reduce GHG emissions and work towards the City's GHG reduction targets. • Higher capital and operating costs to manage this stream of material compared to current approach. • May align well with the implementation of anaerobic processing of Green Bin material, if this is the preferred approach to processing the City's organic waste after the current contract with Convertus expires in 2030. Anerobic digestion cannot process LYW. • May not meet the commitment made through the City's Energy Evolution Strategy's to gasify all LYW after 2030, due to extended timeframe to develop a gasification facility.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes received and processed. • Quantity of renewable energy produced per tonne of material processed could also be calculated.
Case Study:	• Gasification has not been used to manage municipal LYW. There is a biomass gasification plant in operation in Svenljunga, Sweden which has operated since 2008 and produces 14 MW of power. • As noted in Option 7A4 – Emerging Technologies, a gasification/pyrolysis technology is being used by Enerkem to convert 100,000 tonnes per year of municipal solid waste into biofuels (ethanol) and renewable chemicals.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

7. Waste and Energy Recovery

7A1 - Mixed Waste Processing (Mechanical Pre-sort only)

Category	Facility/Intructions
System Overview:	• A mixed waste processing (MWP) facility uses mechanical processing to recover recyclables and/or organics from garbage. MWP facilities do not typically process construction and demolition materials or textiles. • MWP starts with unsorted and unseparated solid waste from residential and/or commercial sources, being brought to a dedicated MWP facility. The material is typically off-loaded onto a tipping floor. Materials are first sorted on the floor using manual labour (if appropriate) and mobile equipment to remove larger or bulky items such as appliances, dimensional wood, metal, or large pieces of plastics that might clog or interrupt operations of the processing systems. Depending on the design of the facility, and types of materials received and recovered, materials are processed using largely mechanical processes (including in some cases artificial intelligence and robotics) to separate fibre, plastic, metal and glass containers, organics and small contaminants or primarily separation of organic material. The remaining material is shipped to a disposal facility (e.g. landfill) or another appropriate waste processing/conversion facility for further processing (i.e. into RDF). • This option would involve the development of a mechanical pre-sort facility only to recover some recyclables and organic materials and does not include facilities to process recyclables, organics or other materials (including into Refuse Derived Fuel (RDF)). • It is assumed this facility would recover organics not captured in the City's Green Bin program. • Applying the estimated overall recovery rate of 29-43 per cent to the projected tonnes of residential garbage for 2030, TWF capacity may be extended by an estimated 1 to 2 years, depending on the materials recovered.
Status:	• Proven • There are many examples of facilities in Europe and a few in the U.S. that have been operating for over 10 years. • Technology is considered innovative in Canada. • Some municipalities in Canada are exploring this technology, including the City of Toronto, Region of Durham and Region of Peel.
Source of Option:	• Consultant, Staff

Category	Facility/Intructions
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly4. Maximize the recycling of waste. • 5. Maximize the recovery of materials and energy. • 6. Aspire to achieve 100 per cent GHG emission reductions Guiding Principles: • Honour the 5Rs hierarchy. • Embrace innovation. • Keep waste local.
Needs Assessment Alignment:	• Aligns with the need to determine what, if any, waste recovery technologies or approaches will be employed to extend the life of the Trail Waste Facility landfill.
Individual Producer Responsibility (IPR) Impact:	• Partial impact. • There may be fewer recyclables (e.g. Blue Box materials) to divert from the waste stream with new Producer Responsibility programs that may recover more recyclables at the source (e.g. curbside). • There may be new types of compostable packaging such as compostable coffee pods that might be recovered through MWP, which will impact the composition of incoming feedstock. How this packaging will impact the waste stream is unknown. • How municipality could work with producers to recover and market recovered recyclables is unknown.
System Consideration:	• Core System Component
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).

Category	Facility/Intructions
Environmental Considerations:	• Estimated diversion potential of approximately29-43 per cent[128] from garbage, depending on materials recovered (noting the higher range includes diapers and based on recovery of Green Bin organics and some higher value plastics and metal). It is estimated that recovery of Green Bin organics could divert between 26 and 35 per cent of garbage from landfill. • Will be a reduction in GHG emissions associated with the diversion of recyclables and organics from landfill via avoidance of methane emissions. • Anticipated to be no/minimal GHG impacts associated with transportation of materials to/from this facility since material would be transported for processing or disposal anyway, especially if processing facilities are co-located with MWP presort facility. • Facility will be required to operate in compliance with Provincial ECA and will have no/minimal impacts to air/water. • Can help City work towards achieving GHG emissions reduction targets and objectives identified in the Energy Evolution Strategy through diverting high levels of organics from landfill.
Social Considerations:	• Depending on where the facility is located, there may be community interruption with increased traffic, noise and potential odours. This would need to be addressed through an appropriate siting process and mitigative measures. • Reliance on a back-end facility reduces the onus on the generator (i.e. the resident) to take responsibility for managing materials properly. • This option requires little resident effort. This will help recover materials that were improperly sorted by residents. There is a risk that this will not encourage any resident's behaviour change to reducing and/or sorting waste properly, which does not support some of the guiding principles and goals of the City but can be mitigated through policies and education focused on proper waste separation at the source. • Indigenous communities with a potential interest in the project would need to be consulted. Resistance from these communities would be expected if a facility has the potential to impact their traditional territory and land uses. • Potential to generate short- and long-term jobs as part of developing a new facility.

[128] Based on estimated recovery rates from Durham Region.

Category	Facility/Intructions
Technical/ Operational Considerations:	• City would need to undertake a siting process to identify a location to develop a new MWP facility. • Would require a high level of effort for the City to undertake a planning and siting process, procurement, implementation, operation and maintenance of a facility. • Lower quality of recovered material compared to source separated recycling and organics recovery, making the products more difficult to market. • Availability of markets for extracted materials may be limited/nonexistent given the 'dirty' nature of the process and higher levels of contamination. • If the City implements more aggressive initiatives to increase the diversion of materials at the source, there would be fewer materials to recover. • Recovery of organics will impact quantities of organics in the landfill, which will impact the creation of landfill gas, and thus the ability to generate energy/revenue at the landfill. There is potential for generation of biogas/RNG from recovered organics which could offset the impact to landfill gas.
Regulatory Considerations:	• Would require an ECA (waste, air, industrial sewage) for the development of a facility. The ECA and municipal approvals may take one to two years to complete. Costs associated with the regulatory process are anticipated to be low (<$1M). • Supports the proposed future provincial ban on organics going to landfill in 2030.
Financial Considerations:	• Capital costs anticipated to be medium/low ($10-$50M) (based on Durham Region's estimated construction costs at $32 to $37 million for a 160,000 tpy MWP presort facility). • Annual operating costs anticipated to be high (>$10M) (based on Durham Region's estimates of $70 to $80 per tonne (including staffing). [129] • Land costs would be in addition to capital costs. • Costs and staffing levels depend on whether the City plans to operate the facility themselves or contract to a private service provider. • There may be some deferred costs from delaying the need for a new landfill.

[129] https://www.durham.ca/en/living-here/resources/Documents/GarbageandRecycling/Anaerobic-Digestion-/Technical-Reports/Durham-PBC-Financial-Analysis---June17---Final-Confidential-FCM.pdf

Category	Facility/Intructions
Unknowns/ Assumptions:	• Uncertainty regarding future regulations regarding organics (i.e. potential ban on organics from landfill) and compostable packaging, which may impact quantities of material available for recovery from the waste stream. • Option will require a detailed business case and feasibility study, including waste stream and end market analysis to confirm potential for successful outcomes and business viability. • Amortized capital costs are not included in operating cost estimates. • Cost estimates assume City would own and operate facility. Other procurement models (e.g. design, build, operate) may be less expensive and would have to be further analyzed through business case development. • At this time, it is unknown how Blue Box IPR, or other federal or provincial initiatives will impact the quantities of recyclables and organics in the garbage stream which could be recovered. • It is unknown what the market may be for recovery of more contaminated materials. • Assume that the facility does not clean up any of the organics fraction. • The City would need to identify a new location for the facility, ideally located in an industrial area of the City with comparable uses. • Assume a facility could be operational in 2030, based on time required to complete a business case, identify a site, procurement, permitting, construction, etc.
Supporting System Requirements for Success:	• Completion of a business case and feasibility study of MWP. If the City implements more aggressive waste diversion policies that would divert recyclables and organics from the garbage stream, the viability of this option would be impacted. • Extensive planning, public consultation and siting of a new facility. • Some facilities are paired with Material Recovery Facilities for recyclables and/or organics processing facilities on the same site (or nearby) and/or disposal facilities (landfill) or thermal treatment facilities. • Supporting processing facilities/contracts with these facilities are required to manage streams (recyclables, organics and residuals) and markets for recovered materials (e.g. recyclables) are required. • Recovered organics will require further processing such as composting, biostabilization or anaerobic digestion. Markets for outputs of these processes are also required (compost, compost-like material, biogas, digestate). Disposal facilities may still be required for some materials (e.g. residual, inerts (bones, rocks)).

Category	Facility/Intructions
Potential Outcomes:	• Recovering more recyclables and organics from materials going to disposal will contribute to extending the life of the Trail Waste Facility landfill. • Recovering more organics from landfill will help the City work towards meeting its Climate Change targets and support the Council approved Energy Evolution Strategy. • It is possible that the recovered organics may not meet quality requirements of the proposed Food and Organic Waste Framework and may not count as diversion. • Provides an alternative to recover materials where source separation is not feasible or less successful (e.g., multi-residential residential, parks and public spaces). • Based on the status quo system, assuming a facility would be operational in 2030 (based on length of time required to conduct a business case, site a facility, permit, design, build etc.). • Applying the estimated overall recovery rate of 29-43 per cent to the projected tonnes of residential garbage for 2030, TWF capacity may be extended by an estimated 1 to 2 years, depending on the materials recovered.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes of recyclables and organics diverted, revenue from the sale of recyclables.
Case Study #1:	• Durham Region is in the process of developing a mixed waste pre-sort facility to recover materials from garbage. The first step will remove bulky items, hazardous waste, and cardboard, followed by a pre-sort to recover dry recyclables and separate organics for further processing. The Region is intending to develop an Anaerobic Digestion facility to process organics recovered from this process, along with source separated organics.[130] As of November 2020, the Region has completed a siting process for the MWP Pre-sort and AD facility and have issued a Request for Pre-Qualification. The new facility is planned to begin operating in 2024.

[130] Mixed Waste Pre-sort and Anaerobic Digestion Facility - Region of Durham

7A2 – Mechanical Biological Treatment

Category:	Facility/Infrastructure
System Overview:	• A mechanical biological treatment (MBT) facility uses mechanical processing to recover recyclables and a biological process to recover organics from garbage. This option would involve the combination of the development of a mechanical pre-sort system and an organics processing system within a facility. The residual material could be further processed into Refuse Derived Fuel (RDF) through a shredding process to make an alternative fuel source. • MBT starts with unsorted and unseparated solid waste from residential and/or commercial sources, being brought to a dedicated MBT facility. The material is typically off-loaded onto a tipping floor. Materials are first sorted on the floor using manual labour (if appropriate) and mobile equipment to remove larger or bulky items such as appliances, dimensional wood, metal, or large pieces of plastics that might clog or interrupt operations of the processing systems. • Depending on the design of the facility, and types of materials received and recovered, materials are processed using largely mechanical processes (including in some cases artificial intelligence and robotics) to separate fibre, plastic, metal and glass containers, organics and small contaminants or primarily separation of organic material. Typically, organics are processed on-site using anaerobic digestion or aerobic composting. The remaining material is shipped to a disposal facility (e.g. landfill) or another appropriate waste processing/conversion facility for further processing (i.e. into RDF). • This option involves the development of a MBT facility to recover recyclables and organics from the City's garbage. It would include a pre-sort facility, an organics treatment facility and could include a facility to create refuse derived fuel (RDF) from the residue. • The City may be able to partner with other municipalities to develop a facility. • Applying the estimated overall recovery rate of 47 per cent - 56 per cent[131] to the projected tonnes of residential garbage for 2030, TWF capacity could be extended by an estimated 3 to 4 years depending on the materials recovered. This estimate includes recovery of diapers and production of RDF.

[131] Based on estimated recovery rates from Durham Region.

Category:	Facility/Infrastructure
Status:	• Proven • There are many examples of facilities in Europe and a few in the U.S. that have been operating for over 10 years. • Technology is considered innovative in Canada. • Some municipalities in Canada are exploring MBT with anaerobic digestion, including Durham Region, City of Toronto and Region of Peel.
Source of Option:	• Consultant, Staff, Consultations
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly • 4. Maximize the recycling of waste. • 5. Maximize the recovery of materials and energy. • 6. Aspire to achieve 100 per cent GHG emission reductions Guiding Principles: • Honour the 5Rs hierarchy. • Embrace innovation. • Keep waste local.
Needs Assessment Alignment:	• Aligns with the need to determine what, if any, waste recovery technologies or approaches will be employed to extend the life of the Trail Waste Facility landfill.
Individual Producer Responsibility (IPR) Impact:	• Partial impact. • There may be fewer recyclables (e.g. Blue Box materials) to divert from the waste stream with new Producer Responsibility programs that may recover more recyclables at the source (e.g. curbside). • There may be new types of compostable packaging such as compostable coffee pods that might be recovered through MBT which will impact the composition of incoming feedstock. How this packaging will impact the waste stream is unknown. • How municipality could work with producers to recover and market recovered recyclables is unknown.
System Consideration:	• Core System Component
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).

Category:	Facility/Infrastructure
Environmental Considerations:	• Estimated diversion potential of approximately 47-56 per cent[132] from garbage depending on materials recovered (noting the higher range includes diapers and based on recovery of Green Bin organics and some higher value plastics and metal) and with the creation of RDF from materials not recovered and non-recyclable materials. • Typically finished compost from a MBT process is of poor quality and may only be suited for land application compared to a system that uses source separated organics as feedstock. • Will be a reduction in GHG emissions associated with the diversion of recyclables and organics from landfill via avoidance of methane emissions. • Anticipated to be no/minimal GHG impacts associated with transportation of materials to/from this facility since material would be transported for processing or disposal anyway, especially if processing facilities are co-located with MBT facility. • Facility will be required to operate in compliance with Provincial ECA and will have no/minimal impacts to air/water. • Can help City work towards achieving GHG emissions reduction targets and objectives identified in the Energy Evolution Strategy through diverting high levels of organics from landfill.

[132] Based on estimated recovery rates from Durham Region.

Category:	Facility/Infrastructure
Social Considerations:	• Depending on where the facility is located, there may be community interruption with increased traffic, noise and potential odours. This would need to be addressed through an appropriate siting process and mitigative measures. • Reliance on a back-end facility reduces the onus on the generator (i.e. the resident) to take responsibility for managing materials properly. • This option requires little resident effort. This facility could help recover materials that were improperly sorted by residents. There is a risk that this will not encourage any resident's behaviour change to reducing and/or sorting waste properly, which does not support some of the guiding principles and goals of the City but can be mitigated through policies and education focused on proper waste separation at the source. • Indigenous communities with a potential interest in the project would need to be consulted. Resistance from these communities would be expected if a facility has the potential to impact their traditional territory and land uses. • Potential to generate short- and long-term jobs as part of developing a new facility. • The proposed promotion of use of soil amendments as part of the Province's Agricultural Soil Health and Conservation Strategy, along with promotion of on and off-farm use of soil amendments made from recovered organic resources, should support the marketing of materials generated from the recovered organic fraction.
Technical/ Operational Considerations:	• City would need to undertake a siting process to identify a location to develop a new facility. • Would require a high level of effort for the City to undertake a planning and siting process, procurement, implementation, operation and maintenance of a facility. • Lower quality of recovered material compared to source separated recycling and organics recovery, making the products more difficult to market. • Availability of markets for extracted materials may be limited/nonexistent given the 'dirty' nature of the process and higher levels of contamination. • If the City implements more aggressive initiatives to increase the diversion of materials at the source, there would be fewer materials to recover. • Would require additional equipment (i.e. a shredder) to create RDF. • Recovery of organics will impact quantities of organics in the landfill, which will impact the creation of landfill gas, and thus the ability to generate energy/revenue at the landfill. There is potential for generation of biogas/RNG from recovered organics which could offset the impact to landfill gas.

Category:	Facility/Infrastructure
Regulatory Considerations:	• The degree of effectiveness of a MBT facility is dependent on the type of policy drivers for developing such facilities (e.g. in Europe, the Landfill Directive and landfill taxes have been drivers for development of these types of facilities), whether or not residential diversion programs are provided, composition of waste being managed, and end-markets for recovered materials. It is important to note that municipalities in Ontario do not have the authority to implement many of the policies and directives that are in place in Europe, and that the regulatory framework at both the provincial and Federal levels in Canada levels to implement these does not currently exist. • Uncertainty regarding future regulations regarding organics (i.e. potential ban on organics from landfill) and compostable packaging, which may impact quantities available for recovery from the waste stream. • Would require an ECA (waste, air, industrial sewage) for the development of a facility. The ECA and municipal approvals may take one to two years to complete depending on the type of facility. Costs are anticipated to be medium/low ($1-$3M), depending on the type of approvals. • Current Ontario legislation does not recognize land application or energy recovery as counting towards the diversion rate calculation. • In line with the Province's direction as part of the Food and Organic Waste Framework to "increase the use of innovative technologies", "recover resources from food and organic waste", "support resource recovery infrastructure", and "prohibit disposal of organic waste". The Framework also speaks to supporting beneficial uses which promote soil health, crop growth and enhance carbon storage, as well as promoting end-products like renewable natural gas. This option is in alignment with this direction, particularly when coupled with anaerobic digestion.

Category:	Facility/Infrastructure
Financial Considerations:	• Capital costs are highly dependent on facility design but are estimated at High (>$200M) (assuming a pre-sort facility, anaerobic digestion (AD) facility and production of RDF). • Annual operating costs are estimated to be high (>$10M) (based on Durham Region operating cost estimates of $145 to $190 per tonne (including staffing) ($75 to $110/ tonne for AD; $70 to $80/ tonne for Pre-Sort).[133] • Land costs would be in addition to capital costs. • Costs and staffing levels depend on whether the City plans to operate the facility themselves or contract to a private service provider. • It is anticipated there might be some revenue from recyclables (e.g. Blue Box materials), depending on market conditions, types and condition of materials recovered and from digestate which would require further investigation through the development of a business case. • There may be some deferred costs from delaying the need for a new landfill. • Potential for revenue from sale of RDF (if produced, and if markets exist).
Unknowns/ Assumptions:	• Uncertainty regarding future regulations regarding organics and compostable packaging, which may impact quantities available for recovery from the waste stream. • Option will require a detailed business case and feasibility study, including waste stream analysis to confirm potential for successful outcomes and markets for outputs, including RDF. • Amortized capital costs are not included in annual operating cost estimates. • Cost estimates assume City would own and operate facility. Other procurement models (e.g. design, build, operate) may be less expensive. • At this time, it is unknown how Blue Box IPR, or other federal or provincial initiatives, will impact the quantities of recyclables and organics in the garbage stream which could be recovered. • It is unknown what the market may be for recovery of more contaminated materials. • Assume the City would recover any biogas for conversion to RNG and would not generate any revenue from this output. • The City would need to identify a new location for the facility, ideally located in an industrial area of the City with comparable uses.

[133] https://www.durham.ca/en/living-here/resources/Documents/GarbageandRecycling/Anaerobic-Digestion-/Technical-Reports/Durham-PBC-Financial-Analysis---June17---Final-Confidential-FCM.pdf

Category:	Facility/Infrastructure
Supporting System Requirements for Success:	• Completion of a business case and feasibility study of MBT. • If the City implements more aggressive waste diversion policies that would divert recyclables and organics from the garbage stream, the viability of this option would be impacted. • Extensive planning, public consultation and siting of a new facility. • Some facilities are co-located with disposal facilities (landfill) or thermal treatment facilities. • Markets for recovered materials (e.g. recyclables) are required. • Markets for outputs of organics processes are required (compost, compost-like material, biogas, digestate). • Disposal facilities are required for some materials (e.g. residual, inerts (bones, rocks)). • Recovery of organics from garbage will impact landfill gas generated at Trail Waste Facility Landfill and may impact the choice of technology for organics processing/quality of output. • If conversion of residual to RDF, require the appropriate equipment to process residual and identification of a markets for RDF.
Potential Outcomes:	• Recovering more recyclables and organics from materials going to disposal will contribute to extending the life of the Trail Waste Facility Landfill. • Recovering more organics from landfill will help the City work towards meeting its Climate Change targets and support the Council approved Energy Evolution Strategy. • It is possible that the recovered organics may not meet quality requirements of the proposed Food and Organic Waste Framework due to the 'dirty' nature of the recovered organics stream. • Provides an alternative to recover materials where source separation is not feasible or less successful (e.g., multi-residential, parks and public spaces). • Based on the status quo system, assuming a facility would be operational in 2030 (based on length of time required to conduct a business case, site a facility, permit, design, build etc.). • Applying the estimated overall recovery rate of 47 per cent - 56 per cent[134] to the projected tonnes of residential garbage for 2030, TWF capacity may be extended by an estimated 3 to 4 years depending on the materials recovered. This estimate includes recovery of diapers and production of RDF.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes of recyclables and organics diverted, revenue from the sale of recyclables.

[134] Based on estimated recovery rates from Durham Region.

Category:	Facility/Infrastructure
Case Study #1:	• A mixed waste processing facility was developed in Hampden, Maine by Fiberight. The facility was designed to process up to 360 tonnes per day (400 tons) and was expected to divert 60-80 per cent of municipal solid waste from landfills. The plant was designed to sort mixed waste (neighbouring municipalities use a “one bin” system with no diversion programs), separate recyclables, anaerobically digest organics to produce biogas and produce briquettes from the residual. The facility experienced significant delays in construction, permitting and start-up, which delayed the opening of the facility until 2019. The $90M USD (~$114M CAD) plant closed its doors in May 2020, less than a year after starting operation, due to technical and financial issues, including difficulties in permitting and selling the fuel product and other end products. • A search for a new buyer and operator of the facility is underway. It is unknown when or if the facility will reopen. In the meantime, waste is being disposed at landfills and Waste-to-Energy facilities.
Case Study #2:	• In 2009,[135] the City of Toronto investigated MBT as an option to achieve their previous diversion goal of 70 per cent as part of their previous diversion plan (Target 70). The City conducted a business case and ultimately concluded, at that time, to not proceed with the development of an MBT facility for a number of factors including: • The primary feedstock would be from the multi-residential sector. If diversion initiatives could significantly increase diversion rates for this sector, then the facility would be redundant. • The viability of MBT relies on being able to find beneficial use markets for the end product which depends on the technologies used (digestate, biogas, compost). Typically finished compost from a MBT process is of poorer quality compared to that from a system that uses source separated organics, and may only be suited for land application. As per the Waste Diversion Act, 2002, the Province does not recognize any form of land application as counting towards diversion.

[135] Planning Study for the Assessment of Mixed Solid Waste Processing Technology and Siting Options, City of Toronto. May 2009.

Category:	Facility/Infrastructure
Case Study #2: (continued)	• In 2016, the City's Long-Term Waste Management Strategy was approved, which included a recommendation to explore Mixed Waste Processing with Organics Recovery as a means to achieving the City's 70 per cent waste diversion target. The City is currently conducting a study to determine if Mixed Waste Processing can support the achievement of this target by recovering resources that can be successfully marketed within the circular economy framework. The impact of IPR on the process, and the extension of the life of Green Lane Landfill are important considerations in the study. • Preliminary findings of this study, based on recent waste characterization studies, show that garbage from both single family and multi-residential sectors would need to be processed at a facility in order to approach the desired diversion targets. Previously it was assumed that waste from the multi-residential sector was more contaminated and more materials could be recovered. This means a MBT facility of almost double the capacity originally envisioned would be required to achieve the desired diversion target. Additionally, there are residual materials that could be used as a refuse derived fuel product, however, there are no long-term end markets for this product, and it does not count as diversion by the Province. Lastly, based on recovery of marketable recyclables and production of digestate, the life of the City's landfill was estimated at being extended by less than one year. • Preliminary cost estimates indicate the development of a mixed waste processing facility with a front-end processing system and anaerobic digestion facility would be within the $310 million budget range (as developed for the Long-term Waste Management Strategy). Annual operating costs were estimated in 2016 at approximately $16.9 million or $63/tonne for a City-owned facility operated by a third party. Approximately $2.7 million annually was estimated for revenue or savings from the sale of recyclables. • In 2020, City Council directed future work to consider how a thermal treatment process may be considered in conjunction with mixed waste processing. This study is still underway.[136]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[136] Mixed Waste Processing Study Update, Infrastructure and Environment Committee, February 13, 2020.

7A3 – Mass Burn Incineration (Direct Combustion)

Category:	Facility/Infrastructure
System Overview:	• This option examines the possibility of the City developing a mass burn incineration facility to manage post-diversion residual waste. Mass burn incineration is the direct combustion of a mixed, typically unprocessed, waste stream where the heat is captured by boilers and converted to a form of energy. Outputs of the process include fly ash (hazardous material) and bottom ash produced from the burning of waste, residual metals which are extracted from the ash and energy. Mass burn incineration is also referred to as waste-to-energy (WTE) or energy from waste (EFW). • Robust waste diversion programs would be required to keep non-combustible, wet and hazardous material out of the WTE facility. • The City may be able to partner with other municipalities to develop a facility.
Status:	• Proven • WTE is commonly used within United States and Europe. These facilities exist in Canada, however are not as commonly used as in the U.S. and Europe. • The Durham-York Energy Centre (DYEC), located in Durham Region ON is the most recent example of development of a WTE facility in Canada, commissioned in 2015.
Source of Option:	• Consultant, Councillor, Consultations
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly. • 4. Maximize the recycling of waste. • 5. Maximize the recovery of materials and energy. Guiding Principles: • Embrace innovation. • Keep waste local.
Needs Assessment Alignment:	• Aligned with the need to determine what, if any, waste recovery technologies or approaches will be employed to extend the life of the Trail Waste Facility landfill.
Individual Producer Responsibility (IPR) Impact:	• Partial impact. • May impact quantities of metals recovered from back end (and revenue from sale of metals).
System Consideration:	• Core system component.

Category:	Facility/Infrastructure
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Low/minimal diversion potential. Some metals may be recovered from the back-end, however, the quantity of materials recovered are dependent on front-end diversion programs. • The impact on GHG emissions is unknown and would require further study to understand the net carbon intensity of the energy benefit that this type of technology provides and how it may or may not align with the City's Climate objectives. • Actual material (ash) to be disposed of after processing is approximately one-third by weight or one-tenth by volume of inbound material, depending on the technology and feedstock used. The WTE facility may result in reductions in GHG emissions due to offsets from electricity production, although due to the clean energy sources used in Ontario, the offsets will not be as great compared to other jurisdictions that utilize coal or fossil fuels. • Anticipated to be no/minimal GHG impacts associated with transportation of materials to this facility, since material would be transported for disposal anyway, especially if processing facilities are co-located with a MWP facility. • There may be some GHG emissions associated with disposal of fly ash at an approved facility. • Facility will be required to operate in compliance with Environmental Compliance Approval, including air pollution control systems that comply with emission and environmental requirements. • Any facility would be subject to ECA requirements, including stringent air quality emissions requirements. Emissions from these types of facilities, for example, dioxins, furans, mercury, NOx, would be controlled using engineering solutions, however there is always a risk that these controls temporarily fail or are not always able to remove the contaminants to achieve the ECA prescribed limits. • There will be an on-going requirement for regular monitoring of air emissions to ensure they do not adversely risk public health.

Category:	Facility/Infrastructure
Social Considerations:	• As part of the Environmental Assessment (EA) process, there will be significant public consultation required. Public consultation would inform the public of the proposed plans. Siting a WTE facility could see significant public resistance. • Indigenous communities with a potential interest in the project would need to be consulted. Resistance from these communities would be expected if a facility has the potential to impact their traditional territory and land uses. • Depending on where the facility is located, there may be community interruption with increased traffic, noise and potential odours. This would need to be addressed through an appropriate siting process and mitigative measures. • Potential for public concerns about air quality and health impacts. • Potential to generate short- and long-term jobs as part of developing a new facility. • No change to level of effort by residents. • Minimal to no health impacts anticipated when in compliance with Environmental Compliance Approval (ECA). • It is anticipated that a Human Health and Environmental Risk Assessment would be expected as part of the Environmental Assessment process prior to issuance of the Environmental Compliance Approval to consider health impacts. There is still potential for public opposition to developing a facility, in part due to public health concerns.
Technical/ Operational Considerations:	• The City would have to undertake a planning and siting process, procurement, approvals, implementation, operation and maintenance of a facility. • The level of effort for developing a facility is dependent on the procurement approach (e.g. design, build, operate) etc. • Potential for operational and maintenance issues associated with mass burn incinerator as approach is more complex compared to operating a traditional landfill. • Fly ash is considered a hazardous material and requires disposal at approved facilities, bottom ash may be used as landfill cover. The City would need to find approved disposal facilities that manage hazardous materials/uses for these materials. • Would require strict emissions monitoring.

Category:	Facility/Infrastructure
Regulatory Considerations:	• It is likely that an environmental assessment (EA) would be required, although it is possible an Environmental Screening Process (ESP) may be sufficient. An ECA (waste, air) would be required for the development of a WTE facility. The EA process is comprehensive and can take many years to complete (estimated at five to eight years) and costs are estimated to be medium ($3-$6M). An ESP may take up to four years and may be in the low/medium range ($1-$3M). Other approvals (e.g. ECA and municipal approvals for land use planning, zoning, and site plan) may take one to two years to complete and would be in the low/medium cost range ($1-$3M).
Financial Considerations:	• Capital costs are estimated to be high (>$200M) and are highly dependent on facility design. Durham York Energy Centre (DYEC) construction costs were $255 million (2016) for a 160,000 tpy mass burn incinerator facility. The DYEC cost approximately $29 million for the EA, permitting and approvals, site servicing, consulting fees and economic development activities in the host community of Clarington. • Land costs would be in addition to capital costs. • Annual operating costs are estimated at high (>$10M) and would depend on the size and throughput of facility. It is expected that Ottawa's costs would be similar to DYEC's (~$20M (2020)). • It is anticipated that approximately 3 staff may be required to oversee operation of the facility (based on Durham Region and its procurement model of DBOM (design, build, operate, maintain)). The operator would require additional staff for the facility.
Financial Considerations: (continued)	• It is anticipated there might be some revenue from the sale of metals, depending on market conditions. Quantities of metal recovered from the back end depend on the degree of diversion at the source and it is unknown what the impact of IPR may be on the quantities of metals remaining in post-diversion residual waste. Durham Region's 2020 budget for estimated revenue is ~$480K for by-product materials (e.g. metals).[137] • It is unknown whether any revenue may be derived from the sale of energy. It should be noted that Durham Region secured a Feed-in-Tariff contract with the provincial government at the time, which contributes revenue. The Province is no longer offering this program. • There may be some deferred costs from delaying the need for a new landfill.

[137] 2020-Detailed-Durham-Region-Approved-Business-Plans-and-Property-Tax-Supported-Budgets.pdf

Category:	Facility/Infrastructure
Unknowns/ Assumptions:	• Option will require a detailed business case and feasibility study, including waste stream analysis to confirm potential for successful outcomes. • The level of public input and opposition during the siting process and development of a new WTE facility is unknown. • The City would need to identify a suitable location for a WTE facility, ideally located in an industrial area of the City with comparable uses and with some proximity to an energy market/user. • It is unknown how energy generated may be used or if there is capacity in the Ontario electrical grid to accept more energy. • At this time, it is unknown how Blue Box IPR, or other federal or provincial initiatives will impact the quantities of recyclables and organics in the garbage stream which could be recovered. • Procurement model for development of a facility is unknown, as is the ability/appetite to partner with other municipalities to fund/develop a facility. • It is unknown what types of future uses will be developed for ash. • In general, these facilities are operated on a put-or-pay basis, which would require the City to supply a pre-determined amount of material on an annual basis as part of the terms of the contract. Any future waste diversion initiatives by the province could make the City responsible to obtain waste from other sources to meet contract terms. Therefore, future provincial waste policies are a risk to guaranteeing future tonnages.
Supporting System Requirements for Success:	• Option will require a detailed business case and feasibility study, including waste stream characterization and tonnage estimates analysis to confirm potential for successful outcomes. • Supporting systems such as robust diversion programs would be required to keep non-combustible/ wet /hazardous material out of the WTE facility. Materials such as food waste have a lower calorific value. • Need hazardous landfill disposal capacity for fly ash as well as landfill disposal capacity for bottom ash, and a market for energy outputs and recovered metals. • TWF could be used to manage some/all of the bottom ash (non-hazardous portion of ash).
Potential Outcomes:	• Tonnage and volume of materials requiring landfill disposal are greatly reduced. The estimated volume of waste can be reduced by 85 to 90 percent which could extend the life of TWF by approximately 12 to 18 years. This assumes that a facility would be fully operational by 2035. • Has the ability to extend the life of TWF if implemented in the mid-term.

Category:	Facility/Infrastructure
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes received, recovered and disposed at facility and energy generated.
Case Study #1:	• In 1999, Durham Region released its 20 year waste reduction and disposal strategy which identified a number of objectives for waste disposal, including searching for waste disposal capacity in advance of the closure of a landfill site they had been utilizing, supporting the development of WTE type of facilities, and not supporting the development of a landfill in Durham Region. In 2003, the Region was shipping waste to Michigan. In 2004, the Region commenced the Durham Residual Waste Disposal Study EA. In 2005, Durham Region partnered with York Region to develop the facility. In 2006, consultants were retained to identify the most feasible technologies to manage post-diversion residual waste. WTE was identified as the preferred technology. A three-year siting process was undertaken to identify the preferred location. In 2008, an RFP was issued for the design, construction, operation and maintenance of the WTE facility and in 2009, the contract was awarded to Covanta. The EA was submitted to the Province in 2009 and approved just over a year later. Construction commenced in 2011 and the facility began commissioning in 2015.
Case Study #1: (continued)	• Operated by Covanta, it employs approximately 40 full-time staff under the Region's supervision for a 20-year term. Three full-time Regional staff are also employed to oversee DYEC operations. The facility manages approximately 140,000 tonnes per year of residential waste from Durham Region and York Region. It generates approximately 14 megawatts (MW) of net electrical energy on a continuous basis, which is enough to power about 10,000 homes per year. The electricity is sold to the Provincial grid as base load energy at the guaranteed price of $0.08 per kWh inflation indexed for a 20-year term. The DYEC has a 20-year contract in place with the Ontario Power Authority for the sale of electricity generated and delivered to the provincial grid. In the future, steam from the DYEC may be used for district heating within the Clarington Energy Park located adjacent to the facility. The steam produced could heat the equivalent of 2,200 homes per year1. • The Region conducts a comprehensive environmental monitoring program including air emissions monitoring (on-site), ambient air monitoring (off-site), groundwater and surface water monitoring, noise monitoring, odour monitoring and soil monitoring. Real time emissions data is available at the facility's website.[138]

[138] Emissions Data

Category:	Facility/Infrastructure
Case Study #2:	• Emerald Energy from Waste Inc. (previously known as Algonquin Power Energy From Waste Inc., (EEFW)) owns and operates a mass burn combustion facility in Brampton, Ontario. The initial design was developed in 1984 with the Environmental Assessment process initiated in 1988 and the facility was commissioned in 1992. The incinerator has a processing capacity of 500 tonnes per day and accepts municipal, institutional, commercial and industrial wastes and is operated by more than 40 employees. Heat from the combustion process produces steam, which is directed to a turbine to produce electricity or to a neighbouring paper mill. Fly ash is collected and sent to a hazardous landfill and bottom ash is disposed in a landfill.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

7A4 – Emerging Technologies (Gasification, Pyrolysis, Hydrolysis, Chemical Recycling)

Category:	Facility/Infrastructure
System Overview:	• The emerging technologies involve various chemical reactions (depending on the selected process) to process waste: • Gasification involves converting solid or liquid carbon-based wastes into gas formed at high temperature without combustion. Technology types include - updraft fixed bed; downdraft fixed bed; bubbling fluidized bed; circulating fluidized bed; and entrained flow. • Pyrolysis involves heating municipal solid waste in an oxygen-free environment to produce a combustible gaseous or liquid product and a carbon char residue. Technology types include - auger-type; rotary kiln; updraft and downdraft fixed bed; bubbling and circulating fluidized bed. • Hydrolysis is a chemical reaction in which the organic fraction of the waste material is used to synthesize glucose and/or other simple sugars that can then be fermented or digested to manufacture other products (e.g., ethanol). • Chemical recycling is a general term used to describe a process that may use pyrolysis or gasification to process plastics, specifically unrecyclable plastics. Chemical recycling is a process where a polymer is chemically reduced to its original form so that it can eventually be processed and remade into new plastic materials for use in new products. • This option includes the development of a facility that would employ an emerging technology to manage some portion of the City's waste stream (e.g. garbage, organics, plastics).
Status:	• Emerging • In research and development, for large-scale application in cities such as Ottawa. • Some municipalities in Canada are exploring this technology (i.e. gasification), such as City of Edmonton.
Source of Option:	• Consultant, Consultations, Energy Evolution Strategy

Category:	Facility/Infrastructure
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly. • 4. Maximize the recycling of waste. • 5. Maximize the recovery of materials and energy. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Lead by example. • Embrace innovation. • Keep waste local.
Needs Assessment Alignment:	• Addresses the need to determine what, if any, waste recovery technologies or approaches will be employed to extend the life of the Trail Waste Facility landfill. Some technologies, e.g. gasification (for LYW), align with the City's Climate Change Master Plan, Energy Evolution and its goals and objectives.
Individual Producer Responsibility (IPR) Impact:	• Partial impact • There may be fewer recyclables (e.g. Blue Box materials) to process with new Producer Responsibility programs that may recover more recyclables at the source (e.g. curbside). • There may be new types of compostable packaging such as compostable coffee pods that might be managed through emerging technologies.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Diversion potential unknown. • Minimal GHG impacts associated with transportation of materials to/from this facility. GHG impacts from facility unknown. • Facility will be required to operate in compliance with Environmental Compliance Approval.

Category:	Facility/Infrastructure
Social Considerations:	• As part of the Environmental Assessment (EA) process, there will be significant public consultation required. Public consultation would inform the public of the proposed plans. Siting one of these facilities could see significant public resistance. • Indigenous communities with a potential interest in the project would need to be consulted. Resistance from these communities would be expected if a facility has the potential to impact their traditional territory and land uses. • Depending on where the facility is located, there may be community interruption with increased traffic, noise and potential odours. There may also be concerns with air quality and health impacts. This would need to be addressed through an appropriate siting process and mitigative measures. • Potential to generate short- and long-term jobs as part of developing a new facility. • May require residents to increase diversion of materials to ensure recyclable and organic materials, which are not conducive to these processes, are removed at source. • Minimal to no health impacts anticipated when in compliance with Environmental Compliance Approval (ECA). • It is anticipated that a Human Health and Environmental Risk Assessment would be expected as part of the Environmental Assessment process prior to issuance of the Environmental Compliance Approval to consider health impacts. There is still potential for public opposition to developing a facility, in part due to public health concerns. • Potential to generate short- and long-term jobs as part of developing a new facility.

Category:	Facility/Infrastructure
Technical/ Operational Considerations:	• Not yet proven at a commercial scale. • Need to site a new facility. • Moisture content, calorific value and a homogeneous feedstock are important technical considerations. • Most facilities need a homogeneous feedstock, which requires pre-processing, and/or a specific feedstock (e.g. plastic). • The City would have to undertake a planning and siting process, procurement, approvals, implementation, operation and maintenance of a facility. • The level of effort for developing a facility is dependent on the procurement approach (e.g. design, build, operate) etc. • Potential for operational and maintenance issues associated with these facilities as approach is more complex compared to operating a traditional landfill). • High quality ethanol, light oil, a medium fuel equivalent to diesel, and a heavy oil may be recovered and would need markets.
Regulatory Considerations:	• As there are no such facilities in Ontario, it is difficult to predict what approvals may be required. The process may be comparable to that for a WTE facility. • It is likely that an EA would be required, although it is possible an Environmental Screening Process (ESP) may be sufficient. An ECA (waste, air) would be required for the development of a facility. The EA process is comprehensive and can take many years to complete (estimated at over five years) and costs are estimated to medium ($3-$6M). An ESP may take up to four years and may be in the low/medium range ($1-$3M). Other approvals (e.g. ECA and municipal approvals for land use planning, zoning, and site plan) may take one to two years to complete and would be in the low/medium cost range ($1-$3M).

Category:	Facility/Infrastructure
Financial Considerations:	• Capital costs highly dependent on facility design and are expected to be high (>$200M). In general, facilities are funded through a number of public and private entities. It is difficult to get accurate estimates of costs of facilities as many are privately owned/operated facilities and information on costing is considered proprietary. • In December 2020, Enerkem announced the proposed construction of a biofuel plant near Montreal, expected to convert >200,000 tonnes of non-recyclable waste and wood waste into biofuel at a cost of $875 million. The project is funded through partnerships with private companies, federal and provincial governments. $60 million has been invested since August 2019 on project development, site preparation and permitting.[139] • Land costs would be in addition to capital costs.
Financial Considerations: (continued)	• Annual operating costs would depend on the size and throughput of the facility and are anticipated to be high (>$10M). The cost to the City of Edmonton for the Enerkem (gasification) facility is publicly reported as $127 per tonne for conversion to biofuels, however, this might not actually reflect the true cost of operation.[140] • Staffing levels depend on whether the City plans to operate the facility themselves or contract to a private service provider. The Enerkem plant in Edmonton reported creation of more than 600 direct and indirect jobs during its construction but cannot be independently verified due to the commercially confidential agreements the City of Edmonton has with Enerkem. • It is anticipated there will be revenue by selling the biofuels, oils, and/or pellets, depending on market conditions. • There may be some deferred costs from delaying the need for a new landfill.

[139] https://enerkem.com/newsroom/releases/?communique_id=122575

[140] Edmonton Journal. (February, 2018). Five minutes from trash to ethanol. https://edmontonjournal.com/business/local-business/five-minutes-from-trash-to-ethanol-edmontons-long-delayed-enerkem-plant-explained

Category:	Facility/Infrastructure
Unknowns/ Assumptions:	• The level of public input and opposition during the siting process and development of a facility is unknown. • The City would need to identify a location for a facility. It is unknown if there are any properties within or near the City that would meet all the criteria required for a new site (i.e., geotechnical characteristics, environmental sensitivity, allowable setbacks, etc.). • It is unknown how outputs may be used/marketed. • At this time, it is unknown how Blue Box IPR, or other federal or provincial initiatives will impact the quantities of recyclables and organics in the garbage stream which could be recovered.
Supporting System Requirements for Success:	• Option will require a detailed business case and feasibility study, including waste stream analysis to confirm potential for successful outcomes. • Some technologies (e.g. gasification) require a homogenous feedstock (e.g. refuse derived fuel). A facility that can produce this material would also be required. • Some technologies are only proven for a specific type of feedstock (e.g. plastic). • Some facilities are paired with Material Recovery Facilities and/or organics processing facilities on the same site (or nearby) and/or disposal facilities (landfill) to support operations efficiencies. • Supporting processing facilities are required to manage streams (recyclables, organics and residuals) and markets for recovered materials (e.g. recyclables) are also required. • Require a market/user for electricity or heat generated and outputs such as fuels. • Disposal facilities may still be required for some materials (hazardous waste, residuals, etc.).
Potential Outcomes:	• Waste typically destined for the landfill will be chemically reacted to form biofuels and other chemicals to be sold as a product and reused within the system, respectively. • Extended life of Trail Waste Facility Landfill. • Generate renewable fuels from waste, which can reduce GHG emissions but would require a fulsome study to understand the GHG implications of this option.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes received and recovered at facility.

Category:	Facility/Infrastructure
Case Study #1:	• Enerkem in Edmonton, Alberta has designed a commercial-scale waste-to-biofuels facility which aims to convert 100,000 tonnes of municipal solid waste into 38 million litres of biofuels (ethanol) and renewable chemicals annually in order to help Alberta reduce its greenhouse gas (GHG) emissions. It is currently using a gasification/pyrolysis technology to convert non-recyclable and non-compostable waste feedstock into methanol and ethanol via a chemical process to convert carbon monoxide into liquid hydrocarbons. It is expected to reduce GHG emissions by more than 60 per cent when compared with fossil fuel production and landfill operations.[141] The company began producing and selling biomethanol in 2016. In 2017 the production included cellulosic ethanol.[142] It has sold ethanol to create revenue (revenue not defined). It is expected to produce 38 million litres of ethanol annually at full capacity (which has the potential to fuel 450,000 cars annually running at 5 per cent ethanol mixed with gasoline). It is unknown how successful this facility is as there is very little publicly available information on the facility and information cannot be independently verified due to the commercially confidential agreements the City of Edmonton has with Enerkem.
Case Study #2:	• As an example of chemical recycling, Pyrowave in Montreal, QC has developed a technology that uses microwaves to heat up and break down polystyrene molecules into their individual links (styrene), which can then be processed back into polystyrene. The process is marketed as being able to handle contaminated polystyrene products (i.e. with labels and films) and generate a 100 percent recycled content new polystyrene product. The process is estimated to consume less energy and produce fewer GHG emissions when compared to producing polystyrene from oil. An estimated 10 percent of the product is lost each time it is recycled, but it can be recycled over and over again making it a circular product. It does not appear that there are any commercial plants in operation, but a demonstration facility located in France is planned in collaboration with the Michelin Group for 2023. There is no information available on capital or operating costs. [143]
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[141] Edmonton. Waste to Biofuels and Chemicals Facility. https://www.edmonton.ca/programs_services/garbage_waste/biofuels-facility.aspx

[142] Cellulosic ethanol is made by converting the cellulose from plant materials or municipal solid waste into glucose which can be fermented into ethanol.

[143] Pyrowave: a new generation of plastics - Pyrowave closing the loop

7A5 – Landfill Mining

Category:	Facility/Infrastructure
System Overview:	• Landfill mining is the process of excavating waste from active or closed landfills to reduce their environmental impact and gain landfill space. This could involve removing materials to recover a combustible fraction, recyclables, metals, Construction & Demolition materials (C&D), soil, and hazardous waste (to be treated). Landfill mining can be used to gain landfill space redevelop property, remediate landfill issues. • This option looks at the requirements and implications of mining the Trail Waste Facility Landfill, specifically to gain landfill space.
Status:	• Proven • The City undertook a pilot program to mine landfilled waste as part of an optimization / expansion project in the early 2000s. Other municipalities in Ontario have undertaken landfill mining for a variety of reasons, typically for remediation purposes.
Source of Option:	• Consultant, Staff
Proposed Strategic Alignment:	Goals: • 4. Maximize the recycling of waste. Guiding Principles: • Honour the 5Rs hierarchy. • Keep waste local.
Needs Assessment Alignment:	• Addresses the need to explore waste and energy recovery technologies to maximize recycling and recovery of materials previously landfilled. • Addresses the need to explore optimization options to extend the life of Trail Waste Facility Landfill.
Individual Producer Responsibility (IPR) Impact:	• No impact.
System Consideration:	• Considered a secondary option to a system-wide consideration (residuals management).
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).

Category:	Facility/Infrastructure
Environmental Considerations:	• Unknown what the diversion potential may be. Based on the City's pilot study in 2001, the material was inspected for potential marketability by City Staff. The findings demonstrated that most of the material was not marketable and would require additional cleaning. It is unlikely that with tighter markets requiring cleaner material, most material could not be marketed. • Depending on how the City will choose to dispose of the excavated waste, redepositing the waste into an improved designed landfill (be relined and/or have an installed leachate system) could reduce GHG emissions. • Given the requirement to expose and handle previously buried waste, a short-term increase in release of GHGs at the landfill mining area is likely. • A short-term increase in GHG emissions are also expected from more vehicular activity during the mining period. • Facility will be required to operate in compliance with Environmental Compliance Approval. • Potential to impact air quality (dust, odours) during excavation. • Based on previous City of Ottawa experience with landfill mining, there is the potential for fires from accidental combustion of methane. • It is likely that the management of special wastes such as asbestos containing materials will be required. It is noted that the City has indicated that Stage 1 and 2 of TWF has managed significant quantities of asbestos since 2007.
Social Considerations:	• Depending on where the excavation occurs, there may be community interruption with odours and noise. This would need to be addressed through mitigative measures. • No resident level of effort – This option requires no resident effort as this is only excavating previous waste already landfilled. • Minimal to no health impacts when in compliance with Environmental Compliance Approval.
Technical/ Operational Considerations:	• If the Trail Waste Facility Landfill is excavated, it is anticipated that the lifespan of the landfill/cell will be increased, depending on the amount excavated and the amount of material recovered or recycled. When City of Barrie excavated their landfill, it increased the life by 18 years (see Case Study below). • As the waste is excavated from a closed landfill/cell, it is expected that the recoverable materials will be contaminated which will make the products more difficult to market. • The volume of in situ waste may be reduced as soil, metals, and concrete are recovered and fully removed from the landfill, thus creating additional landfill space.

Category:	Facility/Infrastructure
Regulatory Considerations:	• An amendment to the Environmental Compliance Approval would be required from the MECP. Approval timing to amend an ECA is unknown and will depend on the complexity of the changes being proposed but could be 1-2 years. • An EA would be required if the landfill mining excavation would increase by more than 100,000 m^3 the amount of waste that could be deposited at the site without any increase in the total waste disposal volume. Timing for approvals is unknown and unpredictable depending on the level of community interest but could be 5+ years. • Costs would be in the low (<$1M) (for an ECA) to low/medium range ($1-$3M) (for an EA) and dependent on existing site conditions and issues to be remediated.

Category:	Facility/Infrastructure
Financial Considerations:	• If landfill mining were to occur while fill operations at TWF were occurring, additional equipment such as bulldozers, excavators and rock hauling trucks would be required for the mining project. The capital cost range to acquire new equipment for landfill mining is likely within the low range (<$10M). However, it is noted that the City could explore renting this additional equipment from local suppliers. • If the materials recovered are processed onsite, additional equipment will be required, which can include trommel screens. The screening process will likely occur outdoors, with the “overs” generated landfilled within the active area. It is noted that the capital cost range to purchase a series of trommel screens are likely within the low range (<$10M). However, it is noted that the City could explore renting these units from local suppliers. • Additional costs would be incurred for the replacement of the final cover (~$1M per ha) and a new liner potentially (~$2M per ha). • Annual operating costs are expected to be medium/high ($6-$10M) for approximately 100,000 m^3 of additional capacity created during a year. The operating cost range is based on the landfill reclamation pilot program completed by the City in 2001. It was estimated at that time that the cost for landfill mining was approximately $35.00 per cubic metre. Applying inflation rates, this equates to approximately $49.00 per cubic metre in 2020, which was applied to determine the operating cost range. • Staffing levels during the duration of the mining project depend on whether the City plans to conduct the excavation themselves or contract to a private service provider and would be in addition to any capital costs. • It is anticipated there would be minimal revenue from the sale of recovered materials depending on market conditions and quality of the materials. It is noted that based on previous pilot studies at the TWF, most of the material recovered was not marketable and would require additional cleaning. • There may be some deferred costs from delaying the need for a new landfill.

Category:	Facility/Infrastructure
Unknowns/ Assumptions:	• Unknown how much airspace could be recovered and the impact on the capacity at Trail Waste Facility Landfill. Factors that would affect how much airspace could be recovered would include the quantity of "overs" generated from the screening process and landfilled, and compaction rates achieved in the areas that were mined. • Unknown what the impact would be on closure costs due to improved re-engineering and re-landfilling practices. • Unknown how much material the City could mine on an annual basis. • Unknown what the potential would be to reduce costs related to importing soil for daily/intermediate cover. • Unknown waste conditions may result in a low rate of material recovery (i.e., mining cost exceeds value of recovered airspace or material). Recovery rates are dependent on a number of parameters (e.g., waste density, soil type, filling practices). • Unknown what the impact would be for remediation of groundwater impacts or reduction of potential environmental liabilities. • Unknown what the level of GHGs that will be emitted once landfill caps are opened and landfill mining operations are undertaken. • Unknown what materials would be recovered and how these materials may be managed (e.g. asbestos). • Unknown if the historical materials disposed are able to be sorted for recovery (e.g. specific plastics). • Unknown if there will be challenges with re-compacting the areas that have been mined to the same density. • Unknown If the recovered materials that are shipped to a MRF (not affiliated with the City) would result in additional costs (e.g. processing and managing materials). • Timing for approvals is unknown – delays could impact the ability to mine and transfer materials with reduced capacity at TWF.
Supporting System Requirements for Success:	• Need disposal capacity for items that cannot be recovered. • Option will require a detailed business case and feasibility study, based on pilot study conducted previously. Economic feasibility is based on the expected content of the landfill and/or reducing long-term liabilities and recovered airspace.

Category:	Facility/Infrastructure
Potential Outcomes:	• Potential revenue from increased landfill airspace and landfill lifespan. • Potential to reduce closure costs due to improved re-engineering and re-landfilling practices. • Potential to reduce costs related to importing soil for daily/intermediate cover as any soil recovered from landfill mining can be used as an alternative source. • Limited potential revenue from recovered valuable recyclable materials due to levels of contamination.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as tonnes excavated and recovered and landfill capacity gained.
Case Study #1:	• In 2018 Durham Region began a landfill mining pilot project at the former Blackstock landfill site in order to reduce GHG emissions from methane, leachate impacts on groundwater quality, divert material not previously separated for recycling, recover energy from reclaimed waste, and eliminate the need for long-term groundwater monitoring. Landfilled scrap metal and concrete were sorted and set aside for recycling. Approximately 98 tonnes of scrap metal, and 500 tires were recovered from the 4,796 tonnes of waste excavated from the site. Recovered combustible waste was processed at the DYEC and the remainder sent to a landfill for disposal. Durham anticipates the final grading to bring the old landfill site back to original condition will be complete in 2020.[144]
Case Study #2:	• The City of Barrie excavated the City's landfill, beginning in 2008. This project encompassed excavating old garbage (approximately 1,600,000 cubic metres) and screening it to separate sand from the garbage. This sand was then re-used for current daily cover, some other materials such as concrete and metal were removed and recycled. After excavation, the City lined the landfill with HDPE and geosynthetic clay liners, and installed landfill gas collection system. After the new liner and systems were installed, the excavated garbage was recompacted into the cells. This project has extended the life of the landfill by an additional 18 years. The gain is largely due to re-use of fines as daily cover, greater density of compaction and reductions in waste disposal rates since the project began. [145]
Recommendation:	• It is recommended that this option proceed to the evaluation stage.

[144] Durham Region (2020). Recycling garbage from the past: Blackstock landfill mining project. https://www.durham.ca/en/news/recycling-garbage-from-the-past-blackstock-landfill-mining-project.aspx

[145] City of Barrie. (2014). Landfill Re-engineering Project. https://www.barrie.ca/Living/GarbageAndRecycling/Pages/LandfillProject.aspx

7A6 - Landfill Gas Management Strategy

Category:	Implementation tool/Strategy
System Overview:	• Under this option, the City would develop a Landfill Gas Management Strategy that considers the City's current commitment through the PowerTrail agreement and the Climate Change Master Plan greenhouse gas (GHG) reduction targets. The strategy would also consider the Renewable Natural Gas Strategy project identified in the City's Energy Evolution Strategy. • Currently, energy is recovered from the Trail Waste Facility landfill through a Landfill Gas Utilization Agreement with PowerTrail Inc. to manage landfill gas (methane) and turn it into electricity. This agreement expires in January 2027, with the possibility of two 5-year extensions, based on City Council approval and pending the ability of PowerTrail to secure a Power Purchase Agreement with the Province. The agreement with PowerTrail provides them with exclusive rights to all landfill gas generated at the Trail Waste facility landfill. • The City owns the existing gas collection and flaring system infrastructure in place for the management of landfill gas which, will be available for use beyond its current agreement with PowerTrail beyond 2027. PowerTrail owns and operates the landfill gas to energy plant. • The City will need to review the current landfill gas management approach and develop a strategy for capturing landfill gas and producing energy once the current contract with PowerTrail expires. • There is an opportunity to develop a landfill gas to renewable natural gas (RNG) project at the Trail Waste Facility landfill. Such a project would have the potential to reduce GHG emissions and produce a clean fuel source. RNG could be used for a variety of energy uses, including transportation fuels, electricity and heating. However, the viability of a future project will be heavily dependent on the level of organics diversion the City hopes to achieve, which will impact the quality and availability of landfill gas. • The strategy would be developed in the short-term to determine how the City will manage landfill gas after 2027. It would review options for turning landfill gas into RNG and develop a recommended approach that considers environmental, financial and other implications.

Category:	Implementation tool/Strategy
Status:	• Emerging • Some municipalities have agreements or systems in place for the management of landfill gas. • The City of Toronto has a strategy to blend the renewable natural gas that will be produced at its landfills and organics processing facilities with the natural gas that the City purchases to fuel vehicles and heat buildings to create a low-carbon fuel blend[146].
Source of Option:	• Staff
Proposed Strategic Alignment:	Goals: • 5. Maximize the recovery of materials and energy. • 6. Aspire to achieve 100% GHG emission reductions. • 9. Maximize cost containment and revenue generation to help minimize costs to taxpayers. • 10. Make sustainable waste management design an essential part of the City's planning process. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Protect the environment for future generations. • Lead by example. • Adopt circular economy principles. • Embrace innovation. • Keep waste local. • Use the triple bottom line.
Needs Assessment Alignment:	• Aligns with the need to identify an approach to utilizing landfill gas and producing energy once the current contract with PowerTrail expires in 2027. • Tied to the need to determine what energy recovery technology/ies or approaches will be employed to recover as much energy as possible from the waste stream and create renewable energy from this waste. • Potential to align with the City's Energy Evolution Strategy - Renewable Natural Gas Strategy project.

[146] http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2020.IE14.7

Category:	Implementation tool/Strategy
Individual Producer Responsibility (IPR) Impact:	• No impact.
System Consideration:	• Secondary – would be an overlay onto core system.
Sector Applicability:	• Not applicable.
Environmental Considerations:	• The decomposition of the organic component of municipal waste in landfills produces landfill gas containing about 50% methane (CH4) and 50% carbon dioxide (CO2). Methane is a potent greenhouse gas, as it has a global warming potential 21 times that of carbon dioxide. As a result, landfills are considered a significant source of greenhouse gas emissions. • Landfill gas emissions can be controlled by installing a network of collection wells and directing the gas by fans to facilities for use of the gas (e.g. for electricity generation or use by a nearby industry), or for flaring (i.e. burning). Simply burning the methane to convert it to carbon dioxide reduces its global warming potential by about 95%. Use of the methane for energy purposes can further reduce greenhouse gas emissions by replacing other energy sources, such as natural gas or coal. • The Energy Evolution Strategy lays out pathways for getting to 100% reduction of GHGs in Ottawa. To achieve the aggressive GHG reduction targets, the Strategy proposes the capture of virtually all organic material for production of biogas and conversion to RNG through anaerobic digestion (in a landfill or organics processing facility) or gasification. The use of gasification for organic waste for manufacturing of renewable natural gas (RNG) is noted as not currently being a proven technology. • Development of a Landfill Gas Management Strategy will allow consideration of the Renewable Natural Gas Strategy project identified in the Energy Evolution Strategy and has the potential to reduce GHG's.
Social Considerations:	• No impact to level of resident effort. • Landfill gas energy projects generate revenue and create jobs in the community.

Category:	Implementation tool/Strategy
Technical/ Operational Considerations:	• Landfill gas generation and capture is influenced by landfill size and age, waste composition, and waste management facilities and technologies. • Starting in 2022, based on provincial regulatory requirements, the Trail Waste Facility landfill is expected to generate increased amounts of GHGs, which will not be captured i.e. they are fugitive emissions that will be released into the atmosphere. • PowerTrail has first rights of refusal for any gas utilization implemented at the site during the term of the contract and own all benefits associated with the management of any landfill gas, including carbon credits. • The City may have to negotiate with PowerTrail if a program/policy/facility is developed before the current contract expires in 2027 that would reduce the amount of organics going to the Trail Waste Facility landfill that would reduce the quality or quantity of landfill gas. • If the PowerTrail generation system no longer runs steady state because landfill gas is directed to other uses, it may be able to bid into the capacity market and run periodically with good economic returns • The City will need to decide on an overall approach to processing organics, given this has significant potential to impact future quantities of landfill gas. Estimates of future quantities of landfill gas can then be made to assist with determining how the City will manage landfill gas from the Trail Waste Facility landfill, including determining if the City wishes PowerTrail to extend the current contract or undertake an alternative approach to this for management of the landfill gas. • Modeling done through the Energy Evolution Strategy requires combustion–based electricity generation to be phased out, unless it is required for redundancy and/or resilience. • The City should investigate alternative uses for landfill gas generation, such as renewable natural gas (RNG). In the short and medium terms, the City will have a better understanding of how organics will be managed and the potential impact on landfill gas. • With some exceptions, in order to mitigate GHG emissions, RNG is best injected into the gas grid to displace the use of fossil natural gas. Provided the RNG is contracted to a user in Ottawa, the community can claim the environmental benefit. • The City could investigate co-locating some anaerobic digestion capacity at the Trail Waste Facility to achieve economies of scale and to boost methane concentrations of a combined biogas / landfill gas stream, which will help to ensure the long-term feasibility of energy production options.

Category:	Implementation tool/Strategy
Technical/ Operational Considerations:	• Landfill gas could be used as a part of a leachate management solution for the Trail Waste Facility site, using the gas as part of an evaporative process. This could impact the amount of landfill gas available for conversion into energy.

Regulatory Considerations:	• Regulations for landfill gas management systems are not applicable to a strategy.
	• However, there are numerous regulatory requirements and approvals that would be required for a RNG project. Considerations include:
	  ○ Landfill gas management systems are regulated by the Province and require provincial approvals.
	  ○ The provincial guideline on landfill gas capture identifies the regulatory and approval requirements for landfill gas. The guideline describes the regulatory and approval requirements for the capture of landfill gas and the information needed to obtain approval of the landfill gas facilities under Part V (waste management) and Section 9 (air and noise emissions) of the Environmental Protection Act.
	  ○ The General Waste Management Regulation under the Act sets out requirements for landfill gas collection and flaring (burning), or use, for new, expanding and operating landfills larger than 1.5 million cubic metres.
	  ○ The requirements set out in the regulations are developed through the approvals process and implemented through an Environmental Compliance Approval (ECA).

Financial Considerations:	• Capital costs related to development of the strategy are estimated to be low (between $100,000 and $500,000). • Carbon pricing, should it continue, has the potential to improve the market economics of energy produced from organics.

Category:	Implementation tool/Strategy
Unknowns/ Assumptions:	• Timing of the implementation of more aggressive measures for diversion of organics is unknown, including the Provincial ban on sending organics to landfill, which has been pushed out from 2022 to being in place across the Province by 2030, and what the impact of these measures may be on the production of landfill gas at the Trail Waste Facility landfill. • It is unknown how much landfill gas will be available in the future for conversion into renewable energy. • It is not completely known how much energy (gaseous, electrical or thermal) can be conveniently moved from the landfill. • The future capacity of the Ontario electrical grid is unknown. Energy Evolution modeling requires combustion–based electricity generation to be phased out unless it is required for redundancy and/or resilience. • Power procurement is a provincial responsibility and it is not certain the Province will renew PowerTrail's power purchase agreement when it expires.
Supporting System Requirements for Success:	• The approach to the collection and processing of organics will impact the Landfill Gas Management Strategy.
Potential Outcomes:	• An effective Landfill Gas Management Strategy will maximize the capture of landfill gas and prevent the release of landfill gas and GHG emissions into the air. • The strategy will also help the City maximize financial benefits from landfill gas capture and conversion into renewable energy. • The strategy will not directly impact waste diversion or landfill life. • More aggressive diversion of organics at the source will significantly reduce the quantities of organics disposed of in the Trail Waste Facility landfill and will reduce future quantities of landfill gas generated, possibly making future energy production from landfill gas a non-viable option.
Measurement:	• Implementation of this option is measurable. • Success measure is the completion of the Landfill Gas Management Strategy.

Category:	Implementation tool/Strategy
Case Study #1:	• The City of Toronto's current landfill, Green Lane, and their closed Keele Valley landfill, and their anaerobic digestion (organics processing) facilities are some of the largest producers of biogas and landfill gas in Ontario. Over the last few years, the City has been looking for opportunities to harness the green energy potential of the biogas produced at their landfills and anaerobic digestion (organics processing) facilities and have identified renewable natural gas (RNG) as a top priority for biogas management[147]. • After identifying RNG as a priority, the City began searching for technologies and partnerships to upgradei ts biogas and landfill gas to RNG. Through multiple studies, the City identified potential RNG production opportunities at four locations: its two anaerobic digestion (organics processing) facilities (Dufferin and Disco Road) and two of its landfill sites. • They have incorporated landfill gas into their Renewable Natural Gas Strategy, to reduce GHG emissions by blending with fuel used for facilities and vehicles. • Through the four sites, it's estimated that the City could produce approximately 64 million cubic metres of RNG per year – the equivalent in greenhouse gas emission reductions of taking 35,000 cars off the road for a year.
Case Study #2:	• The Niagara Falls Renewable Natural Gas plant, a partnership between the Ontario government, Walker Industries, Enbridge and Comcor Environmental is currently under construction. • The $42M plant will capture landfill gas and transform it into renewable natural gas. It is expected that the plant will generate enough energy to heat 8,750 homes and reduce greenhouse gas emissions by 48,000 tonnes annually. • The project is to be completed by the end of 2021.[148]
Recommendation	• It is recommended that the option proceed to the evaluation stage.

[147] https://www.toronto.ca/services-payments/recycling-organics-garbage/solid-waste-facilities/renewable-natural-gas/

[148] https://www.enbridge.com/stories/2020/october/enbridge-and-partners-break-ground-ontarios-largest-rng-plant, https://www.bioenergy-news.com/news/ontarios-largest-rng-facility-to-be-built-in-niagara-falls/

8. Residual Management

8A1 – Purchase an Existing Landfill

Category:	Facility/Infrastructure
System Overview:	• The Trail Waste Facility (TWF) currently has an approved capacity of 16.9 million cubic metres, with approximately 5.1 million cubic metres (30%) of airspace remaining. New or additional disposal capacity will need to be secured before the closure of the TWF. • This option looks at the requirements and implications of purchasing an existing landfill with sufficient remaining approved capacity (i.e. > 10 years) to serve the City's future disposal needs - to supplement current disposal capacity at TWF or be subsequent to the TWF closure. It is noted that if the City cannot secure the purchase of a landfill within the City limits or close to the City limits, a new transfer station, or entering into contractual arrangement with local private waste transfer stations, will likely be required to minimize costs for hauling garbage to a different landfill. • There are several landfill sites in Ottawa or the surrounding areas that are currently owned and operated by the private sector that could be potentially explored for purchase, however, disposal capacity in the province is quickly diminishing and the process involved in securing an existing landfill is significantly lengthy and expensive. • Furthermore, additional considerations and complexities associated with purchasing an existing landfill include the fact that some are not permitted to take solid waste that contains organic matter, have limited capacity remaining, or have other environmental limitations that may pose a risk to the City. Based on these limitations, there are limited opportunities to purchase an existing landfill that would fulfill the City's requirements.

Category:	Facility/Infrastructure
Status:	• Proven • While municipalities have purchased landfills in the past, it is anticipated that it would be extremely difficult to do so now. • There are many factors at play when examining the potential for landfill purchase, in addition to the requirement for the existing owner to be willing to sell. Extensive investigation and pre-acquisition environmental due diligence of the site assets, liabilities, and historical operations would be required prior to determining the feasibility of purchasing an existing landfill. It is noted that there are significant risks of environmental liabilities, approval and/or permitting non-compliance, or other risks associated with the properties and their operations, which requires consideration prior to completing a due diligence investigation into the existing landfill. There may be any number of factors (i.e. regulatory approvals, additional studies, contractual obligations) that could be required that could negate the potential value of a site and the basis for purchase. While there are many factors that need to be considered, there have been examples of municipalities purchasing existing landfills to increase waste disposal capacity, as noted in the Case Studies below.
Source of Option:	Consultant
Proposed Strategic Alignment:	Goals: • 9. Maximize cost containment, revenue generation and the efficient use of waste management resources to help minimize costs to taxpayers. Guiding Principles: • Keep waste local (if the landfill is located in Ottawa). Utilize the triple bottom line.
Needs Assessment Alignment:	Addresses the need to determine ways to extend the life of the Trail Waste Facility landfill to maximize the life of the asset and plan for new disposal capacity, when required.
Individual Producer Responsibility (IPR) Impact:	• Partial impact. • With Individual Producer Responsibility (IPR), there may be more recyclables diverted from landfill disposal. New producer responsibility programs may recover more recyclables at the source (e.g. curbside, public drop off areas). Residual from the current materials recovery facility (MRF) that cannot be recycled would also likely not be disposed at TWF, saving some airspace. With additional recyclables being diverted from landfill disposal, the landfill filling rates may decrease on a year-to-year basis. As such, this may reduce the City's disposal requirements and extend landfill capacity at TWF.

Category:	Facility/Infrastructure
System Consideration:	Core system component.
Sector Applicability:	Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Purchasing an existing landfill would minimize the potential environmental impacts associated with siting and operating a new landfill facility. However, with the purchase of an existing landfill, the City would be obtaining and inheriting the existing risk for adverse environmental impacts associated with the landfill. Extensive environmental due diligence would be required prior to the acquisition of any existing facility. • Depending on the location of any potential landfill that is purchased, there is the potential to either increase or decrease the greenhouse gas (GHG) impacts associated with material transportation, as the distance from the point of collection increases or decreases. Greenhouse gas (GHG) emissions associated with the existing landfill are not anticipated to change since the waste composition and compaction rates are expected to stay within the same range. It is noted, that as the amount of waste landfilled increases, GHG emissions could marginally increase.
Social Considerations:	• Purchasing an existing landfill should constitute minimal social impacts if the site is already operational and its use would continue relatively unchanged; however, there is potential for public resistance, particularly in the host community. • Any public concerns with acquiring an existing landfill could be addressed through appropriate public consultation defining mitigation measures and social benefits, should such consultation be deemed necessary. • Indigenous communities with a potential interest in the project would need to be consulted. Resistance from these communities would be expected if a facility has the potential to impact their traditional territory and land uses. • If a new transfer station is required as a result of the location of the purchased landfill, local public resistance to this station could occur. New transfer stations often increase traffic, odour, and noise in nearby areas. • There may be some opposition in the host community to a new owner of a facility (i.e. the City would own a landfill in another Municipality/Township). Public concerns related to the potential that a new owner may increase traffic, litter, noise and odour.

Category:	Facility/Infrastructure
Technical/ Operational Considerations:	• Technical considerations of this option largely revolve around any environmental due diligence completed for any potential landfill to confirm or identify sources of potential concern and liability with respect to the landfill design, operation, and regulatory compliance. • The remaining capacity and potential for expansion of the existing landfill would need to be considered as part of the evaluation. There is the possibility that an existing landfill could be purchased but the resulting additional waste disposal capacity would not be sufficient to make the landfill a suitable option. • General items of concern with the purchase of an existing landfill would include, but not necessarily be limited to the: o Potential for environmental impairment, such as subsurface contaminated groundwater or soil that may exceed a predetermined threshold of materiality to manage and/or remediate; o Potential for significant regulatory non-compliance issues that could result in the suspension of landfill operations or the requirement to invest funds in excess of a predetermined threshold of materiality; o Regulatory requirements or commitments made under contract that would involve significant capital or operational expenditures that have not been accounted for in the preliminary financial assessment; o Potential conditions and/or limitations with property permits and remaining landfill capacity or design; o Other items that may arise during an environmental due diligence review of any landfill site proposed for purchase; and o Successful negotiations with the potential seller. As mentioned, disposal capacity in the province is quickly diminishing and the process involved in securing an existing landfill is significantly lengthy and expensive. • Uncertainty associated with the timing of purchasing an existing landfill exists. The timing of this option is defined as medium-long term, as significant preliminary discussions, financial assessment, environmental due diligence, and negotiations are required and vital prior to completing a transaction to purchase an existing landfill. Preliminary discussions with private landfill owners, as well as the required funding options for any potential purchase can be deemed short-medium term.

Category:	Facility/Infrastructure
Regulatory Considerations:	• Purchasing an existing landfill would assume that the facility has satisfied all of the requirements of its Environmental Compliance Approval (ECA). Completion of a pre-acquisition environmental due diligence review would seek to confirm that any potential site deemed suitable for purchase satisfies all stipulated requirements and clauses of its ECA and operating permit.
Financial Considerations:	• Financial implications are uncertain at this time and would rely on a number of external factors. It is anticipated that any acquisition could result in high costs, depending on the site assets, liabilities, and other external factors. • It is expected that the capital costs could be within the medium/high cost range (i.e. $100-$200M) to high (i.e. >$200M). For operations, it is uncertain at this time if the City would operate the landfill or a private contractor would be responsible. It is expected that annual operating costs could be within the medium/high cost range (i.e. $6-$10 million) on an annual basis. These costs are based on consultant's experience and case studies with a similar scope of work.
Unknowns/ Assumptions:	• At this time, it is unknown how IPR will impact the quantities of recyclables and organics in the garbage stream which could be recovered and diverted from landfill disposal. • The current market for the sale of an existing privately owned landfill is currently unknown. Existing sites may not be available for purchase or deemed not viable for purchase for a variety of reasons. It is assumed that long-term disposal needs will be confirmed after the completion of the Solid Waste Master Plan and based on any planned initiatives arising from the plan that are implemented to reduce the amount of waste requiring disposal to estimate the potential future tonnage requiring disposal.

Category:	Facility/Infrastructure
Supporting System Requirements for Success:	• Preliminary discussions with existing owners of private landfills to determine the willingness of both sides for the purchase of an existing landfill. • Identification of a suitable site with a willing seller. • Extensive investigation and financial assessment of what a potential deal starting point would be. • Extensive environmental due diligence review of the site and the landfill to determine the efficacy of purchase, potential environmental liabilities, potential for existing approval and/or permitting non-compliance, and other risks associated with the landfill and the landfill operations. • Transportation distances from the City to the proposed landfill will also need to be considered as the City does not currently have a transfer station. However, the use of private sector transfer stations could also be explored given the number of privately owned transfer station that exist within the City's boundaries. In the event the City requires a new transfer station due to the location of the purchased landfill, an ECA would be required. If the transfer station exceeds an outbound limit of 1,000 tonnes per day, the approval process will require an Environmental Assessment screening. Additional approvals would be required from the City and potentially other agencies (e.g. local Conservation Authorities) are likely required for the development of a new transfer station.
Potential Outcomes:	• Prolong City owned landfill airspace capacity. • Secure a waste management disposal facility that can serve the City long after the anticipated closure of the TWF. • Not required to site and develop a new landfill in the short-medium term.
Measurement:	• Not applicable.

Category:	Facility/Infrastructure
Case Study #1:	• In 1989, the City of Sault Ste. Marie, Ontario, purchased an existing landfill which had started operation in the 1960s. After the landfill was purchased by the City, the City applied for a landfill expansion of 4,200,000 m^3, which would increase the total landfill capacity from 2,260,000 cubic meters to 6,460,000 cubic metres. Today, the City is currently working on a five-year expansion for the landfill (approximately $21.5M for a five-year project).
Case Study #2:	• The City of Toronto purchased the Green Lane Landfill in 2007 at a cost of $220 million and an approved site volume of approximately 18M m^3 and began operating the landfill to address all of the City's waste disposal needs, starting in 2010. The City currently utilizes a private contractor to operate the landfill.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

8A2 – Use of a Private Landfill

Category:	Facility/infrastructure
System Overview:	• The Trail Waste Facility (TWF) has an approved capacity of 16.9 million cubic metres, with approximately 5.1 million cubic metres (30%) of airspace remaining. New or additional disposal capacity will need to be secured before the closure of the TWF. • This option looks at the requirements and implications of using an existing landfill to supplement current disposal capacity at TWF or be subsequent to the TWF closure via contract with a private owner and/or operator of a landfill facility. It is noted that if the City cannot secure the use of a private landfill within the City limits, use of a transfer station may be required to minimize costs for hauling garbage to a landfill located elsewhere. • There are landfill sites in Ottawa and the surrounding Eastern Ontario region that are currently owned and operated by the private sector that could be utilized to meet the City's current and future landfilling needs. However, the availability of disposal is ever-changing and there are constant and ever-increasing demands on this limited capacity. This is expected to continue in the future and is an important consideration when exploring the use of private landfills and the ability to secure airspace for Ottawa's long-term residential waste disposal needs. • The City could also consider shipping garbage outside Ottawa and the Eastern Ontario region to landfills elsewhere in Ontario or to the United States (e.g. New York State). However, this would not align with the goal the Solid Waste Master Plan of keeping waste local and would be faced with various transportation logistics, including long haul distances and international border crossings. It would also likely contribute to increasing greenhouse gas (GHG) emissions related to longer transportation to a final disposal location.
Status:	• Proven • There are many factors at play when examining the potential for a contract with a privately owned landfill. All environmental and material liabilities remain with the private facility owner. The risk of this option would be that the City would be relying on the availability of private sector landfill capacity for a core component of its waste management system. If the anticipated operational expenses related to the tipping fees at a private site and transportation costs were deemed appropriate in comparison to the capital and operational expenditures of other alternatives such as siting a new landfill or purchasing an existing landfill, then this option would be relatively simple and viable in terms of securing airspace for the City's solid waste disposal needs, both in the short-term to extend the service life of TWF and after the anticipated closure of the TWF.
Source of Option:	• Consultant, Staff, Consultations

Category:	Facility/infrastructure
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly. • 9. Maximize cost containment, revenue generation and the efficient use of waste management resources to help minimize costs to taxpayers. Guiding Principles: • Keep waste local (if the landfill is located in Ottawa). • Utilize the triple bottom line.
Needs Assessment Alignment:	• Addresses the need to determine ways to extend the life of the Trail Waste Facility landfill to maximize the life of the asset and plan for new disposal capacity, when required.
Individual Producer Responsibility (IPR) Impact:	• Partial impact • With IPR, there may be more recyclables diverted from landfill disposal. New producer responsibility programs may recover more recyclables at the source (e.g. curbside, public drop off areas). • With additional recyclables being diverted from landfill disposal, the landfill filling rates may decrease on a year-to-year basis. As such, this may reduce the City's costs to dispose of waste, with fewer tonnes requiring disposal.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Using an existing landfill would minimize the potential environmental impacts associated with siting and operating a new landfill. Any environmental impacts or liabilities would be the responsibility of the private landfill owner. • Depending on the location of any potential landfill that is utilized, there is the potential to either increase or decrease the GHG impacts associated with material transportation as the distance from the point of collection or generation increases or decreases.

Category:	Facility/infrastructure
Social Considerations:	• Using an existing landfill may raise public concerns related to the potential that a new and large waste generator is using the private landfill and may increase traffic, litter, noise and odour (i.e. an additional user may have higher landfilling rates and more trucks hauling waste to the landfill). • There may be some opposition in the host community to the City using a private landfill situated in another Municipality/Township (i.e. City using valuable landfill space in another landfill). • Public concerns related to the potential that another municipality is using the private landfill and may increase traffic, litter, noise and odour (i.e. an additional user may have higher landfilling rates and more trucks hauling waste to the landfill). • If a transfer station is required as a result of the location of the private landfill, local public resistance to the station could occur. New transfer stations may increase traffic, odour, and noise issues in nearby areas depending on the location. • Depending on the location of the private landfill, waste may need to be hauled by large transfer trailers that consolidate waste from multiple trucks (i.e. curbside trucks). Larger transfer trailers may create impacts on the local transportation network and operations.
Technical/ Operational Considerations:	• The timing of this option is twofold: exploring the ability to redirect waste from the TWF while it is still in operation (considered a short-term option), and securing private sector landfill disposal capacity once the TWF is full (considered a medium-long term option). As the TWF nears its anticipated closure, the timing for the assessment and implementation of this option becomes more critical. • Technical considerations such as assessing the duration of anticipated landfill use and the anticipated length of any arrangement with private landfill owners and/or operators will be required. • The City will need to allow themselves enough time to determine if there are one or more private companies able to meet the capacity requirements and the timeframe for which additional capacity is required. Otherwise, they will need to pursue other options. • Technical requirements for a procurement process are expected (i.e. RFP development, contractual documents). • City would be taking on minimal additional risk and liability. It is noted that the City should review the risks and liability involved prior to engaging in discussions with private providers. • Transportation distances to the proposed landfill will also need to be considered and consideration of whether transfer capacity is required. These considerations would need to be determined in advance of any future collection contracts being issued and can be separate from a landfill capacity contract.

Category:	Facility/infrastructure
Regulatory Considerations:	• No additional regulatory implications or considerations would be required, as any such site would be required to have the necessary approvals to accept the type and volume of waste generated by the City. • It is assumed that any site would be in compliance with the requirements of its Environmental Compliance Approval (ECA). Furthermore, any such issue of regulatory approvals and/or non-compliance would be the responsibility of the private landfill owner and/or operator.
Financial Considerations:	• It is expected that there would be minimal to no capital costs associated with use of a private landfill. • There may be capital costs associated with purchase of transfer trailers for hauling materials to the landfill and/or a transfer station, depending on the contractual arrangements the City makes for hauling waste. Capital cost ranges could be within the medium/low range ($10 to $50 million) (i.e. purchase of large transfer trailers to ship waste to the landfill). • If the City uses a landfill outside the City, it is likely that annual operating costs will increase (i.e. tipping fees and hauling costs). As such, it is estimated that annual operating costs could be within the high range (i.e. >$10 million) depending on the location of the landfill, agreed upon tipping fees and any additional hauling costs. • It is noted that financial implications are uncertain at this time and would rely on a number of external factors. In addition to paying a tipping fee for disposal of the City's waste, there would also be no potential revenue associated with landfilling waste collected and delivered by others to the TWF. • A long-term agreement with one or more private companies would achieve cost and capacity certainty for the term of the agreement.
Unknowns/ Assumptions:	• At this time, it is unknown how IPR will impact the quantities of recyclables and organics in the garbage stream which could be recovered and diverted from landfill disposal. • It is unknown at this time the impact of the impending future ban on organics from landfills as it may add complexity to what the City may deliver to a private landfill. • The length of time that any potential private site would be able to commit to in order to serve the City's long-term waste management needs is unknown. Disposal capacity in Ontario is quickly diminishing and securing waste capacity at an existing private landfill could be expensive year over year. • It is unknown whether one landfill site may be able to manage all the City's waste, or if the City would need to split their tonnage between more than one site. • It is unknown what tipping/hauling fees might be in the future if landfill capacity continues to decrease and markets get tighter. • It is unknown if transfer capacity may be required.

Category:	Facility/infrastructure
Supporting System Requirements for Success:	• Determine short and mid to long-term disposal capacity requirements and disposal strategy. • Financial assessment of the efficacy of sending the City's waste to an existing private facility(s). • Contract negotiations with private provider(s) to obtain preferred tipping fee rates for an anticipated annual tonnage of waste delivered. It is noted that given the number of available landfills within the area, the City would need to undertake a procurement process, followed by Determine if transfer capacity is required.
Potential Outcomes:	• Prolong secured landfill disposal capacity. • Supplement current disposal capacity at the TWF. • Identify a waste management facility(s) that can serve the City's disposal needs after the anticipated closure of the TWF.
Measurement:	• The implementation of this option would be qualitative based on the volume of waste capacity secured, the duration of the contract with the private operator and price per tonne (i.e. tipping fees).
Case Study #1:	• The Municipality of Chatham-Kent uses a private landfill (Ridge Landfill) to dispose their residential waste. The Ridge Landfill, located in Blenheim Ontario in the Municipality of Chatham-Kent, is owned and operated by Waste Connections. The Ridge Landfill is approved to receive waste from the IC&I sector in southern and northern Ontario and also receives residential waste from the Municipality of Chatham-Kent. It is noted that in 2020, Waste Connections completed the environmental assessment (EA) process for the Ridge Landfill expansion and it was approved by the Province. It is expected that the EA approval will extend the life of the Ridge Landfill and continue to allow Chatham-Kent to use this private landfill.
Case Study #2:	• Municipalities such as the Region of Peel and City of Guelph send their waste to the privately owned Twin Creeks Landfill. The Twin Creeks Landfill is a regional facility located in Watford, Ontario, and provides disposal services for communities, businesses and industries in Ontario. • The landfill is owned and operated by Waste Management and is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous waste, including non-hazardous contaminated soil. The landfill is located within Lambton County, which also has a long-term contract with Waste Management for access to landfill disposal capacity. • Peel Region pays $75/tonne for hauling and disposal of waste at Twin Creeks landfill (~$20.8 million annually). The City of Guelph pays $56.50 for hauling and disposal of a minimum of 20,000 tonnes annual to Waste Management (to their Twin Creeks landfill) as part of a 10-year contract (as of 2013). The landfill is located within Lambton County, which also has a long-term contract with Waste Management for access to landfill disposal capacity.

Category:	Facility/infrastructure
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

8A3 – Develop a New Landfill

Category:	Facility/infrastructure
System Overview:	• The Trail Waste Facility (TWF) has an approved capacity of 16.9 million cubic metres, with approximately 5.1 million cubic metres (30%) of airspace remaining. New or additional disposal capacity will need to be secured before the closure of the TWF. • This option looks at the requirements and implications of siting and developing a new landfill to supplement current disposal capacity at TWF and/or be subsequent to the TWF closure. The City could develop a new landfill located inside City limits or outside City limits, in another municipality. It is noted that if the City cannot secure a property within the City limits to develop a new landfill, use of a transfer station will likely be required to minimize costs for hauling garbage to a landfill outside the City. • As part of designing a new landfill, the City could also explore implementation of a biocell or bioreactor design approach as part of this option. A landfill biocell combines a number of technologies including anaerobic bioreactor, air injection, leachate recirculation system, landfill gas (LFG) recovery and utilization system, air pumping equipment, computerized monitoring system, and base and surface liners. Landfill bioreactors are designed to enhance and accelerate the degradation of landfilled materials through biological processes (bacteria). Leachate is typically collected and recirculated back into the landfill. Bioreactors can be designed as aerobic reactors (which rely on oxygen to sustain bacteria), anaerobic reactors (which rely on a low oxygen environment to sustain bacteria), and hybrid reactors which employ both types of bacteria. Biocells differ from bioreactors in that there is always both anaerobic and aerobic phases, and air space is recovered through mining of residuals.

Category:	Facility/infrastructure
Status:	• Proven • Municipalities within Ontario, including the City of Ottawa, have sited and developed landfills in the past. Municipalities such as the Cities of Toronto and Hamilton have also developed transfer stations within their municipal boundaries to consolidate waste from collection trucks into larger transfer trucks for transport to the landfill site. • Siting a new landfill could take several years, as factors such as identification and availability of suitable land, regulatory approvals, hydrogeological and geotechnical studies, etc. will need to be completed ahead of time. • It is noted that while new landfills have been developed in the past, the most recent greenfield or new landfill that was developed by a municipality comparable to Ottawa within Ontario was in Halton Region, which dates back to 1992. Many municipalities have stated that no new landfills will be developed. • The two most recent private sector landfills in Ontario of comparable size to Ottawa include the GFL (Lafleche) Eastern Ontario Waste Handling Facility in Moose Creek, developed in 2000, and the Taggart-Miller Capital Region Resource Recovery Centre, which is currently in the process of being developed. • It is noted that even though bioreactor technologies introduce several benefits, these types of projects within North America are still within the research, pilot and demonstration stage, or have been abandoned (i.e., unknowns regarding regulatory requirements, funding).
Source of Option:	• Staff
Proposed Strategic Alignment:	Goals: • 9. Maximize cost containment, revenue generation and the efficient use of waste management resources to help minimize costs to taxpayers. Guiding Principles: • Keep waste local (if the landfill is located in Ottawa). • Utilize the triple bottom line.
Needs Assessment Alignment:	• Addresses the need to determine ways to extend the life of the Trail Waste Facility landfill to maximize the life of the asset and plan for new disposal capacity, when required.

Category:	Facility/infrastructure
Individual Producer Responsibility (IPR) Impact:	• Partial impact. • With IPR, there may be more recyclables diverted from landfill disposal. New producer responsibility programs may recover more recyclables at the source (e.g. curbside, public drop off areas). • With additional recyclables being diverted from landfill disposal, the landfill filling rates may decrease on a year-to-year basis. As such, this may reduce the City's disposal requirements and extend landfill capacity. • A new landfill would be developed with IPR considerations included and the resulting facility would align with IPR.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Developing a new landfill would pose significant environmental risks that need to be managed and addressed throughout the siting, design and operating phases. • After closure of the landfill, the City would be responsible for on-going environmental monitoring of the site and responding to any issues that are identified. • Potential to introduce groundwater and surface water impacts at a new location. • Concerns related to groundwater quality could be raised, as drinking water for residents in the rural areas is often from a drilled well on their properties. Groundwater sampling in these properties would likely be required on a frequent basis (pending Provincial direction) and it would be at the expense of the City. • Potential to increase greenhouse gas (GHG) emissions if transportation and waste hauling distances increase compared to TWF to dispose the waste at the new landfill. • A new landfill will contribute additional GHGs, however there is the potential to capture some of these and convert into energy. • With respect to the bioreactor approach, bioreactors accelerate waste decomposition to stabilize the waste, realize the benefits of additional waste capacity faster than a traditional landfill, and reduce landfill gas emissions. Bioreactors can reduce GHG emissions from rapid generation and collection of landfill gas. For aerobic bioreactors, carbon dioxide gas is produced instead of methane, which has less global warming potential than methane.

Category:	Facility/infrastructure
Social Considerations:	• Siting a new landfill could see significant public resistance. • A new landfill could produce odour, noise, increased traffic, litter, dust and a visual impact to the community where it is located. • As part of the Environmental Assessment (EA) process, there will be significant public consultation required. Public consultation would inform the public of the proposed plans. As such, it could introduce public concerns that may impact the Province's timing of the approval process on the development of a new landfill. • A new landfill will likely be required to be sited as far away as possible from existing and planned residential developments in order to minimize nuisance impacts on residents. • Indigenous communities with a potential interest in the project would need to be consulted. Resistance from these communities would be expected if a facility has the potential to impact their traditional territory and land uses. • If a transfer station is required as a result of the new landfill location, local public resistance could occur, as transfer stations often increase traffic, odour, and noise issues in nearby areas. • Potential to generate short and long term jobs as part of developing a new landfill.
Technical/ Operational Considerations:	• Siting and designing a new landfill is a significant technical undertaking and would require significant effort and resources from the City. • Significant time, estimated between 10 and 15 years, would be required for the siting, approvals, procurement process, and construction of a new landfill. • Siting and planning of a new facility would need to go through an Environmental Assessment (EA) process and extensive public consultation. • It is recommended to begin planning (i.e. through a siting or business case study) in the short-term to allow for development and implementation of a new landfill in the long-term. It is anticipated that siting and permitting would not be able to occur until the medium-term. • Bioreactors are recommended for new sites in the design phase as specific infrastructure is more easily integrated during early stages of site development. Leachate recirculation system and other injection systems are easier to install during landfill construction. For anaerobic and hybrid bioreactors, landfill gas collection systems that can accommodate high gas generation rates and oxygen induced conditions are required. There is also a limited number of pilot and research bioreactor projects in North America.

Category:	Facility/infrastructure
Regulatory Considerations:	• An Individual EA and ECA (waste, air, and industrial sewage) would be required for the development of a new landfill. The EA process is comprehensive and can take many years to complete, estimated at over seven years. Other approvals such as ECA and municipal approvals, including land use planning, zoning, and site approvals may take more than two years to complete for a new landfill. • Consultation with local Conservation Authorities will determine the type of permit required to fulfil their requirements. • Indigenous communities with a potential interest in the project would need to be consulted. • For the bioreactor approach, it is unknown at this stage the extent of regulatory approvals that would be involved, as most bioreactors are currently in the pilot or research stage. A bioreactor will require an Environmental Compliance Approval (ECA) from the Province. Approval timing for an ECA is unknown and will depend on the complexity of the bioreactor details being proposed. • Bill 197, the COVID-19 Economic Recovery Act would be applicable if the City was to site a landfill within 3.5 kilometers of a municipal border. This Bill requires support from adjacent local municipalities to develop a new landfill.
Financial Considerations:	• Landfill disposal capacity in Ontario is quickly diminishing and the process involved in securing additional disposal capacity (e.g., via a new landfill) is lengthy and very expensive. • Estimated initial capital costs are estimated to be in the medium cost range (i.e. $50-$100 million) for the development of a new landfill (i.e., cost to purchase land, regulatory approvals, planning, design, construction, commissioning, new equipment, etc.). The capital costs are based on case studies for municipalities in Ontario, along with expected costs that have been discussed within the waste management industry. • Estimated annual operating costs are estimated to be in the medium/high cost range (i.e. $6-$10 million per year) for a new landfill. Staffing needs to operate a new landfill would include managers, lead hands, operators, compliance staff, supervisors, etc. Should the City decide to operate the new site, it is likely that additional staff will be required, especially if the TWF landfill is still active and staff cannot relocate. • For bioreactors, net lifecycle costs including capital, operating and closure/post-closure care range considerably depending on the type of bioreactor, scale of the site, and local site conditions.

Category:	Facility/infrastructure
Unknowns/ Assumptions:	• The level of public input and opposition during the siting process and development of a new landfill facility is unknown. • The City would need to find a new location for a new landfill. It is unknown if there are any properties within or near the City that would meet all of the criteria required for a new site (i.e., geotechnical characteristics, environmental sensitivity, allowable setbacks, permitted land use zoning, etc.). • Unknown if privately owned properties would be available for the City to purchase for landfill development and the potential purchase price. • It is assumed that there will be an overlap between the TWF closure and commissioning of the new landfill. • It is unknown how much of the equipment or staff would be transferred from TWF to the new site.
Supporting System Requirements for Success:	• Completion of a siting study and/or business case of siting and developing a new landfill. • If located outside the City, support from adjacent local municipalities (within 3.5 km) via a Council resolution would be required as part of Bill 197. • Extensive planning, public consultation and siting of a new facility. • Engineering design of a new landfill facility, including landfill gas collection and leachate management systems. • Construction of a new landfill and other waste management infrastructure as needed, such as a transfer station. • If a future landfill site within the City cannot be obtained, it should be noted that the City does not have a transfer station. Depending on the results of the siting, a new transfer station may also need to be developed. Alternatively, this capacity could also be contracted out to the private sector. • In the event the City requires a new transfer station due to the location of the new landfill, an ECA would likely be required. If the transfer station exceeds an outbound of 1,000 tonnes per day, the approval process will likely require an EA screening. Additional approvals would be required from the City and other agencies (e.g. local Conservation Authorities) are likely required for the development of a new transfer station. • If a new transfer station is required, there will be additional capital and operating costs (i.e. regulatory approvals, planning, design, construction and new equipment). • Feasibility study of a bioreactor technology is recommended before any planning and implementation for new landfill.

Category:	Facility/infrastructure
Potential Outcomes:	• Secure future landfill airspace for the City's waste disposal requirements well into the future after the anticipated closure of the TWF.
Measurement:	• The application of this option would be measurable with quantitative (landfill site life, operation and maintenance costs, etc.) and qualitative milestones associated with going through the process of developing a new landfill.
Case Study #1:	• Taggart Miller Environmental Services submitted an EA for an integrated waste management facility, referred to as the Capital Region Resource Recovery Centre (CRRRC). The CRRC is proposed for the east end of Ottawa and is intended to provide capacity for recovery of resources and diversion of materials from disposal for solid non-hazardous wastes that are generated by the Industrial, Commercial and Institutional (IC&I) and Construction and Demolition (C&D) sectors. The facility will primarily serve the Ottawa region, with the service area extending to portions of eastern Ontario. The CRRRC will also provide landfill disposal capacity within the same site for post-diversion residuals and non- divertible materials. • The CRRC will include: a materials recovery facility, construction and demolition waste processing, organics processing, hydrocarbon contaminated soil treatment, surplus soil management, a drop off for separated materials or separation of materials, leaf and yard waste composting, and 10.1 million cubic metres of potential disposal capacity for residuals and materials from IC&I and C&D waste that are not diverted. • The Terms of Refence were submitted in September 2012 and the EA was approved by the Province in May 2017. The proposed facility was met with opposition from the community. The City participated in the EA and ECA approval processes and provided further oversight as part of the land use approvals process. The facility has not yet been constructed.
Case Study #2:	• An example of a private company proposing to develop a new landfill in Ontario is the Walker Southwest Landfill proposal. Walker Environmental Group started the process for developing a greenfield (new) landfill in 2012. Their proposal is to develop a landfill located in Oxford County to manage 17.4 million tonnes (~850,000 tonnes annually) of solid non-hazardous waste generated in Ontario from municipalities, residences and institution, commercial and institutional operations. Walker released its draft EA in March 2020. There is some opposition from local municipalities and recent legislation (Bill 197) gives these local municipalities more say in the approvals process.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

8A4 – Trail Waste Facility Landfill Expansion

Category:	Facility/infrastructure
System Overview:	• The Trail Waste Facility (TWF) is permitted to accept solid, non-hazardous waste generated within the boundaries of the City of Ottawa (City). The TWF has a total site area of 153 hectares, of which 85 hectares are approved for landfilling and the remaining 68 hectares is considered buffer land, which is designed to attenuate potential landfill impacts on the surrounding area and local communities. • The TWF has an approved capacity of 16.9 million cubic metres, with approximately 5.1 million cubic metres (30%) of airspace remaining. New or additional disposal capacity will need to be secured before the closure of the TWF. • This option examines the possibility of expanding the approved capacity of TWF. Based on previous studies, there are limited opportunities to expand the TWF. Previous studies have indicated that the area north of Stages 1, 2 and 3 (area B) would be the most favourable option to expand due to the geotechnical characteristics and available area. Further investigation is required to determine if the woodlot (i.e., environmentally sensitive land) in this area can be disrupted by an expansion to the TWF (i.e. significant tree and vegetation clearing will be required). The most significant constraint to expand the TWF occurs within the north-eastern portion of the property, where the soil conditions limit the amount of waste that could be landfilled. • One additional expansion option that the City could investigate in the future includes the feasibility of connecting the Stage 4 footprint to the approved future Stage 5 footprint. Stages 4 and 5 of the TWF are currently separated by a valley, which could be filled to create a continuous waste mound with the future Stage 5 footprint. According to the City, it is estimated this expansion option could add approximately 2 million cubic metres of airspace to the TWF.

Category:	Facility/infrastructure

System Overview:	• Based on the Review of Potential Additional Expansion Opportunities at TWF completed in December, 2017 by Dillon Consulting, the vertical development over the currently approved waste footprints is also constrained, as outlined below:
	  ○ Additional vertical expansion over Stages 1 and 2, which function as natural attenuation cells, is not considered desirable or practical due to groundwater compliance concerns.
	  ○ Additional vertical expansion over Stage 3 is not possible due to loading concerns on the existing leachate collection piping and basal liner.
	  ○ Some limited vertical expansion over Stage 4 may be possible, but the geometry would still be constrained by the crest height on the north slope, which could not be raised further, and any such change would likely be impractical unless it could be approved in the near term to be integrated with the currently planned waste filling operations in Stage 4, considered unlikely as a vertical expansion EA was already completed in Stage 1 to 4 and approved in 2015.
	• Stage 5 is geometrically constrained such that additional vertical expansion is not likely achievable; the Stage 5 is currently being designed and will likely be tied into the top contours of Stage 1 and 4.

Status:	• Proven • The City has expanded the TWF in the past, however, the current options available are quite limited.
Source of Option:	• Consultant, Staff
Proposed Strategic Alignment:	Goals: • 9. Maximize cost containment, revenue generation and the efficient use of waste management resources to help minimize costs to taxpayers. Guiding Principles: • Keep waste local. • Utilize the triple bottom line.
Needs Assessment Alignment:	• Addresses the need to determine ways to extend the life of the Trail Waste Facility landfill to maximize the life of the asset and plan for new disposal capacity, when required.

Category:	Facility/infrastructure
Individual Producer Responsibility (IPR) Impact:	• Partial impact • With IPR, there may be more recyclables diverted from landfill disposal. New producer responsibility programs may recover more recyclables at the source (e.g. curbside, public drop off areas). • With additional recyclables being diverted from landfill disposal, the landfill filling rates may decrease on a year-to-year basis. As such, this may reduce the City's future disposal requirements and extend landfill capacity.
System Consideration:	• Core system component.
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• Expanding the TWF could extend the life of the TWF and could postpone the need to site another landfill in the short term. As such, this would not introduce additional environmental impacts to groundwater and surface water quality on other geographical locations within the City, where a new landfill site would be developed. • Expanding the TWF may delay securing future disposal capacity for several years. Maintaining landfill disposal at the TWF may avoid the potential risk of increasing GHG emissions as a result of longer transportation distances to another landfill. • Expanding the TWF in area B would require clearing of trees and vegetation within the woodlot. This may disrupt ecological species within this area. Further ecology and environmental studies would need to be performed in this area to confirm the magnitude of the ecological impact and environmental sensitivity of this area.
Social Considerations:	• Any expansion of the landfill, either vertically or horizontally, may introduce concerns from the public regarding continued use of the site. Public concerns could be addressed through appropriate public consultation defining mitigation measures and social benefits. • It is anticipated that operating impacts would continue, similar to current operations, so it is anticipated there would not be an increase in traffic, noise, or odours.

Category:	Facility/infrastructure
Technical/ Operational Considerations:	• The greater potential for further development comprises the area (area B) immediately north of the current footprint within the area with more suitable soils. This area had been considered a potential 10 ha expansion area in previous studies. It is noted that one of the disadvantages recognized at the time this study was undertaken with this alternative was the need to remove a significant portion of the woodlot. • Connecting Stages 4 and 5 through filling in the valley in between will require additional planning and design work, and has the potential for long timelines and significant cost. The City will need to perform technical studies and a cost-benefit analysis to assess if this option for expansion is feasible, given that design on Stage 5 has already been initiated. • The expansion of the TWF is defined as a short-medium option, as there is significant planning to be done in the short-term before any approvals are considered. The planning required will involve the feasibility of expanding the TWF and confirming if area B would be the most suitable option moving forward. • The time to implement the expansion and acquire approvals from regulatory authorities is considered a long-term option. Timing for approvals is unknown and unpredictable, depending on the level of community interest. Any construction relating to expanding the TWF cannot be started until the regulatory approvals are obtained and the City secures project funding. Total development timing to implement this option including planning, approvals, permitting, regulatory approvals, design and construction is likely to take a minimum of 5 years.
Regulatory Considerations:	• Depending on the extent and type of landfill expansion, an Environmental Assessment (EA) will be required, and an amendment to the Environmental Compliance Approval (ECA). It is likely that since the TWF went through the EA process in the past, it will need to go through the same process if it were to expand again. The City would likely need to go through the EA screening process in order to confirm the regulatory requirements. • Depending on the expansion desired by the City (vertical or horizontal), the permitting and approval process can range from 4 to 5 years. The permitting approvals can be affected by a number of factors including pre-existing approvals of the site, regulatory requirements, environmental sensitivity of the adjacent land and public response.

Category:	Facility/infrastructure
Financial Considerations:	• An Individual EA could take several years, and costs could be within the low range (i.e. <$10 million). • Depending on the extent of expansion (either within Area B or the valley between Stage 4 and 5), initial design and construction could be within the low/medium cost range (i.e. $10-$50 million). • Changes to annual operating costs will be minimal, as operations will continue in a similar manner to current. It is anticipated that no additional staff will be required to operate the TWF.
Unknowns/ Assumptions:	• At this time, it is unknown how IPR will impact the quantities of recyclables and organics in the garbage stream which could be recovered and diverted from landfill disposal. • It is unknown if the Province will approve the expansion of the landfill. • It is unknown if clearing the woodlot area for the expansion will be approved. • It is unknown if the Province would approve the valley between Stage 4 and 5 to be filled. • It is assumed that the City will perform the required technical studies (e.g. geotechnical) as part of the approvals process. • It is assumed that long term disposal needs will be confirmed based on the completion of the Solid Waste Master Plan and any planned initiatives to reduce waste requiring disposal.
Supporting System Requirements for Success:	• The requirements for success include additional geotechnical inspections (in area B) and a feasibility study for expansion within this area. It is noted that the woodlot in this area could also be considered a significant woodlot (i.e., a defined natural heritage system). As such, a natural heritage review would have to be completed as a minimum along with an environmental sensitivity study of the area.
Potential Outcomes:	• Gain additional landfill capacity at TWF. • Secure waste disposal capacity for the City, delaying the need to secure future disposal capacity in the short-medium term.
Measurement:	• Implementation of this option will be measurable with quantitative measures such as landfilling rates. • Measurement can also be monitored based on compaction rates to maximize the amount of waste that is landfilled at the TWF.

Category:	Facility/infrastructure
Case Study #1:	• On April 10, 2002, Ottawa Council approved a report entitled Trail Waste Facility Landfill Optimization/Expansion - Environmental Assessment (EA) and Environmental Protection Act, (EPA) which sought Council approval to submit the Final EA/EPA Report to the Ministry of the Environment for approval of the expansion of the Trail Waste Facility landfill. • The EA/EPA Report was submitted to the Ministry on May 31, 2002, which was followed by an extensive review process. • The Minister approved the EA to expand the Trail Waste Facility landfill in June of 2005. The expansion was anticipated to provide an additional 10 to 40 years of landfill capacity (past 2008).
Case Study #2:	• In 2020, Waste Connections of Canada completed an EA for the proposed expansion of the Ridge Landfill located in Blenheim, Ontario. The permitting process took over six years for approvals. The expansion provides 20 years of additional capacity at 1.3 million tonnes per year. It is noted that the total cost of the EA is commercially confidential and cannot be disclosed.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

8A5 – Trail Waste Facility Optimization Strategy

Category:	Programs/ Implementation Tools/ Strategy

System Overview:	• The City of Ottawa applied for and received Environmental Assessment Act Approval for a vertical and horizontal expansion of the Trail Waste Facility landfill (TWF) in 2005. The TWF landfill currently has an approved capacity of 16.9 million cubic meters, with approximately 5.1 million cubic meters (30%) currently remaining.
	• The Trail Landfill Optimization Strategy option involves the development of an optimization strategy that considers optimizing landfill operations over and above what is currently done to continually optimize operations in order to increase the remaining capacity and extend the site life of the landfill. The optimization options could include:
	  ○ Upgrade the GPS system on the landfilling equipment (e.g., compactor and/or dozer) with new technology to optimize compaction rates and closely monitor the side slopes to meet the Province's approved final contours. As new GPS technologies emerge over time (i.e. accuracy improvements), the landfill operation can be improved by using modern equipment and up to date technologies.
	  ○ Assess options to minimize the amount of bulky waste (e.g. mattresses, appliances) being landfilled to increase waste compaction and maximize air space usage.
	  ○ Implement shredding/baling operations for bulky waste to reduce waste volume prior to final disposal.
	  ○ Develop a Fill Sequence Plan and Soil Management Plan for future cells to optimize landfill space and surplus soil disposal.
	  ○ Review of existing approved contours to determine if it is feasible to increase landfill capacity through Provincial approvals.
	  ○ Other landfill optimization strategies that could be assessed include the feasibility of leachate recirculation, soil loading opportunities to increase settlement, methods to optimize airspace potential and slope optimization.
	• The City could also include disposal bans for waste it is not required to manage as per the Municipal Act, including IC&I, C&D, MR and farm waste, as well as residuals from the material recovery facility (MRF), which accounts for approximately 25 to 30% of annual tonnage disposed at the TWF. Disposal bans are covered in option description 2A1 - Disposal Bans.

Category:	Programs/ Implementation Tools/ Strategy
Status:	• Proven • Some municipalities in Canada (e.g. the Region of Halton and the City of Fredericton, as part of Regional Service Commission 11) are exploring options to optimize their landfill operations to maximize compaction and prolong the life of their landfills. These municipalities are working on a thorough review of their landfilling operations to develop recommendations for optimizing landfill operations.
Source of Option:	• Consultant, Staff
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly. • 9. Maximize cost containment, revenue generation and the efficient use of waste management resources to help minimize costs to taxpayers. Guiding Principles: • Keep waste local. • Utilize the triple bottom line.
Individual Producer Responsibility (IPR) Impact:	• Partial impact • With Individual Producer Responsibility (IPR), there may be more recyclables diverted from landfill disposal. New producer responsibility programs may recover more recyclables at the source (e.g. curbside, public drop off areas). • With additional recyclables being diverted from landfill disposal, the landfill filling rates may decrease on a year-to-year basis. As such, this may reduce the City's disposal requirements and extend landfill capacity. • The current volume of recyclables and organics received is likely to be less under the new producer responsibility programs included under the IPR legislation. This could impact landfill operations as the type of waste being landfilled could differ from current operations. Landfilling a different composition of waste may impact compaction rates and potential optimization results.
System Consideration:	• Considered a secondary option to a system-wide consideration (residuals management).
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).

Category:	Programs/ Implementation Tools/ Strategy
Environmental Considerations:	• Optimizing TWF may prolong the capacity of the landfill and maximize the air space available for landfilling under the existing constraints of the site and ECA. This will decrease expansion requirements in the short/medium term. • An Optimization Strategy can incorporate diverting specific materials from landfill disposal (e.g. through a mattress recycling program). This could recover more materials for recycling and decrease the amount of these 'difficult to manage' materials that are landfilled on an on-going basis. • The anticipated greenhouse gas (GHG) emissions per unit of waste do not change compared to pre-landfill optimization, however, GHG impacts are marginally increased due to the greater volume of waste deposited and optimization scenario chosen.
Social Considerations:	• The public is anticipated to support measures to optimize the City's biggest solid waste management asset, especially since it will not directly impact them. Optimizing operations demonstrates to the public that the City is attempting to maximize their existing resources, even if it requires adjustments to their current operations. • Optimizing the landfill will still require the City to be in compliance with the ECA. As such, there is minimal to no health impacts when in compliance with ECA.
Technical/ Operational Considerations:	• Landfill optimization consists of making changes to an existing landfill to enhance its operation and review landfill equipment for improvements to increase the quantity of waste that can be deposited within the approved contours of the TWF. • The City would need to review current operations and identify any potential areas of improvement that could be implemented to optimize operations. The City would need to develop a strategy to apply the recommendations. • It is noted that there is a possibility that the City would need to procure new equipment to successfully implement some of the recommended strategies (e.g. higher accuracy of GPS equipment, upgrade landfilling equipment (i.e. compactors, bulldozers)).

Category:	Programs/ Implementation Tools/ Strategy
Regulatory Considerations:	• It is anticipated that the landfill optimization recommendations will not require any updates to TWF's ECA. However, it is recommended that once these optimization strategies are implemented, the Province be informed by the City. • An amendment to the Environmental Compliance Approval (ECA) will not be required if landfill optimization techniques are applied within existing approved landfill volume contours and within the commitments of the TWF's Environmental Assessment (EA).

Financial Considerations:	• Net lifecycle capital costs range considerably, depending on the type and extent of the optimization practices. It is anticipated that the capital cost range will be within the low range (<$10 million). Examples of the potential capital costs include:
	  ○ The current GPS system could be upgraded with newer technology (equipment, software).
	  ○ Assessment of mobile shredder and baler performance associated with increasing landfill completed by a third party.
	  ○ Fill Sequencing Plan to be completed every 1 to 3 years and Soil Management Plan to be completed every 10 years.
	  ○ Working with consultants to assess current operations and develop recommendations.
	  ○ Landfilling equipment upgrades (i.e. compactors, bulldozers).
	• It is expected that the annual operating costs will not change significantly from the current operations.
	• Staffing levels will depend on whether additional landfill staff would be required to implement any of the optimization measures.
	• There may be some cost savings from delaying the need for additional landfill capacity.
	• Potential to reduce closure costs due to improved re-engineering and re-landfilling practices.

Unknowns/ Assumptions:	• At this time, it is unknown how IPR will impact the quantities of recyclables and organics in the garbage stream which could be recovered and diverted from landfill disposal. • Option will require a detailed feasibility and optimization study, including waste stream analysis to confirm potential for successful strategies that could be applied to optimize the remaining capacity of the landfill.

Category:	Programs/ Implementation Tools/ Strategy
Supporting System Requirements for Success:	• The development of an optimization strategy for the TWF landfill would involve a review of current operations and assessing what the benefits would be to enhance operations and maximize the amount of waste landfilled within existing approved contours. • Supporting systems for this option includes detailed topographic data to monitor compaction, cooperation between site operators and developing recommendations on how to maximize factors such as compaction at the active face of the landfill. • A decision by Council on whether or not to implement a policy to limit certain types of waste from being disposed of at the Trail Waste Facility landfill, for example, a ban on the disposal of waste that the City is not required to manage per the Municipal Act.
Potential Outcomes:	• Additional landfill capacity through optimization. • Better data to monitor operations at TWF.
Measurement:	• The implementation of this option will be measurable with quantitative measures such as compaction rates and additional landfill airspace.
Case Study #1:	• Halton Region is currently preparing a solid waste management strategy. As part of the Short-Term options, the Region considered the following measures that would optimize landfill operations to increase the remaining capacity and extend the site life of the landfill: ○ leachate recirculation to increase settlement; ○ use of GPS system to upgrade equipment operations; ○ implement an evapotranspiration final cover to increase water storage capacity; ○ purchase a shredding/baling system to reduce waste volumes prior to final disposal; and ○ develop a fill sequence plan for current and future cells to optimize landfill space.

Category:	Programs/ Implementation Tools/ Strategy
Case Study #2:	• In 1993, the Fredericton Region Solid Waste's landfill became the first landfill in Atlantic Canada to bale solid waste. The baling process involves placing garbage in a compactor to compress it into rectangular cubes. Baling solid waste can introduce several benefits such as reducing the environmental impacts of leachate, decreases the amount of blowing litter generated and extends the lifespan of the landfill (i.e. more waste landfilled per cubic metre of air space available). Once a bale is produced, it is transported to the landfill, where is placed in a cell. Approximately 120,000 bales of solid waste can fit in one cell, where they are covered with gravel. When the cell reaches capacity, it is covered with approximately one metre of clay, 300mm of topsoil and seeded.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

9. Innovation

9A1 Innovation and Technology Strategy

Category:	Programs/ Implementation Tools/Strategy
System Overview:	• The City would develop a strategy to integrate innovation into solid waste technologies and approaches. The Solid Waste Innovation and Technology Strategy would help the City proactively match it's short, medium and long-term waste management needs with innovation and technology solutions that will help address key challenges and drive the City towards its Zero Waste, Circular Economy and Climate Change Master Plan Goals. • The strategy would include a framework, governance model and procurement strategy for how to attract local and international green-tech and knowledge-based industries to drive innovation, collaboration and local economic development. Helping further build upon Ottawa's strong history of innovation and diversity as a technology hub, this framework would seek to make Ottawa a hub that addresses key challenges facing the waste management industry. • The strategy would support the core goals of the Smart City 2.0 Strategy to create a Connected City, Smart Economy and Innovative Government and align opportunities to support the City's Economic Development Strategy by further strengthening and supporting the continued diversification of the local knowledge-based business sector. • The strategy would explore opportunities to partner with the private sector and other partners, including local universities, government researchers, and local economic development partners, such as Invest Ottawa and the Innovation Centre at Bayview Yards, to support and enable the creation, testing, demonstration and commercialization of new and innovative technologies and approaches to managing waste. It would also include the development of a governance model that would detail the roles and responsibilities of the City and all partners in delivering initiatives identified in the strategy, and include a funding strategy that would help attract and leverage grants and public sector funding and private investment to support initiatives. • The strategy would invite both macro and micro innovations. The macro innovations would focus on big ideas and solutions to address major gaps or needs or embrace major opportunities in the City's solid waste system. The City could use vacant landfill bufferland properties not required for future operations to enable public/private sector innovators to pilot/ test and demonstrate their technology solutions however Micro innovations could be allowed access and use of the City's waste stream to pilot and test out products and processes before they are patented and produced. Other vacant properties throughout the City could also be used to support this initiative, but consideration will have to be made to additional approvals that may be required depending on the innovation/technology being piloted.

Category:	Programs/ Implementation Tools/Strategy
Status:	Emerging Some municipalities have developed solid waste strategies to drive innovation or implemented initiatives such as Resource Innovation Hubs or campuses to explore technologies to achieve solid waste goals.
Source of Option:	• Councillor, Councillor Sponsors Group, Staff
Proposed Strategic Alignment:	Goals: • 1. Extend the life of the Trail Road Landfill significantly beyond its current estimated end of life. • 2. Reduce the amount of waste generated. • 3. Maximize the reuse of waste. • 4. Maximize the recycling of waste. • 5. Maximize the recovery of materials and energy • 6. Aspire to achieve 100% GHG emission reductions • 7. Support, influence and partner with the IC&I and C&D sectors to reduce, reuse and divert waste. • 9. Maximize cost containment and revenue generation to help minimize costs to taxpayers. • 10. Make sustainable waste management design an essential part of the City's planning process. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Honour the 5Rs hierarchy. • Lead by example. • Adopt circular economy principles. • Embrace innovation. • Use the triple bottom line.

Category:	Programs/ Implementation Tools/Strategy
Needs Assessment Alignment:	• The City needs to identify more ways to reduce and reuse waste generated by residents and in its own operations to decrease the amount of waste entering the City's solid waste management system. • Identify specific waste streams that can be diverted from landfill disposal and develop new collection and diversion programs to capture these streams. • Need to determine what, if any, waste recovery technologies or approaches will be employed to extend the life of the Trail Waste Facility landfill. • Need to determine what energy recovery technology/ies or approaches will be employed to recover as much waste as possible from the waste stream and create renewable energy from waste. • Being a key City asset, determine ways to extend the life of the Trail Waste Facility landfill to maximize the life of the asset and plan for new disposal capacity, when required. • Determine the future use of bufferland properties, including for operational, community use and or pilot/demonstration opportunities. • Expand and/or modify technologies and approaches used to reach the City's diverse customer base, to create the desired behavioural changes and to support program priorities.
Individual Producer Responsibility (IPR) Impact:	• Partial – Depending on the outcome of the transition to IPR, technologies focused on supporting innovation for programs that have/will transition to IPR will not necessarily need to be an area of focus for the City through this strategy. This would include the City's blue and black box recycling program, as well as the Municipal Hazardous Special Waste program.
System Consideration:	• Secondary – would be a program to overlay onto core system, as well as specific initiatives to enhance core system elements.
Sector Applicability:	• Could apply to waste from all sectors – Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).

Category:	Programs/ Implementation Tools/Strategy
Environmental Considerations:	• The strategy could identify opportunities and strategies for achieving the Solid Waste Master Plan vision and goals. Innovation and technology solutions can help maximize waste reduction, reuse and recycling. For example, repair industry initiatives could support the repair of products instead of planned obsolescence. Innovation investments could transform the single-use plastics industry. Compostable product innovation could divert more materials from garbage to organics streams. More analysis is needed to determine the diversion potential of these and other initiatives. • The Energy Evolution Strategy lays out pathways for getting to 100% reduction of GHGs in Ottawa. To achieve the aggressive GHG reduction targets, the Strategy proposes the capture of virtually all organic material for production of biogas and conversion to RNG through anaerobic digestion (in a landfill or organics processing facility) or gasification. The use of gasification for organic waste for manufacturing of renewable natural gas (RNG) is noted as not currently being a proven technology.
Social Considerations:	• Innovation and technology could help drive behavior change to increase participation in waste reduction, reuse and recycling programs and achieve solid waste goals. Gamification is one example for increasing resident awareness and participation. This was identified as an opportunity in the Hill + Knowlton work carried out for the City's Green Bin program.
Technical/ Operational Considerations:	• Innovation and technology opportunities are numerous and broad. The strategy could narrow the City's focus to the City's specific needs, considering the timing of these needs as identified in the Solid Waste Master Plan. • The technology strategy could tie into lifecycle of the City's infrastructure. • Could build on the success of the Smart Farm and Area X.O. partnership with Invest Ottawa and others. • The City's Innovation Pilot Program (IPP) could offer an example to follow. The IPP Recovery Stream provides companies the opportunity to test and quickly deploy their technology innovations in real-life testing environments with the City or one of its economic development partners. • Operational needs would have to be considered and integrated into any future testing or piloting of potential technologies.

Category:	Programs/ Implementation Tools/Strategy
Regulatory Considerations:	• The strategy would require Council direction and approval. • Demonstration or pilot projects involving the development of a new facility could require a Provincial Environmental Compliance Approval (ECA). The ECA and any associated municipal planning approvals may take one to two years to complete. • The Province has introduced a streamlined approvals process for small research and development projects. If the project meets identified design and storage limits (i.e. is small) and the duration is less than one year, the Ministry has committed to a three month approval period. • Costs associated with the regulatory process are likely to be low (<$1M). • Depending on the initiatives undertaken through the strategy, it could support the proposed future provincial ban on organics being disposed in landfill in 2030. • The Food and Organic Waste Policy Statement establishes targets for food and organic waste reduction and resource recovery by sector. The Province has released proposed changes to the Statement to expand the categories of food and organic waste that municipalities should make efforts to reduce and recover, including compostable coffee pods, soiled paper food packaging, and certified compostable bags. Amendments also state that municipalities should support the use of pilot projects and research on the processing of compostable products and packaging and encourage municipalities to consider adopting technology to collect and process compostable products and packaging in their systems when they are planning for new technology • Compostable packaging is not accepted in the City's current Green Bin program. These materials behave very differently in organics processing facilities, depending on the technology. The Food and Organic Waste Policy Statement amendments are encouraging municipalities to find solutions to manage the anticipated increase in compostable packaging.

Category:	Programs/ Implementation Tools/Strategy
Financial Considerations:	• Difficult to estimate capital costs as it is unknown if innovation and technology strategy strategies or initiatives may require any infrastructure. • Annual operating costs anticipated to be medium/low ($100K-$500K) for staff time to develop/implement the innovation and technology strategy and oversee work with partners. The City does not currently have staff resources to carry out this work. • Would need to establish principles and clear parameters for the strategy and supporting initiatives. For example, municipal taxpayers cannot subsidize industry initiatives. • The strategy would identify financial implications related to implementation costs. The strategy could incorporate a green procurement and investment strategy, depending on Council direction.
Unknowns/ Assumptions:	• It is unknown what potential future technologies or innovations could be considered to meet the City's waste management needs.
Supporting System Requirements for Success:	• Interest from the private sector to develop and test innovative waste management technologies in Ottawa. • Interest from different partners to collaborate on this initiative.
Potential Outcomes:	• There is potential for waste avoidance, reduction and diversion through various initiatives the City may decide to implement, but it is difficult to estimate this quantitatively. • There is potential to reduce the amount of waste being landfilled, which could extend the life of the Trail Waste Facility. • The strategy could advance innovation and technology strategies and initiatives that will support local economic development and create new opportunities. • There is potential for Ottawa to become a destination for innovation and technology demonstration in the solid waste field.
Measurement:	• Completion of the strategy.

Category:	Programs/ Implementation Tools/Strategy
Case Study #1:	• City of Edmonton has partnered with Alberta Innovates and industry to establish waste-to-biofuels and waste processing facilities that accelerate the use of new technologies[149] ○ The Waste-to-Biofuels Facility will convert over 100,000 tonnes of municipal solid waste residuals into 36 million litres of biofuels annually, reducing Alberta's carbon dioxide (CO_2) footprint by six million tonnes over the next 25 year. ○ Partnership with research and technology development organizations to accelerate the implementation of new technologies that reduce the cost and environmental footprint of energy operations in Alberta. ○ Bioenergy and renewable resources are a major focus for the Waste-to-Biofuels Facility, and the accompanying Advanced Energy Research Facility.
Case Study #2:	• City of Phoenix Resource Innovation Campus is attracting manufacturing processes and conversion technologies that transform waste into resources[150] ○ The campus aims to be a hub for innovators to develop Phoenix's circular economy and find sustainability solutions. The innovative processes and technologies will divert more waste away from the landfill and into the city's circular economy. ○ Facilities include a new transfer station, a materials recovery facility, a new compost facility and a business incubator for start-up/emerging technologies and manufacturing processes. The compost site and business incubator are located on the campus. ○ Land leases at and around the campus will be used to develop a resource cluster focusing on a circular economy and by-product synergies. Leases will be made available via a competitive process for innovators and manufacturers with market-ready technologies and processes that use waste to create new products.
Recommendation	• It is recommended that the option proceed to the evaluation stage.

[149] https://www.edmonton.ca/city_government/initiatives_innovation/world-renowned-waste-management-facilities.aspx

[150] https://www.phoenix.gov/publicworks/reimagine/risin

10. Other

10A1 – Future Use of Bufferlands Around Trail Waste Facility and Nepean Landfill

Category:	Facility/Infrastructure

System Overview:	• This option would see the City complete the review of potential alternate and identify future uses for these lands.
	• The City owns a number of properties abutting or in the vicinity of the Trail Waste Facility (TWF) and the closed Nepean Landfill, which are commonly referred to as 'bufferland properties'. These properties serve as contamination attenuation for the two waste management facilities, as a visual barrier for the TWF and are also used for City operational needs. Some of these properties are woodlots and are currently undeveloped. TWF also has a woodlot onsite which is used as contaminant attenuation for Stages 1 and 2.
	• In total there are approximately 309 hectares (ha) of land in 7 locations:
	  ○ Dewatering Pond, approximately 32 ha;
	  ○ West of Moodie, three individual properties comprising approximately 25 ha;
	  ○ Former White Pit, approximately 15 ha;
	  ○ Noel Property, approximately 4 ha;
	  ○ Aggregate Extraction Properties, two individual properties comprising approximately 150 ha;
	  ○ South of Barnsdale Road, approximately 45 ha; and,
	  ○ TWF woodlot, approximately 38 ha.
	• The current land uses are not intensive and other facilities, such as buildings, yard and equipment lots for example, could be constructed while still maintaining their intended purpose of contamination attenuation and visual barriers.
	• The City is currently reviewing options for alternate and additional uses for the bufferland properties. Potential options could include for the re-located Small Loads Facility (drop-off facility for residents, businesses and private haulers), future soil management or leachate treatment facility, leaf and yard waste processing, other City operations, leased to third-party for operations or for community use such as a BMX park, bird observatory, or nature trails. In addition, the bufferland properties could also be used as demonstration/pilot sites for future waste management technologies.

Category:	Facility/Infrastructure
Status:	• Proven • Municipal landfill sites occupy large areas of land and alternate uses of bufferlands and undeveloped areas of the landfill site is a common practice. Examples include related waste management operations such as public drop-off areas, leaf and yard waste composting site, transfer station for materials being diverted from landfill, lease of lands for agricultural uses such as farming and recreational uses.
Source of Option:	• Staff
Proposed Strategic Alignment:	Goals: • 10. Make sustainable waste management design an essential part of the City's planning process. Guiding Principles: • Embracing innovation • Keeping waste local.
Needs Assessment Alignment:	• Aligns with the need to determine the future use of bufferland properties, including for operational, community use and or pilot/demonstration opportunities.
Individual Producer Responsibility (IPR) Impact:	• No impact.
System Consideration:	• Secondary - will be a program to overlay onto core system
Sector Applicability:	• Applicable to waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Parks and Public Spaces (PP).

Category:	Facility/Infrastructure
Environmental Considerations:	• Past investigations have indicated that soil at some of the bufferland properties has been impacted by historical uses. Depending on the proposed use of the bufferland property, additional investigations and/or permits may need to be obtained prior to development. • Potential to introduce groundwater and surface water impacts at a bufferland property, depending on the proposed future use. It is noted that specific environmental protection measures may need to be implemented depending on the infrastructure and operation use considered. • Need to mitigate any environmental effects in the bufferland properties introduced by new waste management operations and infrastructure (i.e., soil Management facility, small loads facility, leachate treatment facility). • It is anticipated to be no/minimal GHG impacts associated with this option.
Social Considerations:	• Some of the bufferland properties serve as a visual barrier for the TWF and this would need to be considered as part of any change in use of the individual bufferland property. • Potential to generate short and long term jobs, depending on the future use of the bufferlands. For example, implementation of a larger small loads or soil management facility. • Local public resistance could occur if the bufferland properties are developed and used for waste management operations. Additional waste management operations in this area may increase traffic, odour, and noise issues in nearby areas. • Public concerns may arise if the bufferland properties are developed for waste management purposes. The public may have the perception that these areas are to be environmentally protected (e.g. woodlots) or that the buffer zone from adjacent waste management operations would be removed or reduced. • The City could consult with the community on future recreational uses of the bufferland properties. • Any public concerns may be addressed through appropriate public consultation defining mitigation measures and social benefits, should such consultation be deemed necessary. • Any alternative uses would need to need to be assessed for impact to the local community.

Category:	Facility/Infrastructure
Technical/ Operational Considerations:	• Each of the bufferland properties has their own constraints (e.g., available area, historical impacts, and surrounding properties) that would need to be examined prior to determining potential future uses. • Bufferland properties that are currently used as contamination attenuation areas are limited in what they could be developed into as the development would need to allow for the continued use as an attenuation area. • The City will need to complete a study to determine the feasibility of developing or relocating a waste management operation within a bufferland property. This could include but not limited to a cost-benefit analysis, geotechnical assessment, environmental studies, and traffic assessments. A design and tendering process would be required to construct any new waste management infrastructure (if it is a feasible option) on a bufferland property. • With TWF Stage 5 anticipated to be constructed and developed prior to 2023, it is suggested that options for uses of bufferland properties be looked at in the short-term. • Siting and planning of a new facility within a bufferland property would need to go through public consultation. • It is noted that planning would be required for the siting, procurement process, approvals and construction of any waste management infrastructure within any of the bufferland properties. • Some of the bufferland properties are currently being used for City operations other than waste management, for example, bus storage and fire training facilities. Given the extent of the area potentially available, there may be other uses besides waste management for the bufferlands that the City may wish to consider, including for community use or for innovation pilot/demonstration opportunities. • The City is currently reviewing a number of different potential options for the future use of the bufferlands through the Trail Road and Nepean Landfills - Bufferlands Assessment Report by Dillon Consulting Limited, dated April 2020. This report should be considered when determining the future use of the bufferlands.

Category:	Facility/Infrastructure
Regulatory Considerations:	• The City will need approval from the Province to relocate the small loads facility and soils management facility from within the TWF Stage 5 footprint. • An Environmental Compliance Approval (ECA) for waste, air and industrial sewage would be required for the development of any waste management infrastructure and operations within any bufferland property that is not adjoining or part of TWF. An ECA amendment would be required for facilities/activities at TWF. An ECA can take up to two years to complete. • Other approvals such as municipal approvals, including zoning and site plan may be required. It may take more than two years to complete this approval process. • Consultation with local Conservation Authority will determine the type of approvals required, if any, to fulfil their requirements of developing within a bufferland property. • Indigenous communities with a potential interest in the project may need to be consulted. • Regulatory approvals for any alternative uses to waste management operations would need to be reviewed, including for pilot or demonstration facilities for waste management.

Category:	Facility/Infrastructure

Financial Considerations:	• The capital cost to determine the future use of bufferland properties surrounding the Trail Waste Facility and Nepean landfill are estimated to be low (<$10M). Operational costs are dependent upon the future use of each site.
	• Capital and operational cost estimates for waste management infrastructure are as follows:
	  ○ Capital costs to relocate the soils management facility to a bufferland property are likely within the low cost range (<$10 million).
	  ○ Capital costs to relocate the small loads facility to a bufferland property are likely within the low cost range (<$10 million).
	  ○ Capital costs for a new leachate treatment facility to treat leachate from TWF on a bufferland property are likely within the low range (< $10 million).
	  ○ Operational costs for the small load facility and soils management facility are likely to be consistent with operational costs at their current location. However, operational costs may increase if the City decides to increase the capacity and footprint of each facility in the new area.
	  ○ Annual operational costs for a new leachate treatment facility on a bufferland property could be within the low cost range < $1 million, as additional staff may be required to operate this system.
	  ○ Operation of the facility could be contracted out however additional costs would be incurred (i.e. for electricity, chemicals, etc. depending on the treatment process). Depending on the treatment capacity, costs could be in the medium/low range ($1-$3 million) annually.
	• Use of bufferland property for waste management operations eliminates the need for land purchase and approvals, reducing capital costs.
	• Alternative uses by other City operations may reduce costs for those operations.
	• Alternative uses may result in new revenues for the City (e.g. land lease).

Unknowns/ Assumptions:	• It is unknown if the Province would have a concern with relocating waste management infrastructure and operations to a bufferland property. • It is assumed that the City will perform the required technical studies and investigations on the bufferland property as part of the planning, approvals, and siting process. • It is assumed that the City is assessing if a leachate treatment facility is required for the leachate generated by TWF Stages 3, 4, and 5.

Category:	Facility/Infrastructure
Supporting System Requirements for Success:	• Conduct a study to determine future uses of bufferland properties. • Completion of a siting study and/or business case to develop and implement waste management operations within a bufferland property, if identified as a future use of one or more properties. • Engineering design of new waste management infrastructures, including siting, design and tendering. • Planning and regulatory/public consultation.
Potential Outcomes:	• Excess soil management opportunities would maintain revenue streams for operations and landfill cover savings. • Relocate the small loads facility and soil management facility to a bufferland property in preparation for the landfill development of TWF Stage 5. • The small loads facility can also be expanded to support the permanent neighbourhood drop-off depots for some or all material option (Option 4D2). • Potential location for a leachate treatment facility to serve the TWF, specifically Stages 3, 4, and 5. • Potential for alternative uses that are compatible with TWF operations. • Various bufferland properties could be considered for use as potential soil management locations in response to the Provincial Excess Soils Management regulations. • Bufferland properties could be used for future waste management demonstration/pilot opportunities that align with the City's zero waste vision and circular economy guiding principle. • Larger bufferland properties could be used for a new LYW facility, adding LYW capacity as required in the future.
Measurement:	• Identification of future uses for the bufferland properties. • The implementation of this option will be measurable with quantitative measures including costs for relocating or adding new waste management infrastructure (capital and operations) and revenue.

Category:	Facility/Infrastructure
Case Study #1:	• In April 2020, Dillon Consulting Limited (Dillon) was retained by the City of Ottawa to complete an assessment of these bufferland properties. The assessment included reviewing the current conditions of these properties and potential land use issues and constraints. Based on a high-level review, the assessment identified the following as possible locations for the relocation of the soils management facility and small loads facility, along with a leachate treatment facility for TWF Stages 3, 4, and 5: ○ The White Pit property could accommodate future soil management requirements; ○ Relocating the Small Loads Facility to the north-eastern portion of the Cedar Forest, within the landfill property; and ○ Future Leachate Treatment Facility remains in the south-western portion of the Dewatering Pond property (as currently planned).
Case Study #2:	• In the 1980s, Halton Region began a process to identify their waste management needs and determine the location for a new landfill. The proposed landfill design assumed a minimum of 100m buffer surrounding the landfill area. As such, the identified location for the landfill was previously cleared for agriculture. It is noted that the area that was not cleared for agriculture included forested areas on the west and east side of the proposed fill area. This land is used for other waste management purposes such as leaf and yard waste (LYW) composting, a public drop-off area and household hazardous waste (HHW) depot.
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

10A2 - Working Towards A Zero Emissions Solid Waste Fleet

Category:	Infrastructure
System Overview:	• The solid waste fleet contributes to greenhouse gas (GHG) emissions in Ottawa. This option would aim to reduce GHG emissions from the solid waste fleet, which includes residential waste collection trucks, landfill equipment, trucks used to collect waste from parks and other public spaces such as transit stops, as well as other vehicles used by solid waste staff to carry out their work. • This option is closely related to the Green Fleet Plan Update and the Energy Evolution Strategy and could be advanced and supported through implementation of those initiatives. It would consider opportunities such as different fuel types, including Renewable Natural Gas (RNG) and hybrid or electric vehicles for municipally-owned and contracted collection service fleets. GHG reduction requirements for private sector contractors could be established through future waste collection contracts. • Solid waste collection vehicles are typically the heaviest fuel users. As a result, waste collection vehicles offer the greatest opportunity for achieving GHG emission reductions. The proposed initial focus for this option is therefore on opportunities for working towards a zero emissions waste collections fleet. • A phased approached towards a zero emissions solid waste fleet is proposed. Measures for progressively reducing the GHG impact of the fleet would be implemented according to the availability of technology, continuous research and piloting/testing of technologies to determine their suitability to the City's needs. The transition to a zero-emissions solid waste fleet will occur over time, as technology becomes available, collection contracts are issued and as fleet vehicles and equipment are replaced at the end of their lifecycle. • This option could be advanced and supported through Fleet Services' work. The City's Fleet Services actively monitors technologies available and implements them once they have been demonstrated in an Ottawa context. Fleet Services also undertakes trials to test new technologies and alternate fuels, where funding is available and operations are not negatively affected. It is critical that vehicles and equipment can operate in Ottawa's climate conditions and geography and suit operational needs. The focus is therefore on proven technologies that will meet service delivery needs. This option is tied to Option 5D3 – Curbside Collection Efficiency Study and 6A2 - Anaerobic Digestion. • This option is tired to Option 5D3 - curbside Collection Efficiency study and 6A2 - Anaerobic Digestion.

Category:	Infrastructure
Status:	• Emerging • Some municipalities are using biodiesel (20% biodiesel; 80% fossil diesel), however it can only be used through warmer months, while some municipalities have moved to Natural Gas trucks where their operation has or plans to have a significant internal supply of Renewable Natural Gas. A few municipalities are piloting or have deployed a limited number of electric collection vehicles. Electric vehicle battery technology is evolving rapidly – trending closer to what could meet Ottawa's operational needs. At the same time, the high cost of early versions of these heavy electric vehicles is trending downwards.
Source of Option	• Consultations, Staff
Proposed Strategic Alignment:	Goals: • 6. Aspire to achieve 100% GHG emission reductions. • 9. Maximize cost containment and revenue generation to help minimize costs to taxpayers. • 10. Make sustainable waste management design an essential part of the City's planning process. • 11. Collaborate with external stakeholders to advance waste management practices. Guiding Principles: • Protect the environment for future generations to come. • Lead by example. • Embrace innovation. • Use the triple bottom line.
Needs Assessment Alignment:	• This option aligns with the need to progressively work towards a zero-emissions solid waste fleet over the short-, medium- and long—term, as contracts come up for renewal and vehicles reach the end of their useful life

Category:	Infrastructure
Individual Producer Responsibility (IPR) Impact:	• Yes • The collection system, including the number of vehicles required for collection of waste, may be impacted as a result of IPR, as the City will no longer be responsible for the collection of recycling, which is currently co-collected with organics. This has the potential to change the way that garbage and organics is collected in the future and may also impact the number of vehicles in the City is responsible for in its own fleet, and in the fleets of contractors. The impact of this change will not be known until final regulations are in place and may not be fully realized until the transition to IPR takes place across the entire Province.
System Consideration:	• Core system component – tied to the collection system.
Sector Applicability:	• Applicable to collection of waste from all sectors: Single Family (SF), Multi-residential (MR), Parks and Public Spaces (PPS), City Facilities/Operations (CF), Partner Programs (PP).
Environmental Considerations:	• The Energy Evolution Strategy lays out pathways for getting to 100% reduction of GHGs in Ottawa. According to the energy and emissions modelling for the strategy, the transition to zero emissions commercial fleets is one of the top five actions the City can take to get to 100% reduction by 2050, accounting for approximately 8% of these reductions. The scenario for achieving these emission reductions in the transportation sector calls for the municipal fleet (does not include OC Transpo passenger fleet) to achieve 60% zero emission by 2030 and 100% by 2040. The ability to achieve these targets is dependent on industry availability of technology that meets the City's operational needs.
Social Considerations:	• No impact to level of resident effort. • Emission reductions and cleaner energy sources generally have a positive impact on public health, especially near solid waste fleet operations. • Electric collection vehicles could reduce noise from waste collection in residential areas.

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Technical/Operational Considerations:	• In terms of fuels, biodiesel, up to B20, can be used in warmer months and the City is trying to work this into its fuel sites. Renewable diesel is expensive. Both fuel types already make up part of the 4% renewable content as required for Ontario. • After-market hybridization technologies available to date have not shown significant success in reducing fuel usage for solid waste collection vehicles. • There are no viable fully electric vehicles currently available that meet Ottawa's operational requirements for waste collection. When they become available, the location and use of charging infrastructure may require changes in the operation (parking locations, availability of sufficient electricity, available backup generators or other methods) to manage power-outages and still meet operational requirements. • Once fully electric vehicles become more widely available and a proven technology for waste collection operations, they should be tested to determine suitability for waste collection in Ottawa. The use of transfer stations to charge electric waste collection vehicles and/or separate vehicle recharging stations for these vehicles should then be explored to determine the feasibility and viability of a fully electrified waste collection fleet. • The potential of RNG as a fuel for collection vehicles should be considered. • A secure supply of RNG, refueling infrastructure and building retrofits would be required for a collection fleet that uses RNG. • Routing for collection vehicles may change, move to a lower/no GHG emissions waste collection fleet. • The collection approach e.g. if materials will be co-collected nor not, will need to be determined once collection system requirements are confirmed after the recycling program transitions to IPR and the City is only responsible for collecting organics and garbage under its residential waste collection contracts. Consideration of cart-based garbage collection could also be explored. These could be included in Option 5D3 – Curbside Collection Efficiency Study. • Consideration should be given to including specific requirements in future waste collection contracts around the use of technologies and fuels that reduce GHG emissions from the waste fleet, provided that operational needs can still be met. For example, specific requirements could be included in the next curbside collection tender. • PWES would need to work with Fleet Services and contractors or other industry experts to understand the availability of vehicle technology and to identify the most appropriate vehicle requirements and specifications to incorporate into future waste collection contracts. • Requirements to reduce emissions from waste collection vehicles will need to be confirmed in advance of the next curbside collection tender being issued.

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Regulatory Considerations:	• Vehicle emissions are regulated federally and provincially. • Renewable content in diesel fuel content is regulated provincially, currently 4%.
Financial Considerations:	• Significant investment will be required for infrastructure to support electrification of future waste collection fleet and its supporting charging infrastructure. The City does not currently own or have contractual agreements with private sector transfer stations, which may be required to support a fully electrified collection fleet. • Similarly, the cost for RNG refueling infrastructure, building retrofits and site upgrades to accommodate RNG would also require significant investment. • Higher vehicle capital costs of low or zero emission collection vehicles when compared to traditional diesel vehicles. Currently, the difference in cost is in the order of two and a half to three times the cost of a traditional diesel vehicle. Infrastructure requirements, such as charging and/or refueling stations, adds additional complexity and costs to the initial implementation. • There are also high capital costs associated with the transition to electrification of the waste collection fleet, including charging infrastructure. The costs associated with this infrastructure will be dependent upon the number of vehicles in the fleet and type of charging infrastructure. • In the absence of confirmation of what vehicle technology, fuel type that will be used in the future for waste collection vehicles, as well as impact from the transition of recycling collection to IPR, it is difficult to estimate the capital costs for this option. However, transitioning the solid waste fleet to lower or no GHG emissions will be significant and these costs will be identified in the future, as collection tenders are developed and issued. • Operating costs will also likely be impacted with the transition to an electric fleet, for example, truck routing may change. • With the introduction of new technology under a new collection contract, contractors bidding will likely submit conservative bids to address any uncertainties and risks associated with the implementation of this new technology. • The Energy Evolution projects related to waste management are currently not funded and will be subject to future updates of the City long range financial plan as well as consideration in the Solid Waste long range financial plan.

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Unknowns/ Assumptions	• Assume that vehicle and fuel technologies will continue to advance and become more cost effective. It is not known how quickly this will happen.
Supporting System Requirements for Success	• The next waste collection contract and the transition to Individual Producer Responsibility will directly impact waste collection fleet needs and requirements. • Option will require a detailed business case and feasibility study to confirm vehicle and fuel requirements specific to reducing GHG emissions for future waste collection contracts. • This option is closely related to the Green Fleet Plan Update and the Energy Evolution Strategy and could be advanced and supported through implementation of those initiatives. • Industry advances in low or zero emission collection vehicles and cleaner fuels.
Potential Outcomes:	• Potential for GHG emission reductions. • No expected impact on waste or landfill life.
Measurement:	• Implementation of this option is measurable. • Measures would be quantitative (i.e. fuel consumption and GHG emissions). • The City maintains an inventory of fuel use internally, for diesel and gas/ethanol. Reductions in fuel use could be monitored over time. • The City could require GHG emissions reporting for contracted services through clauses in collection contracts.

Category:	Infrastructure
Case Study #1:	• The City of Calgary is implementing new practices and technologies for a greener fleet. Their procurement processes ensure compliance with the Environmental Protection Agency (EPA) standards and considers all available fuel types when purchasing new vehicles and equipment (link). • One of Calgary's procurement strategies for greening their fleet is to add clauses to Request for Proposals (RFP) to enable the City to try new green solutions and technologies as they become available in the market. • Calgary received funding in 2020 to test energy-saving options by piloting electric and hybrid waste collection trucks. The City is testing one Class 7 cab-over hybrid waste collection truck, and one Class 7 cab-over battery-electric waste collection truck for one year. • Calgary has also been piloting two compressed natural gas (CNG) waste collection trucks. • All options being explored and tested will need to sustain operations in Calgary's extreme weather conditions. • In 2018, Calgary carried out an Alternative Fuel Study to explore opportunities for expansion of alternative fuels, especially for their waste collection and recycling fleet. The study considered several options and assessed the feasibility and the potential environmental, social and economic impacts.

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Case Study #2:	• The City of Vancouver has committed to reducing fleet emissions to 30% below 2007 levels by 2020, reducing fleet emissions to 50% below 2007 level by 2030, and transitioning to 100% renewable energy usage by 2050[151]. • In 2018, Vancouver shifted to 100% renewable diesel fuel provided by Suncor. This was a major step towards renewable fuels as 55% of their City's fleet is fuelled by diesel. • Vancouver has a dedicated natural gas compression station that allows for City vehicles (including 33 refuse trucks) to be operated on 100% compressed natural gas. • The City of Vancouver fleet currently has over 50 hybrid or plug-in hybrid vehicles, including two engineering medium duty refuse trucks and one engineering bulldozer, used for moving waste and building roads at the Vancouver Landfill. • In 2021, the City of Vancouver issued an open call for innovation through Project Greenlight for solutions around transportation, zero-waste solutions, buildings, and rainwater solutions. The call seeks transportation solutions that support the City's pursuit of zero-emissions fleets (medium- to heavy-duty), including charging infrastructure, pick-up trucks, garbage and recycling trucks, utility vans and emergency response vehicles[152].
Recommendation:	• It is recommended that the option proceed to the evaluation stage.

[151] https://vancouver.ca/green-vancouver/green-fleets.aspx

[152] City of Vancouver – Project Greenlight