

DILLON
CONSULTING

CITY OF MEDICINE HAT

Waste Management Strategy

Final Report



January 16, 2023

City of Medicine Hat
2190 Brier Park Place NW
Medicine Hat, Alberta
T1C1S6

Attention: Jamie Garland
Waste and Recycling Manager, City Assets

2023 to 2032 Waste Management Strategy

Dillon Consulting Limited (Dillon) is pleased to provide this report which summarizes the information collected as part of the City of Medicine Hat's (City) Waste Management Strategy.

Through this strategy, we have collected information on best practices and existing programs to provide a foundation for developing options that will enhance and improve the City's current waste management systems. This waste management strategy update considered current and future City needs based on information collected from the City, as well as government legislation and policies.

Thank you for this opportunity to assist you with this important assignment.

Sincerely,

DILLON CONSULTING LIMITED

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Table of Contents

Acronyms and Abbreviations

Definitions

Executive Summary

1.0	Introduction	1
1.1	Background to Waste Management Strategy Update	1
1.2	Limitations	1
1.3	Project Approach.....	1
1.3.1	Task 1: Project Initiation	2
1.3.2	Task 2: Vision Workshop.....	2
1.3.3	Task 3: Current State Review	3
1.3.4	Task 4: Recommendations Development.....	3
1.3.5	Task 5: Reporting.....	4
2.0	Current and Upcoming Regulations	5
2.1	Local Bylaws.....	5
2.2	Extended Producer Responsibility.....	5
2.2.1	Federal Jurisdiction – Canadian Council Ministers of the Environment.....	5
2.2.2	Provincial Jurisdiction – Alberta.....	6
2.2.3	Extended Producer Responsibility – Alberta Regulation.....	6
2.3	Emerging Trends	10
3.0	Waste Management System	11
3.1	Historical Waste Information.....	11
3.1.1	2012 to 2022 Waste Management Strategy.....	11
3.1.2	Waste Generation	11
3.2	Current State.....	12

3.2.1	Waste Management System Overview	12
3.2.2	Waste Quantities and Characterization.....	15
3.2.3	SWOT Analysis.....	20
3.3	Waste Projections	21
3.3.1	Population Trends	21
3.3.2	Forecasted Waste Quantities.....	22
4.0	Options Development	28
4.1	Long List of Options	28
4.2	Criteria for Options Evaluation.....	29
4.3	Preferred Options.....	30
4.4	Preferred Options Evaluation.....	40
4.5	Additional Options for Consideration.....	43
5.0	Implementation Plan	44
6.0	Conclusions and Next Steps	45

Figures

Figure 1: Material Management Requirements by October 31, 2027	7
Figure 2: Waste Generation at the Landfill (2017 to 2020)	12
Figure 3: Estimated Landfill Life Expectancy	15
Figure 4: Residential Blue Cart Composition (July 2021).....	18
Figure 5: Grey Cart Curbside Collection (2017 to 2021).....	18
Figure 6: Green Cart Curbside Collection (2017 to 2021)	19
Figure 7: Recycling Generation (2017 to 2021)	20
Figure 8: Population Projections (2011 to 2032)	22
Figure 9: Waste Generation Rates (tonnes/capita, 2017 to 2020)	23
Figure 10: Summary of Total Curbside Waste Disposed (2021 to 2032).....	24
Figure 11: Breakdown of Total Waste Collected through City's Curbside Collection by Collection Stream (2021 to 2032).....	24
Figure 12: Breakdown of the Total Amount of Recycling found in all City Curbside Collection Programs vs the Total Amount of Recycling found in the City's Blue Cart Collection Program (2021 to 2032).....	25

Figure 13: Breakdown of the Total Amount of Yard Waste found in all City Curbside Collection Programs vs the Total Amount of Yard Waste found in the City’s Green Cart Collection Program (2021 to 2032).....	26
Figure 14: Estimated Food Waste Recovery in a Food Waste Curbside Collection Program.....	27
Figure 15: Preferred Options Implementation Timeline.....	44

Tables

Table 1: Materials Found in Grey Cart Waste Scan Audit (2017 to 2019).....	15
Table 2: Organic Materials Found in Grey Cart Waste Scan Audit (2017 to 2019).....	16
Table 3: Garbage Found in Grey Cart Waste Scan Audit (2017 to 2019).....	16
Table 4: Recyclable Material Found in the Grey Cart Waste Scan Audit (2017 to 2019).....	17
Table 5: 2017 to 2022 Active Depots.....	20
Table 6: SWOT Analysis Results.....	21
Table 7: Long List of Options.....	28
Table 8: Evaluation Criteria.....	29
Table 9: Preferred Options Summary.....	30
Table 10: Evaluation Summary.....	42

Appendices

A	Detailed Preferred Options Evaluation
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Acronyms and Abbreviations

AD	Anaerobic digestion
ADC	Alternative daily cover
AESO	Alberta Electric System Operator
AEP	Alberta Environment and Parks
ARMA	Alberta Recycling Management Authority
CCME	Canadian Council of Ministers of the Environment
CCRI	Circular Cities & Regions Initiative
C&D	Construction and demolition
CEPA	Canadian Environmental Protection Act
CNG	Compressed natural gas
ECCC	Environment and Climate Change Canada
ÉEQ	Éco Entreprises Québec
EPA	Environmental Protection Agency
EPEA	Environmental Protection and Enhancement Act
EPEAA	Environmental Protection and Enhancement Amendment Act
EPR	Extended Producer Responsibility
ERA	Emissions Reduction Alberta
EV	Electric vehicle
FAQ	Frequently asked questions
FCM	Federation of Canadian Municipalities
GHG	Greenhouse gas
HSP	Household special products
ICI	Industrial, commercial and institutional
L&Y	Leaf and yard
LWRC	Lethbridge Waste and Recycling Centre
MR	Multi-residential
MRF	Material recovery facility
MSW	Municipal solid waste
OCWA	Ontario Clean Water Agency
PET	Polyethylene terephthalate
PVC	Polyvinyl chloride
P&E	Promotion and education
RNG	Renewable natural gas
RFP	Request for Proposals
RFI	Request for Information
RSC	Regional Service Commission
SUI	Single-use item
SUP	Single-use plastics

SSO	Source separated organics
SWOT	Strengths, weaknesses, opportunities and threats
TIER	Technology innovation and emissions reduction
WTE	Waste-to-energy
WWTP	Wastewater treatment plant

Definitions

"Grey cart"	accepts garbage
"Green cart"	accepts yard waste including grass clippings, leaves, weeds, small branches, garden materials, biosolids, yard waste, trees and clean wood feedstock
"Yard waste"	is the term for material accepted into the green cart
"Organics"	refers to co-mingled organic materials that may be accepted into a green cart program depending on the municipality's capabilities and facilities (e.g., food waste, yard waste, pet waste, etc.)
"Blue cart"	accepts recycling
"Landfill"	refers to the City-owned waste management facility
"Digestate"	refers to the material that remains after anaerobic digestion has occurred

Executive Summary

The City of Medicine Hat (City) requires an update to its 10-Year Waste Management Strategy. The previous Waste Management Strategy was developed by the City in 2011 for the implementation period of 2012 to 2022. A 5-Year Progress Report was developed and published in 2016 to evaluate the mid-term implementation progress and summarize priorities for the remaining term. With the 2012 to 2022 strategy period coming to an end, the development of a new vision and path forward for the City's Solid Waste Utility is required.

Dillon Consulting Limited (Dillon) was retained in 2021 by the City to conduct a review of the strategies set in the 2012 to 2022 Waste Management Strategy, update strategies that should be considered and suggest additional recommendations to improve waste management systems and services. This update included reviewing the City's background and historical information on the waste management system, analyzing the current and future waste generation and trends, conducting a Vision Workshop and assessing recommendations from previous strategies and plans.

Based on a review of the City's current waste management situation, an initial long list of 23 options was developed. Following the receipt of feedback and in consultation with the City, options were narrowed down and categorized into program development, operational impact and/or improvements, education and partnerships, research and/or other recommendations. The final 20 options were reviewed and analyzed according to resourcing needs (operational and capital costs), proven and unproven status in western Canada and applicability to the City. Once research was completed, an evaluation tool was developed to compare each of the options which used triple bottom line criteria considering economic, social and environmental impacts. The Evaluation Summary outlines the final results of the options evaluation where the higher the final score the more favourable it is and vice versa. The most favourable options, based on the triple bottom line evaluation, which are recommended to be pursued by the City include:

- Developing a food waste curbside collection pilot program;
- Developing a circular economy roadmap;
- Developing a construction and demolition waste policy;
- Exploring further options to optimize landfill airspace;
- Exploring additional tipping rates for certain materials (e.g., cardboard, construction and demolition (C&D) materials); and
- Exploring ways to reduce wind impact and decrease closures at the landfill.

After evaluation was completed, an Implementation Timeline was created to act as a 10-year roadmap for executing the preferred options of the updated Waste Management Strategy. Recommendations are not all deliverables; briefing notes and businesses cases are anticipated to be created as these options are researched and deemed feasible.

Evaluation Summary

Option	Economic Feasibility				Social Impact				Environmental Impact					TOTAL
	Operating Costs	Capital Costs	Level of Risk	Subtotal:	Public Acceptance Proven/Unproven	Level of Effort	Subtotal:	Climate Impacts	Land Requirement	Nuisance Impact	Diversion Impact	Subtotal:		
1: Develop a food waste curbside collection pilot program	3	3	2	8	3	3	2	8	2	2	2	3	9	25
2: Expand and improve education programs and outreach	3	3	3	9	2	3	2	7	1	3	2	1	7	23
3: Consider expanding multi-residential and commercial recycling collection	3	3	2	8	1	2	2	5	2	3	2	3	8	21
4: Develop a C&D Policy	3	3	3	9	3	3	2	8	1	3	2	3	9	26
5: Explore additional tipping rates for certain materials	3	3	2	8	2	3	3	8	1	3	2	3	9	25
6: Explore options to optimize landfill airspace	3	3	2	8	3	3	3	9	2	3	2	2	9	26
7: Explore ways to reduce wind impact at landfills and decrease closure	3	3	3	9	3	3	3	9	1	2	3	1	7	25
8: Explore upgrades available for anaerobic digestion	3	3	3	9	3	3	3	9	1	2	2	1	6	24
9: Develop bylaw amendments to increase enforcement capabilities	3	3	3	9	2	3	2	7	1	2	1	1	5	21
10: Explore options to develop a green city fleet	3	3	1	7	3	1	1	5	2	1	3	1	7	19
11: Develop a circular economy roadmap	3	3	3	9	3	3	2	8	2	2	2	2	8	25
12: Explore a single use plastic item ban	3	3	3	9	3	2	3	8	1	2	2	1	6	23
13: Identify impacts extended producer responsibility will have on current operations	3	3	3	9	2	3	3	8	1	2	2	1	6	23
14: Develop a strategy for promotion of non-profits that accept and sell reusable items	3	3	2	8	3	3	2	8	2	2	2	1	7	23
15: Create a joint effort with the wastewater treatment plant on how to manage biosolids	3	3	3	9	2	3	3	8	1	1	2	1	5	22
16: Improve participation in litter reduction education programs	3	3	3	9	3	3	2	8	1	2	2	1	6	23
17: Explore potential revenue streams for the City related to waste	3	3	3	9	3	3	1	7	1	2	2	1	6	22
18: Explore waste-to-energy options	3	3	3	9	2	1	1	4	1	2	2	1	6	19
19: Explore glass recycling marketability	3	3	3	9	1	1	2	4	1	2	2	1	6	19
20: Continue conducting waste composition studies (curbside and landfill)	3	3	2	8	2	3	3	8	1	2	2	1	6	22

*The rankings range from 1 to 3 where 1 indicates the least favourable outcome and 3 indicates the most favourable outcome; therefore, the higher an option scores the more favourable it is.

Implementation Timeline

Option	Short Term			Medium Term				Long Term		
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1: Develop a food waste curbside collection pilot program										
2: Expand and improve education programs and outreach										
3: Consider expanding multi-residential and commercial recycling collection										
4: Develop a C&D Policy										
5: Explore additional tipping rates for certain materials										
6: Explore options to optimize landfill airspace										
7: Explore ways to reduce wind impact at landfills and decrease closure										
8: Explore upgrades available for anaerobic digestion										
9: Develop bylaw amendments to increase enforcement capabilities										
10: Explore options to develop a green city fleet										
11: Develop a circular economy roadmap										
12: Explore a single use plastic item ban										
13: Identify impacts extended producer responsibility will have on current operations										
14: Develop a strategy for promotion of non-profits that accept and sell reusable items										
15: Create a joint effort with the wastewater treatment plant on how to manage biosolids										
16: Improve participation in litter reduction education programs										
17: Explore potential revenue streams for the City related to waste										
18: Explore waste-to-energy options										
19: Explore glass recycling marketability										
20: Continue conducting waste composition studies (curbside and landfill)										

Planning Period
 Implementation Period

1.0 Introduction

1.1 Background to Waste Management Strategy Update

The City of Medicine Hat (City) is located in southeastern Alberta along the South Saskatchewan River, approximately 300 kilometers from Calgary. In 2021, the City was the tenth-largest city in Alberta with a population of 65,203.

In 2021, Dillon Consulting Limited (Dillon) was engaged by the City to conduct an update to the 2012 to 2022 Waste Management Strategy to determine recommendations that may enhance and improve the current waste management programs. The purpose of the project was to review progress on the current Waste Management Strategy and establish priorities and new best practices, as well as review several service-related questions that have been brought forward since the inception of the current plan. This update involved several tasks and considered several factors, including the following:

- Review of the 2012 to 2022 Waste Management Strategy and identify outstanding recommendations;
- Identify local challenges and unique features;
- Understand the potential impacts to relevant and proposed legislative changes and provision of flexibility to adapt to future changes that are currently not defined (i.e., EPR); and
- Provision of recommendations such as curbside collection programs, material disposal bans and partnerships.

An assessment of existing waste services was completed, including a Vision Workshop with municipal staff to provide a thorough understanding of current operational procedures and challenges. Best practices and approaches to managing waste were considered to identify program successes and lessons learned in Medicine Hat. A long list of potential recommendations have been generated with a high level analysis in Section 4.1.

1.2 Limitations

The outcomes of this study are based on data and information received from the City of Medicine Hat. Data presented or obtained from City staff is presented as received without discretion.

1.3 Project Approach

As part of the 2023 to 2032 Waste Management Strategy, the following five tasks were undertaken to provide the City with recommendations to improve waste management programs and diversion rates:

1. Project initiation;
2. Vision workshop;

3. Current state review;
4. Recommendations development; and
5. Reporting.

1.3.1 Task 1: Project Initiation

The project kick-off meeting was attended by representatives from the City and Dillon. During the meeting, the project scope was presented and requests for waste management data and reports were made by Dillon.

1.3.2 Task 2: Vision Workshop

The Vision Workshop was attended in-person by Dillon staff and City staff March 3, 2022. The workshop consisted of three components: background review, strengths, weaknesses, opportunities and threats (SWOT) analysis and brainstorming draft recommendations.

Background Review

Dillon reviewed the information provided by the City, including municipal material and reports such as:

- 2012 to 2022 Waste Management Strategy documents and progress on initiatives;
- 5-Year Progress Report;
- City Assets, Waste and Recycling Utilities capital and operating budgets;
- Operating data;
- Progress on implementation actions;
- Annual landfill reports;
- Residential waste and yard curbside collection waste scans from 2014 to 2019; and
- Other City Assets, Waste and Recycling Utilities data and reports.

Based on the background information, Dillon developed materials to aid the discussion during the workshop. This included information on the following items:

- High-level description of waste management services provided;
- Tonnage and associated management cost information for each target material stream;
- Roles and responsibilities of staff and contractors with respect to waste management including the level of effort and associated costs;
- Comparison across the community of the range of services provided;
- Strengths and weaknesses of existing practices including local challenges;
- Suggested improvements to current challenges and/or best practices from other jurisdictions;
- Opportunities and/or concerns with the elements of a waste management plan; and
- Opportunities for neighbouring municipalities to collaborate together.

SWOT Analysis

During the Vision Workshop, Dillon conducted an interactive SWOT analysis with attendees. Discussions focused on the following key items:

- Identification of main strengths, concerns and potential opportunities with the current waste management system;
- Input on how the different players in the City's waste management system function (e.g., City staff, contractors);
- Commentary on other municipalities that the City's waste programs are often compared (e.g., by elected officials, the general public); and
- Input on opportunities, messaging, priorities and/or concerns with the communication and engagement plan, especially successes in virtual engagement within the City.

Brainstorming Future Recommendations

After discussing the City's background, previous waste strategy recommendations, current state and future goals, a brainstorming session occurred to develop a long list of draft options. Options were categorized by timeline (short, medium or long term) as well as waste category (program development, operational improvements, education, partnerships and research).

1.3.3 Task 3: Current State Review

Based on the discussions and notes developed during the Vision Workshop, a Current State Summary memorandum (memo) was developed. The Current State Summary memo represented an interim deliverable in the strategy development to document the understanding of the City's solid waste management system and desired outcomes with the strategy update. Dillon incorporated the City's comments into the development of the recommendations and formal Strategy Document.

1.3.4 Task 4: Recommendations Development

Dillon completed an analysis of the data received from the City and information obtained in the Vision Workshop to determine a draft list of options and strategies for consideration. Initially, a long list of 23 potential options was developed. In collaboration with the City, the list was reduced to 20 options to be carried forward for high-level evaluation. A list of draft criteria to evaluate each of the options was provided to the City. The criteria included financial, environmental and social impacts. Based on input from the City, three indicators for economic and social impacts and four indicators for environmental impacts were selected to evaluate each option. The 20 options were evaluated by Dillon initially, followed by review and feedback from the City. The list of 20 options, evaluation criteria and the evaluation results are presented in Section 4.2 to Section 4.4.

1.3.5

Task 5: Reporting

A draft Strategy report was prepared for review by the City. Upon updating the document based on comments received, the Strategy was finalized.

2.0 Current and Upcoming Regulations

There are a number of solid waste management industry trends and policies that currently have or will have an impact on municipal waste management planning in Alberta. A brief overview of these trends and policies, including local bylaws are presented in the following subsections. Current and upcoming regulations in this section are based regulations up to October 2022; therefore, any changes and/or updates past this date have not be included in this report.

2.1 Local Bylaws

Local Bylaw 1805, known as the “Solid Waste Bylaw” establishes and maintains a system for collection, removal and disposal of ashes, garbage, refuse and other waste in the City. The 15-page Solid Waste Bylaw outlines the residential and commercial collection, disposal and diversion restrictions, rates, fees, charges, prohibitions, violations and penalties. The residential waste collection section outlines cart use, customer responsibilities (e.g., cleaning spillage and reporting damage), acceptable materials segregation for each cart and actions which result in suspension of collection services.

2.2 Extended Producer Responsibility

Extended Producer Responsibility (EPR) policy frameworks shift the cost of recycling of designated products from municipalities and taxpayers to the industries that produce the designated products in that jurisdiction. EPR is a circular economy policy and legislative lever that has been well established in the European Union for several decades and in Canada for two decades. The most common EPR types of programs are for printed paper and packaging, tires, electronics and municipal hazardous and special wastes. EPR programs can have a shared responsibility (partially paid by municipalities and partially by industry), or a full EPR system whereby industry is responsible for 100% of the cost of the program.

2.2.1 Federal Jurisdiction – Canadian Council Ministers of the Environment

The past five years have been a period of significant policy, program and legislative development across Canada in the solid waste area in general and waste reduction and waste diversion in particular. At a federal level, the Government of Canada is tackling the issue of plastic waste both through the Canadian Council of Ministers of the Environment (CCME) and independently through Environment and Climate Change Canada (ECCC). In June 2019, Prime Minister Trudeau announced plans for European Union level action on waste plastics, singling out single-use plastics (SUPs). The following year in October 2020, ECCC announced the next steps in the Government of Canada’s plan to achieve zero plastic waste by 2030. Recently, announcements were made that new legislation would be delivered in 2022 regarding the six SUP bans, nationally.

2.2.2 Provincial Jurisdiction – Alberta

Bill 83, the *Environmental Protection and Enhancement Amendment Act* was recently introduced on November 15, 2021 to enable the creation of an *EPR Framework* in Alberta¹. The EPR framework approach will support a circular economy to help Alberta better manage SUPs and other recyclable materials and reduce greenhouse gas emissions. In parallel, Alberta's *Natural Gas Vision and Strategy* was also developed to reduce waste in landfills while diversifying the economy and creating jobs. A shift to EPR will increase the provincial gross domestic product share to more than \$148 million. The change would also cut emissions by an estimated 72,000 tonnes of carbon dioxide annually which is the equivalent of taking 120,300 passenger cars off the road each year. The next steps will be for the province to develop the specific regulations and policies, as well as set targets, that will guide the EPR programming in Alberta.

2.2.3 Extended Producer Responsibility – Alberta Regulation

On October 3, 2022, the Alberta provincial government approved a regulatory framework for establishing EPR in the province. The Minister of Environment and Parks, Water and its Waste Policy Branch developed the EPR framework. It falls under the authority of the Environmental Protection and Enhancement Act (sections 162, 166, 175, 193 and 239). A copy of Order in Council 346/2022 is found on the King's Printer². Information and fact sheets regarding the new regulation and the next steps will be public on Alberta.ca at <https://www.alberta.ca/waste-reduction-and-recycling.aspx>. The EPR regulation will come into force on November 30, 2022. Transition and implementation will be a continued effort between government, the oversight organization and stakeholders with ongoing consultation starting fall 2022.

2.2.3.1 Designated Materials

A designated material means material designated by the Regulation. For each type of designated material, a management board (the Authority) shall be responsible for the administration and oversight of the matters described in the Regulation. The Authority shall enter into an agreement with the Minister and comply with the terms and conditions of that agreement with respect to the Authority's administration and oversight of the matters described in this Regulation. The Authority may make bylaws respecting 24 clauses in the regulation.

The Authority shall provide a business plan, an annual report and audited financial statements in the form and manner and with the content required by the Minister not more than six months after the end of its fiscal year. The Authority's annual reports and business plans shall be made publicly available.

¹ Alberta Ministry of Environment and Parks. <https://www.alberta.ca/circular-plastics-economy-engagement.aspx>. Accessed on December 6, 2021.

² https://kings-printer.alberta.ca/documents/Orders/Orders_in_Council/2022/2022_346.html

The Regulation is organized as three parts:

- Part 1 - Designated Materials —SUPs, packaging and paper products;
- Part 2 - Designated Materials — Hazardous and special products; and
- Part 3 - Expiry and Coming into Force.

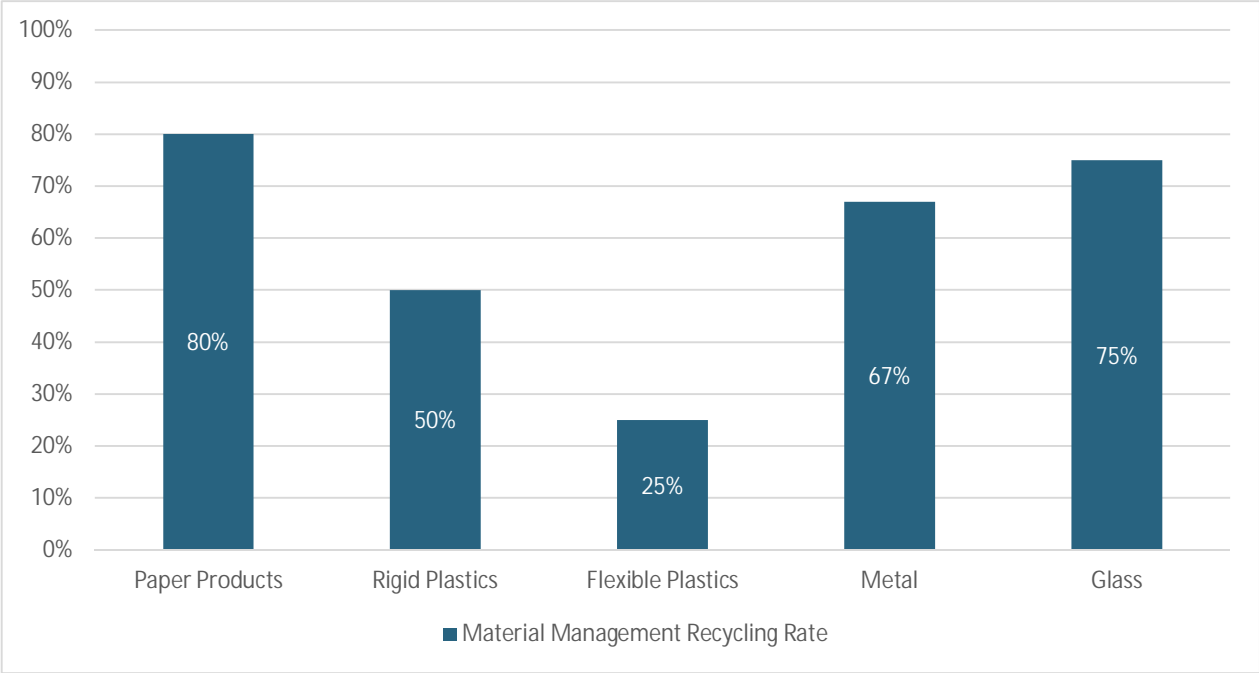
Part 1 – Designated Materials – SUPs, Packaging and Paper Products

Note that this regulation does not apply to materials already subject to:

- The Designated Material Recycling and Management Regulation (AR 93/2004), e.g., tires and oil; and
- The Beverage Container Recycling Regulation (AR 101/97) i.e., deposit return system.

A producer must meet the material management requirements specified in the Regulation and those specified in the bylaws. Figure 1 highlights the designated materials and the recycling requirements that must be achieved by October 31, 2027, with increasing required recycling rates over time. The material management recycling requirement is the amount of a designated material type that is recycled divided by the amount of that designated material type that the producer supplies in Alberta. For example, 80% of paper products that are generated by producers must be recovered through recycling.

Figure 1: Material Management Requirements by October 31, 2027



In addition to these targets, some companies have come out with goals to reduce their waste and/or increase their recyclability of packaging. For examples, Proctor and Gamble is targeting by 2030 all of their consumer packaging will be 100% recyclable or reusable.

Service Standards - Single-family (SF) Dwellings

A producer must provide at no charge, by April 1, 2025, a common collection system to SF dwellings in communities registered with the Authority that are receiving recycling service from a community authority as of November 30, 2022.

The common collection system must include the following minimum services:

- Curbside collection every two weeks to SF dwellings that have curbside recycling from a community authority; and
- Depot access and collection for communities that have depot recycling service from a community authority.

Where SF dwellings are constructed after November 30, 2022 in a community where a community authority provides curbside recycling services as of November 30, 2022, the producer must provide curbside collection every two weeks as of the date that the community authority begins providing waste services to the SF dwellings, or April 1, 2025, whichever is later.

A producer must provide at no charge, by October 1, 2026, to SF dwellings in communities registered with the Authority that were not receiving recycling service from a community authority as of November 30, 2022, a common collection system with the following minimum services:

- Curbside collection every two weeks to SF dwellings that have curbside waste collection service from a community authority; or
- Depot access and collection to SF dwellings that do not have curbside waste collection service from a community authority.

The above do not apply to producers where an alternative collection system has been approved by the Authority.

Service Standards — Multi-residential (MR) Dwellings

A producer must provide at no charge, by April 1, 2025, a common collection system to MR dwellings in communities registered with the Authority that are receiving recycling service from a community authority as of November 30, 2022.

A producer must provide at no charge, by October 1, 2026, a common collection system to MR dwellings in communities registered with the Authority that are not receiving recycling service from a community authority as of November 30, 2022.

The above do not apply to producers where an alternative collection system has been approved by the Authority.

Part 2 – Designated Materials – Hazardous and Special Products

Hazardous and special products (HSP) are designated materials and consist of the following:

- Batteries;
- Corrosive products;
- Corrosive product containers;
- Flammable products;
- Flammable product containers;
- Pesticides;
- Pesticide containers;
- Toxic products; and
- Toxic product containers.

Material Management Requirements

A producer must meet the material management requirements specified in the Regulation and those specified in the bylaws. Currently, batteries are a designated HSP material with a regulated recycling requirement of 40% that must be achieved by October 31, 2027 and with increasing required recycling rates over time. The material management recycling requirement is the amount of a designated material type that is recycled divided by the amount of that designated material type the producer supplies in Alberta.

Collection Requirements

A producer must provide a common collection system for designated materials at no charge to communities registered with the Authority that meet the following requirements by April 1, 2025:

- Communities with a population equal to or greater than 125,000 people must have at least one permanent collection depot for every 125,000 people;
- Communities with a population equal to or greater than 10,000 people but less than 125,000 people must have at least one permanent collection depot;
- Communities with a population equal to or greater than 1,000 people but less than 10,000 people must have at least one collection event per calendar year; and
- Communities with a population less than 1,000 people must have at least one collection event per calendar year once the community has provided notice of interest for a collection event to the Authority.

Where a community is serviced by a permanent collection site by a community authority, a producer shall maintain the current site or provide a replacement permanent collection site. Where a permanent regional collection site is maintained, the producer is not required to provide a collection event. The Authority may authorize a producer to use an alternative collection system instead of any common collection system.

Affiliations of Producer Responsibility Organizations

A producer responsibility organization, must not be affiliated with an entity or individual that provides recycling services or waste management services for designated materials.

Part 3 – Expiry and Coming into Force

The Regulation comes into force on November 30, 2022. The Regulation shall be reviewed for ongoing relevancy and necessity and amended before June 30, 2030.

2.2.3.2

Impacts to Medicine Hat

This Regulation will have an impact on the City as Designated Materials become the responsibility of the producing industry rather than the City. Ongoing review and monitoring will be required to understand the impacts that this will have to the City.

2.3

Emerging Trends

A variety of emerging solid waste management trends and related policies are emerging across Canada in municipal, provincial and federal jurisdictions. These emerging trends may be considered to guide the City in their waste management policy, goals and objectives over the next 10 years. Some of these emerging trends and potential issues facing the waste management industry include the following:

- Adaptation to a circular economy;
- Reduce and divert more organic waste from disposal;
- Responsibility of the recycling cart program switching from the City to producers of products and packaging (Provincial EPR);
- Manage the decrease in single-use items (SUI), plastic and ‘compostable’ waste and adjust to future federal legislation;
- Adapt to changes in the way people learn how to properly participate in waste diversion programs; and
- Embracing new technology, such as artificial intelligence.

3.0 Waste Management System

This section outlines the City's historical and current state of waste management. A review of the 2012 to 2022 Waste Management Strategy in Section 3.1.1 provided data on waste generation and populations as well as outlined the City's direction and priorities in waste management. Dillon reviewed annual landfill reports and waste scans which were provided by the City to gather information on current practices. Waste projections based on tonnages and populations were also completed.

3.1 Historical Waste Information

The following provides information on the City's previous Waste Management Strategy and waste generation information (tonnages) from the past several years.

3.1.1 2012 to 2022 Waste Management Strategy

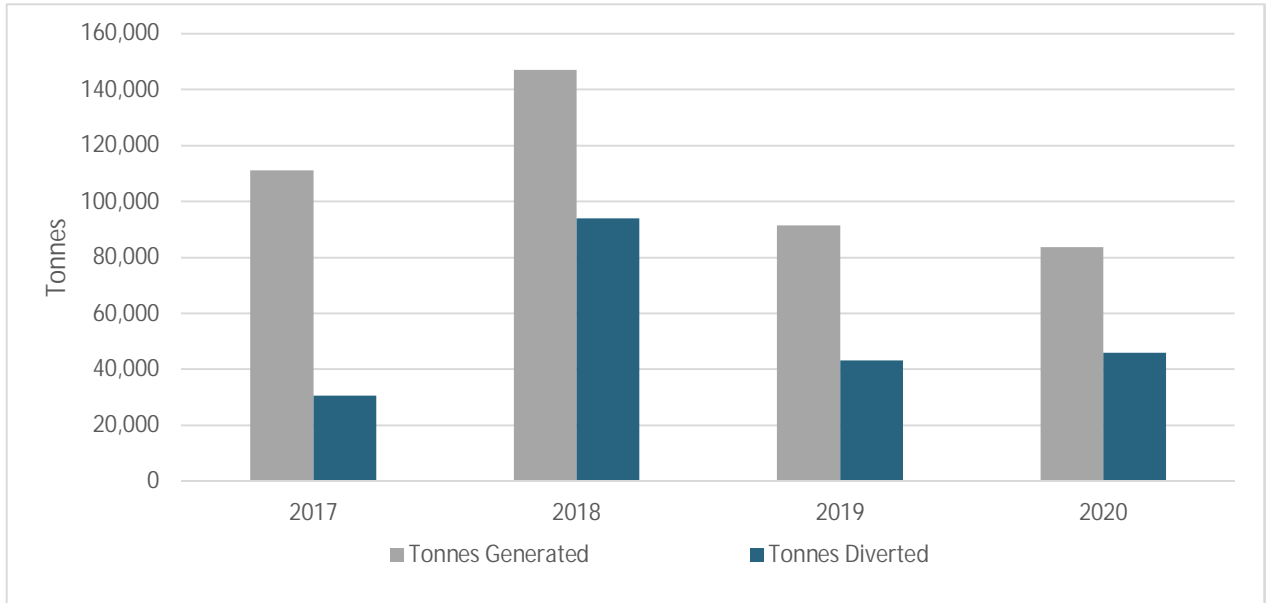
The 2012 to 2022 Waste Management Strategy is based on three principles: the Industry's *Reduce, Reuse, Recycle, Recovery and Dispose* hierarchy, the triple bottom line approach and the *Reasonable Diversion at Reasonable Cost*. The goal of the City Assets, Waste and Recycling Utilities is to provide safe, reliable and effective solid waste and recyclables handling and services. In 2016, the Environmental Utilities team conducted a review of the proposed strategies with the outcome of the Five Year Progress Report. The results of the Five Year Progress Report were reviewed and supported the development of options in Section 4.0.

3.1.2 Waste Generation

In 2020, the Waste Management Facility (landfill) received approximately 84,000 tonnes of waste from both residential and commercial sectors and diverted or removed 46,000 tonnes. This information does not include materials diverted through the recycling facility, collected at the three recycling depots, e-waste from Saamis Rotary Club.

Figure 2 highlights the waste received and diverted or removed from the City's landfill. An increase in waste generated in 2018 is attributed to the partnership with Secure Energy for hydrocarbon impacted soil, as well as a large amount of internal construction work which was occurring and generated approximately 70,000 tonnes of soil.

Figure 2: Waste Generation at the Landfill (2017 to 2020)



3.2 Current State

This section outlines the current state of waste management in the City, including programs, services, generation rates, landfill capacity, cart composition and a SWOT analysis.

3.2.1 Waste Management System Overview

The City provides a range of waste management services to approximately 65,000 residents³ in 29,000 residential units and commercial businesses within Medicine Hat and the hamlet of Veinerville. Residential units are primarily SF; however, some MR buildings and commercial businesses receive waste management services. According to historical waste data outlined in the 2012 to 2022 Waste Management Strategy, between 2000 and 2011 the City had an average diversion rate of 36%. Waste management services for collection, drop-off facilities, disposal facilities and promotion and education (P&E) initiatives are summarized in the following sub-sections.

3.2.1.1 Collection

The City offers garbage (grey cart), yard waste (green cart) and recycling (blue cart) curbside collection services on a weekly basis to 20,796 households (2022). Collection days for all three streams occur on the same day. The following describe the program in place for each waste stream.

³ Alberta Municipal Affairs (2022). *Population Lists: Medicine Hat*.

Grey Cart (Garbage)

City trucks used for garbage collection use a side load technology. Commercial and MR curbside collection is an opt-in service, which currently has approximately 1,000 pickup locations. Residents are provided with a 95-gallon cart and businesses have the option of either 1.5 or 3 cubic yard carts.

Blue Cart (Recycling)

Residential curbside collection for recyclables was rolled out in May/June 2018. There is currently no program for curbside collection of recyclables for MR buildings. The City has a ten-year contract with GFL (contract expires in 2029) for collection, processing and marketing recycling materials collected from both curbside and the depots.

Green Cart (Yard Waste)

An opt-in curbside collection program for yard waste runs from April to November. There are approximately 14,000 residential pickup locations. Acceptable materials in the yard waste cart includes: grass clippings, leaves, weeds, small branches, garden materials, yard waste, trees and clean wood feedstock. Collected yard waste is composted at the compost facility located at the City-owned landfill. It should be noted that currently food waste is not accepted into the green cart curbside collection program.

3.2.1.2 Drop-off Depot Facilities

There are three unmanned recycling depots for residents to drop off excess materials that do not fit into their blue cart and for MR and commercial properties to utilize. Acceptable materials at the recycling depots include glass products, recyclable cans and cartons, plastic, tin and fiber products. These depots are managed by GFL and are located on the north side of the City in Northlands Coop, in the City centre on Kipling Street and in the south at the Medicine Hat mall.

3.2.1.3 Disposal

The City owns a Waste Management Facility (landfill) for its waste management services which accept materials not allowed in the curbside collection program, at the recycling depots or any donation centers. Materials accepted for diversion or disposal purposes include:

- HSP;
- Electronic equipment (e-waste);
- Batteries;
- Cellphones;
- Used oil;
- Paint;
- Automobile tires;
- C&D waste;

- Scrap metal; and
- Bulky items (e.g., mattresses).

3.2.1.4 Promotion and Education

The City uses a Recycle Coach app which provides residents with their waste collection schedules, information, notifications and reminders, news and updates and proper sorting techniques. The City website provides information on proper cart set out locations, times, missing cart procedures, frequently asked questions (FAQs), commercial collection information, waste regulations and previous solid waste management plans.

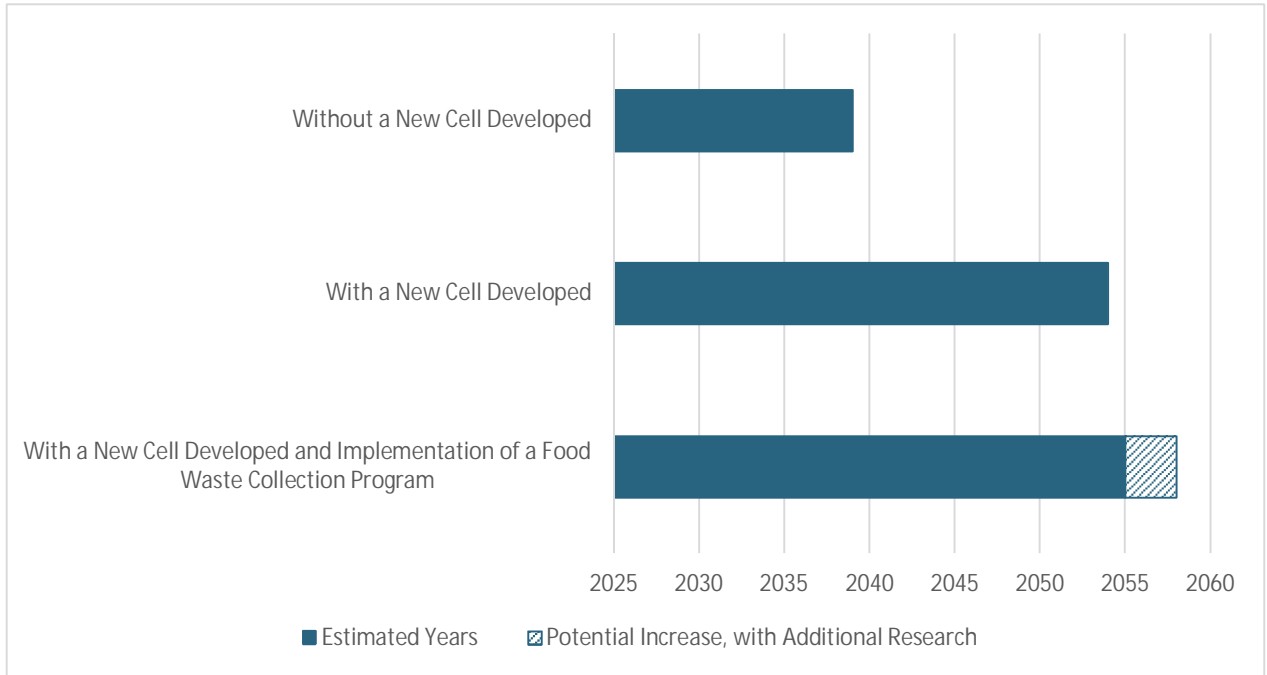
Other P&E activities occurring in the City include:

- Waste calendar mail-out (by request);
- Televised reminders for collection schedule and/or waste tips;
- Landfill tours;
- Community Programs:
 - 'Communities in Bloom' program;
 - Urban Recreation Advisory and Environment Board;
 - Grasslands Naturalists;
 - Horticultural Society; and
 - Various trial and pilot programs (as required).

3.2.1.5 Landfill Capacity

The development of a new northwest landfill cell in 2020 increased the landfill's total airspace by 110,000 cubic meters. Estimates indicate that the remaining airspace at the end of 2020 to 1,625,645 cubic meters. According to the City's 2020 Landfill Report, it is estimated that the landfill will reach capacity in 2039. The development of a new waste cell is estimated to extend the landfill life to 2054. The implementation of a new programs such as a food waste curbside collection program has the potential to further increase the capacity of the landfill. An analysis of the potential reduction in waste tonnage with the implementation of a food waste collection program has been completed in Section 3.3.2.2. Figure 3 highlights the estimated landfill life expectancy with and without the development of a new cell; a third scenario that considers the estimated landfill life expectancy with a new cell developed and the implementation of a food waste collection program has also been included. Additional research is required through additional waste composition studies to further analyze the amount of food waste that could potentially be recovered through a food waste collection program (see Section 3.3.2.2).

Figure 3: Estimated Landfill Life Expectancy



3.2.2 Waste Quantities and Characterization

Table 1 provides a summary of the materials found in the grey cart during the 2017 to 2019 waste scan audits. Due to the COVID-19 pandemic, waste scan audits did not occur between 2020 and 2022. Table 2 shows that the majority of organic materials in the grey cart is food waste for all three years (2017 to 2019), with a range between 57% and 85%.

Table 1: Materials Found in Grey Cart Waste Scan Audit (2017 to 2019)

Material	2017		2018		2019	
	Kilograms	Percentage	Kilograms	Percentage	Kilograms	Percentage
Organic Materials	139	10%	2,316	28%	1,565	30%
Garbage	728	51%	3,189	38%	2,000	38%
Recycling Materials	553	39%	2,801	34%	1,702	32%
Total	1,420	100%	8,306	100%	5,267	100%

Table 2: Organic Materials Found in Grey Cart Waste Scan Audit (2017 to 2019)

Material	2017		2018		2019	
	Kilograms	Percentage	Kilograms	Percentage	Kilograms	Percentage
Yard Waste	22	16%	137	6%	171	11%
Food Waste	80	57%	1,970	85%	1,318	84%
Wood - Dimensional	15	11%	85	4%	66	4%
Wood – Oriented Strand Board and Plywood	0	0%	4	0%	7	1%
Drywall Clean	22	16%	120	5%	3	0%
Total	139	100%	2,316	100%	1,565	100%

Table 3 outlines the garbage found in the grey cart audit. The two highest percentages of materials found in the grey carts are miscellaneous dry garbage and miscellaneous wet garbage. Textiles make up an average of 9% of the garbage over the three years.

Table 3: Garbage Found in Grey Cart Waste Scan Audit (2017 to 2019)

Material	2017		2018		2019	
	Kilograms	Percentage	Kilograms	Percentage	Kilograms	Percentage
Furniture	8	1%	5	0%	8	1%
Miscellaneous Dry Garbage	204	28%	844	26%	1,310	65%
Miscellaneous Wet Garbage	405	55%	1689	53%	417	21%
Styrofoam	35	5%	68	2%	21	1%
Textiles	76	10%	334	10%	160	8%
Drywall Contaminated	0	0%	12	1%	2	0%
Feces	0	0%	120	4%	40	2%
Wood – Treat, Painted	0	0%	112	4%	36	2%
Insulation	0	0%	5	0%	2	0%
Mixed Materials	0	0%	0	0%	4	0%
Total	728	100%	3,189	100%	2,000	100%

Table 4 shows the majority of recyclable materials found in the grey cart are clean cardboard, rigid plastic and mixed clean paper; making up 51%, 16% and 8%, respectively, in 2019.

Table 4: Recyclable Material Found in the Grey Cart Waste Scan Audit (2017 to 2019)

Material	2017*		2018*		2019	
	Kilograms	Percentage	Kilograms	Percentage	Kilograms	Percentage
Cardboard – Clean	127	23%	585	21%	875	51%
Cinder Block	0	0%	0	0%	3	0%
Electrical Fittings	2	0.5%	37	1%	3	0%
Electric Products	0	0%	45	1%	2	0%
Electronic Waste	7	1%	13	0%	31	2%
HSP	8	1%	25	3%	10	0%
Linoleum	0	0%	10	3%	5	0%
Medication Pill Form	0	0%	1	0%	0	0%
Metal Ferrous	2	0.5%	185	6%	105	6%
Metal non-Ferrous	60	11%	99	3%	30	2%
Oil - Used	3	1%	0	0%	0	0%
Paint	13	2%	0	0%	5	0%
Paper – Mixed, Clean	106	19%	524	18%	132	8%
Paper – Newsprint, Clean	48	9%	153	5%	62	4%
Plastic - Bags	6	1%	165	6%	64	4%
Plastic - Film	60	11%	222	8%	94	6%
Plastic - Rigid	103	19%	683	24%	271	16%
Porcelain	8	1%	43	1%	5	0%
Polyvinyl Chloride (PVC)	0	0%	0	0%	0	0%
Rubber	0	0%	9	0%	5	0%
Aerosol	0	0%	2	0%	0	0%
Total	553	100%	2,801	100%	1,702	100%

*Residential curbside collection for recycling was only implemented in June 2018

Figure 4 summarizes the City's waste composition of the residential curbside recycling stream in July 2021. Materials collected were primarily paper products, plastic products, metals, building materials, electronics, fine materials and non-compostable organics.

Figure 4: Residential Blue Cart Composition (July 2021)

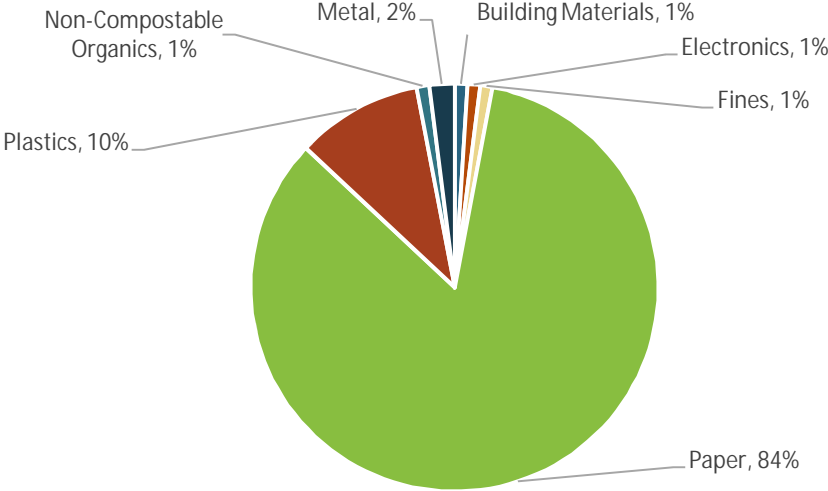


Figure 5 summarizes the grey cart (garbage) tonnages collected curbside from 2017 to 2021. The year with the highest generation of garbage was in 2018 where 19,303 tonnes were generated; the lowest generation year was in 2019 with 18,352 tonnes generated. The average generation of garbage between 2017 and 2021 is 18,722 tonnes.

Figure 5: Grey Cart Curbside Collection (2017 to 2021)

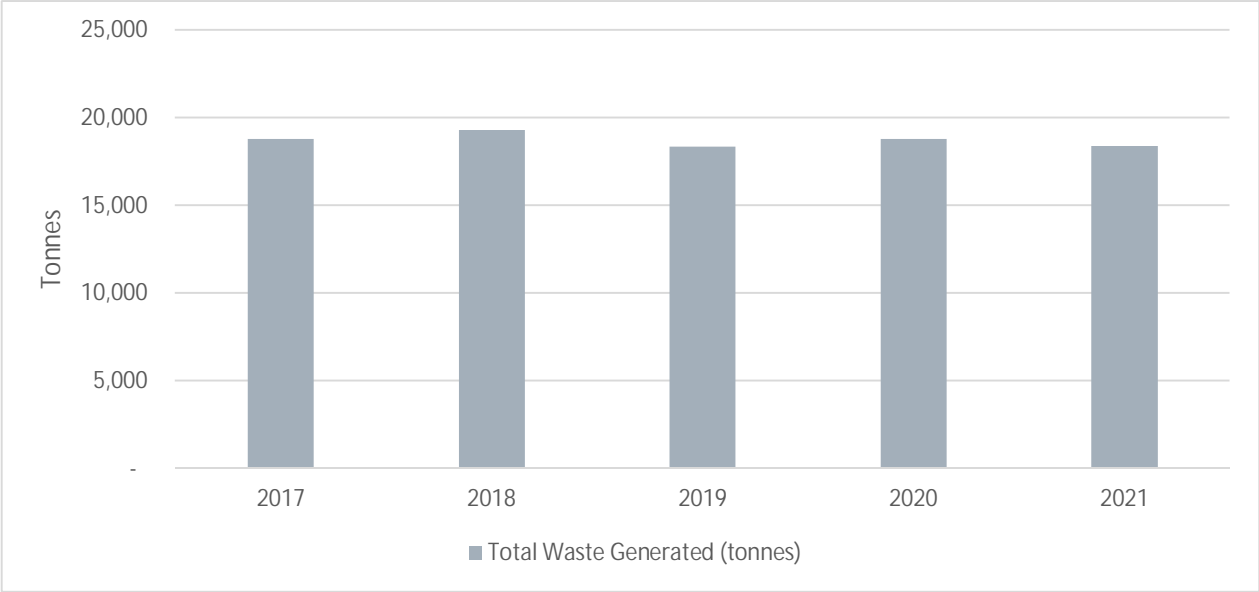


Figure 6 shows green cart (yard waste) tonnages collected curbside from 2017 to 2021. The lowest amount yard waste generated was in 2017 as 4,097 tonnes and the highest tonnage was in 2020 at 4,654 tonnes. There appears to be a consistent trend of collection with an annual average of 4,304 tonnes collected.

Figure 6: Green Cart Curbside Collection (2017 to 2021)

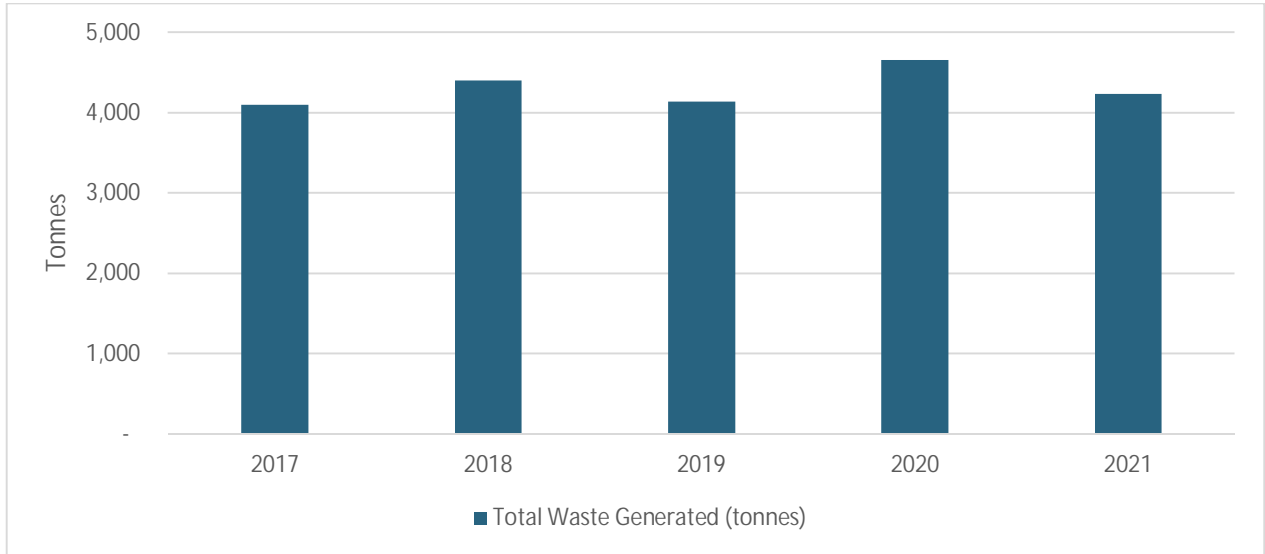
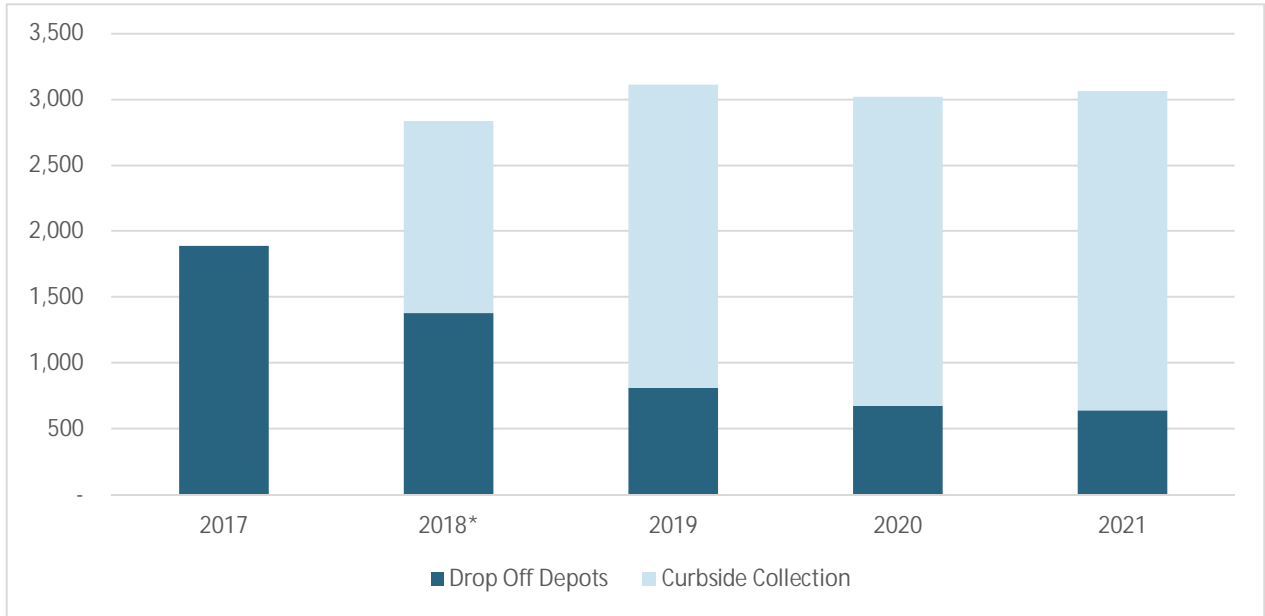


Figure 7 shows the amount of recycling collected at the curbside and accumulated at the three drop off depots from 2017 to 2021. Residential curbside collection for recycling was implemented in May 2018 and therefore curbside collection tonnages were only recorded for eight months (1,456 tonnes collected). In 2018 there was a decrease in tonnages received at the depots by 500 tonnes which is likely due to the implementation of the new curbside collection program and residents becoming accustomed to the provided services. Since curbside collection has been implemented, depots have received between 812 and 638 tonnes (2019 to 2021) annually. The tonnes of recycling collected curbside is consistent from 2019 to 2021 with an average of 2,357 tonnes collected each year (2018 curbside tonnages were not included in this calculation as only 8 months of collection was completed).

Figure 7: Recycling Generation (2017 to 2021)



*Residential Blue Cart Curbside Collection was implemented in May 2018

Four recycling drop off depots were used until 2021 (Table 5) when the Redi location was shut down. In 2021 the Shamrock depot was moved to Northlands.

Table 5: 2017 to 2022 Active Depots

	2017	2018	2019	2020	2021	2022
Shamrock	X	X	X	X	X*	X
Mall	X	X	X	X	X	X
Kipling	X	X	X	X	X	X
Redi	X	X	X	X		

*Shamrock recycling depot moved to Northlands August 1, 2021

3.2.3 SWOT Analysis

Dillon conducted an in-person workshop on March 3, 2022 to gather information, conduct a SWOT analysis and develop a better understanding of the City’s waste management, priorities and progress on previous strategies. Table 6 outlines the results of the SWOT analysis.

Table 6: SWOT Analysis Results

SWOT Analysis
<p>Strengths</p> <ul style="list-style-type: none"> • The newly appointed Council strives to be highly transparent in their operations and are supportive of improving waste management services and programs; • The waste management hierarchy priority is on 'reduction'; • The City runs all high-level waste management services; • The City owns and operates the landfill; • Solid Waste collection fleet is made up of compressed natural gas (CNG) and some diesel units to act as a contingency plan for interruption of service; • The City has one of the lowest waste and recycling costs in Alberta; and • Curbside collection of grey, blue and green cart programs is offered on a weekly basis.
<p>Weaknesses</p> <ul style="list-style-type: none"> • There is an aging population/retirement community in the City which can create resistance to change; • Residents are concerned with the costs of increasing diversion efforts and are generally opposed to any additional costs; • The green cart program does not accept food waste; and • There is a lack of a market for biosolids compost.
<p>Opportunities</p> <ul style="list-style-type: none"> • Development of a green cart program that accepts food waste; and • The City has implemented progressive waste management strategies and programs. This may create an environment and community that is open and willing to accept and implement new programs.
<p>Threats</p> <ul style="list-style-type: none"> • The City currently experiencing difficulty hiring summer, seasonal students due to the lack of retention of younger populations; • The Redcliff Landfill is in close proximity to the City owned landfill which has created competition in tipping fees; and • Due to the geography, the City experiences high levels of wind which create challenges for waste management services.

3.3 Waste Projections

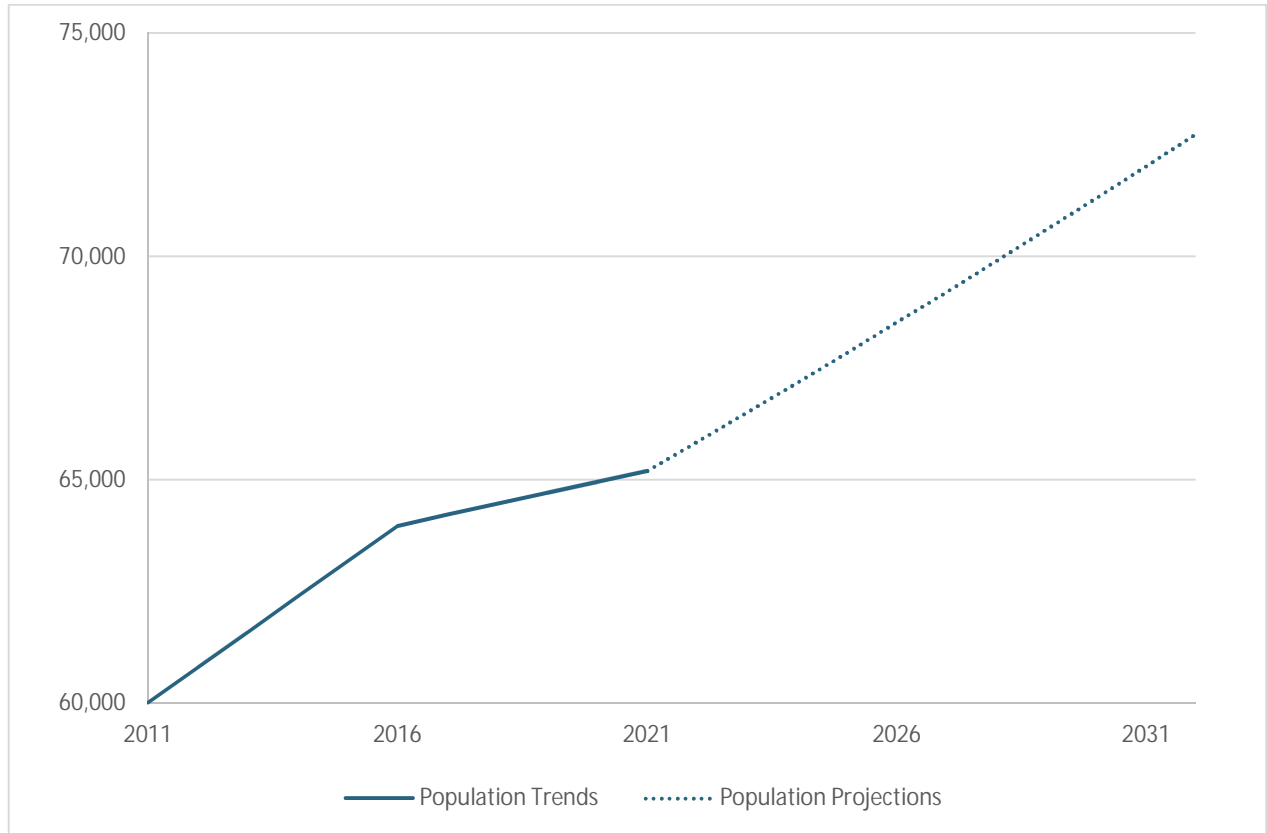
The following sections include population and waste projections. Population projections are based on Statistics Canada's Census Data and populations from previous waste management strategies. Waste projections are calculated using these population trends as well as information provided to Dillon by the City Assets, Waste and Recycling Utilities staff.

3.3.1 Population Trends

Population changes for the City are presented in Figure 8. The population has increased 1% year-over-year. It is noted that City's growth projections should be confirmed in future strategic planning and execution work as COVID-19 has influenced immigration and emigration trends in ways that are not yet fully understood and should be investigated further as this will have an impact on waste management. In order to develop a population projection, the City's future population was estimated through interpolation over a ten-year period. It was assumed that the population would continue to increase at

the 1% annual rate and was confirmed with City staff. The projected populations over ten years are provided in Figure 8 with the projected population in 2032 estimated to be 72,745.

Figure 8: Population Projections (2011 to 2032)



3.3.2 Forecasted Waste Quantities

For the purpose of the 2023 to 2032 Waste Management Strategy, a ten year planning period was used to support and rationalize the direction of the future waste management programs and services. The steps involved understanding historical and current trends in waste generation and reviewing available waste data and population projection data. This data was used to estimate the future total quantities of waste to be managed over the planning period.

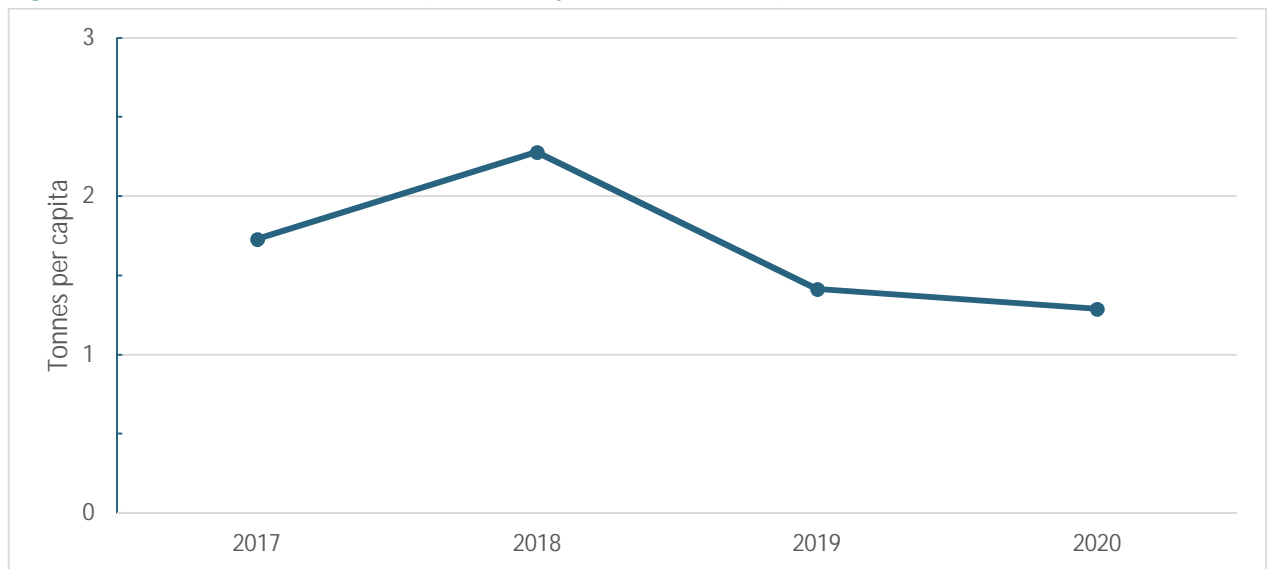
To estimate future waste quantities to be managed over the ten-year Strategy, 2021 was selected as the base year. It was assumed that the waste scan data would remain unchanged over the ten-year Strategy. However, the participation (e.g., use of diversion programs, but not necessarily putting materials in the right stream) and capture rates (e.g., putting materials in the right stream) will change over time due to new programs and policies, increased P&E and product stewardship initiatives. It is challenging to predict the future waste stream based on how quickly and continuously waste continues to change. Some examples of how waste is currently changing include the following:

- Product packaging is getting lighter to reduce transportation costs;
- More people prefer to get their news from online sources, which is decreasing the generation of newspapers;
- Increased online shopping in general as well as throughout COVID-19 generates more household cardboard; and
- Increased availability of single-use products (e.g., coffee capsules, stand-up pouches, takeout containers).

3.3.2.1 Waste Generation Data

The waste generation rate estimates the total quantity of materials generated or produced by a per capita basis. Waste generation rates are affected by various factors and can be closely linked with economic conditions. In general, the more prosperous the population is, the more money they will spend and in turn, the more waste they will generate. Using the City's tonnage and population data, waste generation rates were calculated for curbside collection and waste management facilities. The 2020 per capita waste generation rate was 1.29 tonnes/capita (Figure 9).

Figure 9: Waste Generation Rates (tonnes/capita, 2017 to 2020)



3.3.2.2 Future Curbside Collection Projections

Curbside Waste (All Streams)

To estimate the future quantities of waste generated over the ten-year planning period, the average waste generation rate was based on 2021 tonnages. To carry forward from 2021 and from 2022 to 2032 for a ten-year outlook, the preceding year's waste quantity was multiplied by the annual percent change in population (0.302%) and a 1% annual increase in waste generation. A graphical representation of these forecasts are provided in Figure 10.

Figure 10: Summary of Total Curbside Waste Disposed (2021 to 2032)

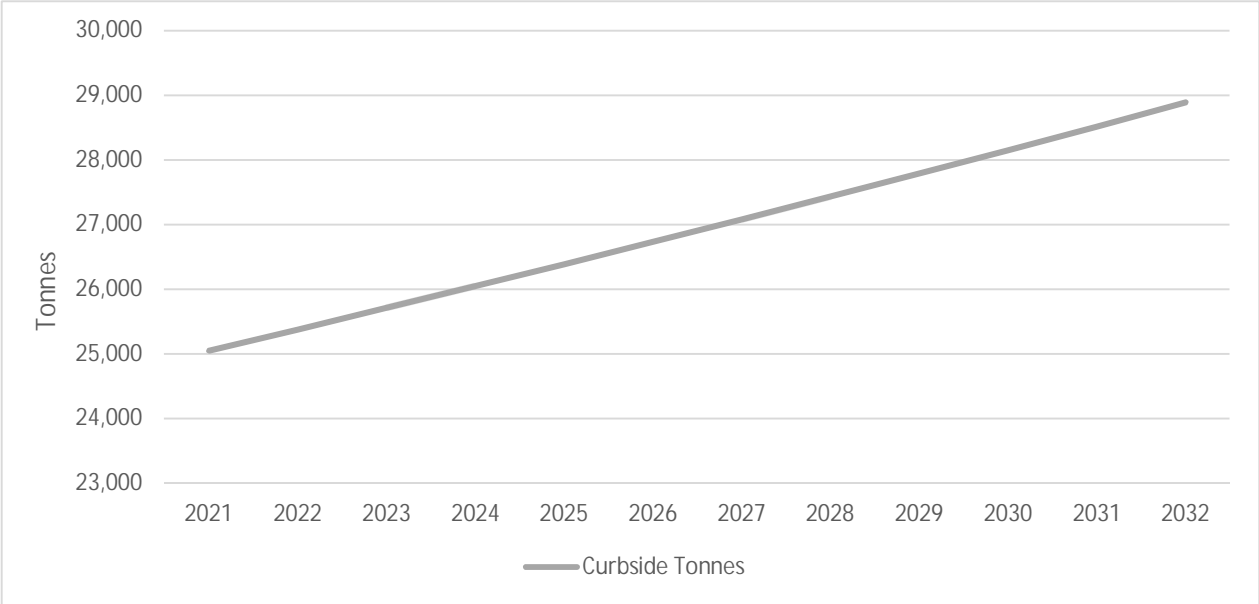
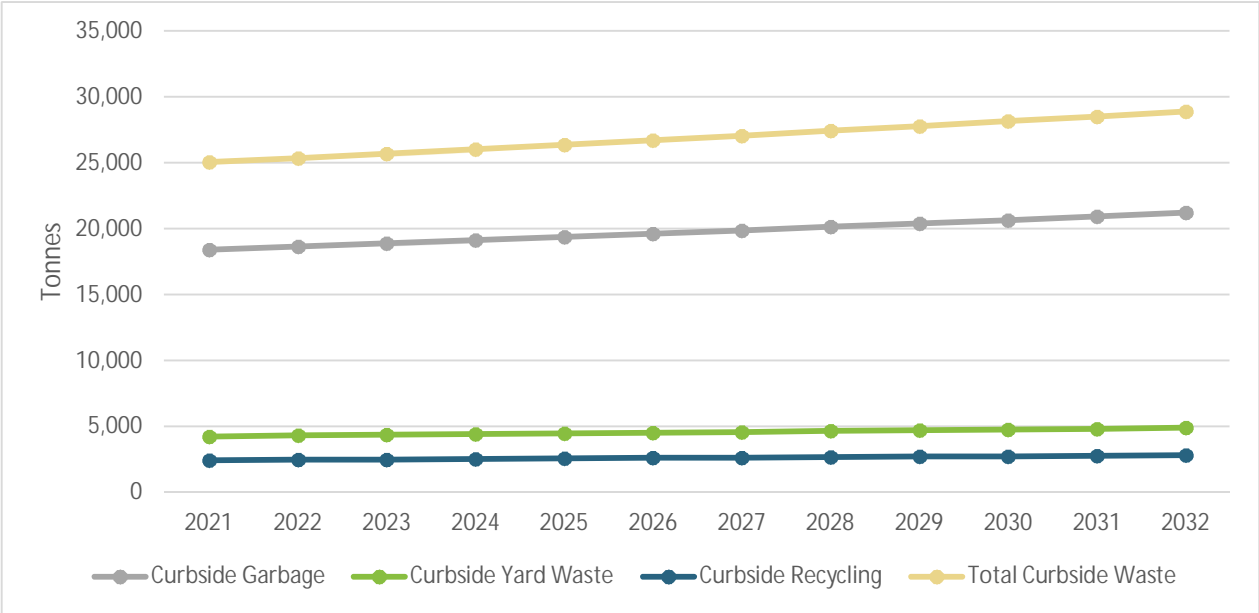


Figure 11 shows that by 2032, with limited changes to the City’s curbside collection program, the City is estimated to manage 29,000 tonnes of all material (yard waste, garbage and recycling) collected curbside, compared to 25,000 tonnes in 2021. This is an estimated annual increase of 4,000 tonnes.

Figure 11: Breakdown of Total Waste Collected through City's Curbside Collection by Collection Stream (2021 to 2032)

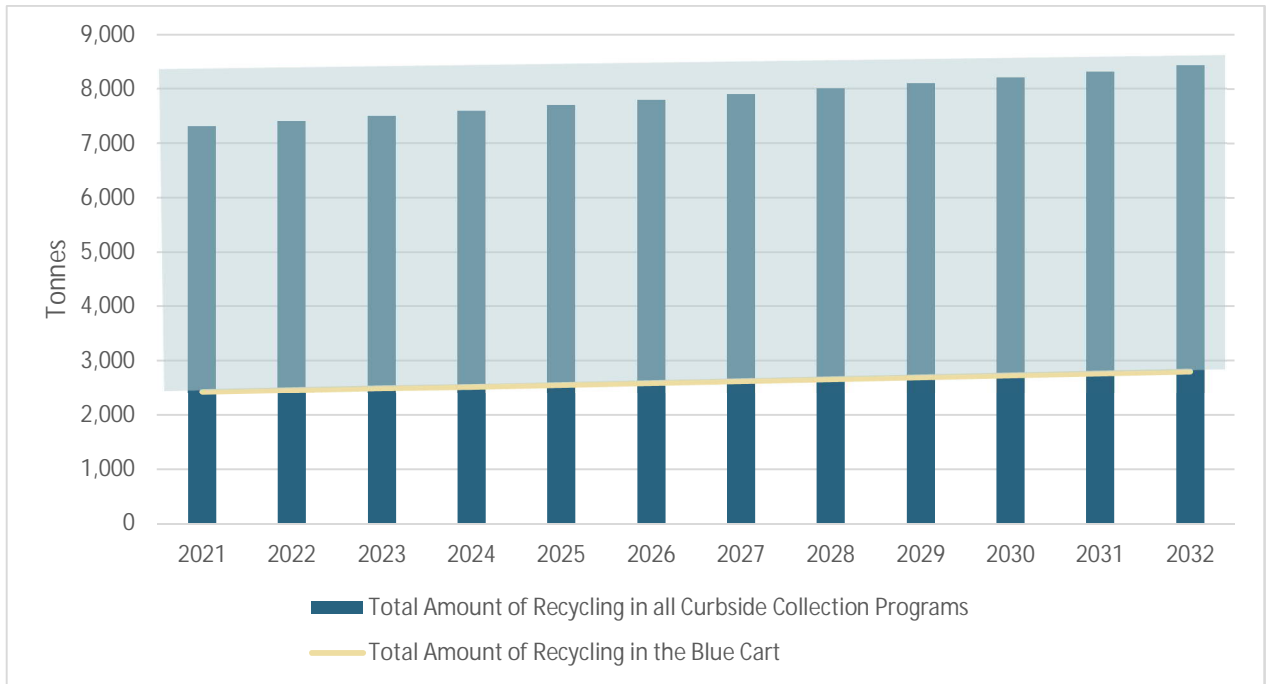


Curbside Recyclables

Figure 12 estimates the amount of recyclables found in all the City’s curbside waste collection programs that are estimated to be disposed (bar chart), compared to the amount of recyclables in the blue cart that are estimated to be diverted (linear line). The shaded area of the figure highlights the recyclables that are estimated to be disposed of as garbage that could have been diverted in the recycling stream based on current trends.

In 2021, the total amount of recyclables generated in all the City’s curbside collection programs was 7,309 tonnes, of that amount only 2,427 tonnes ended up in the recycling cart and were diverted from the landfill. It is projected that by 2032, 8,500 tonnes of recyclables will be generated of which only 2,800 tonnes will be diverted through the recycling cart. On average, the difference between the generated and actual diverted recyclables is 5,300 tonnes.

Figure 12: Breakdown of the Total Amount of Recycling found in all City Curbside Collection Programs vs the Total Amount of Recycling found in the City’s Blue Cart Collection Program (2021 to 2032)

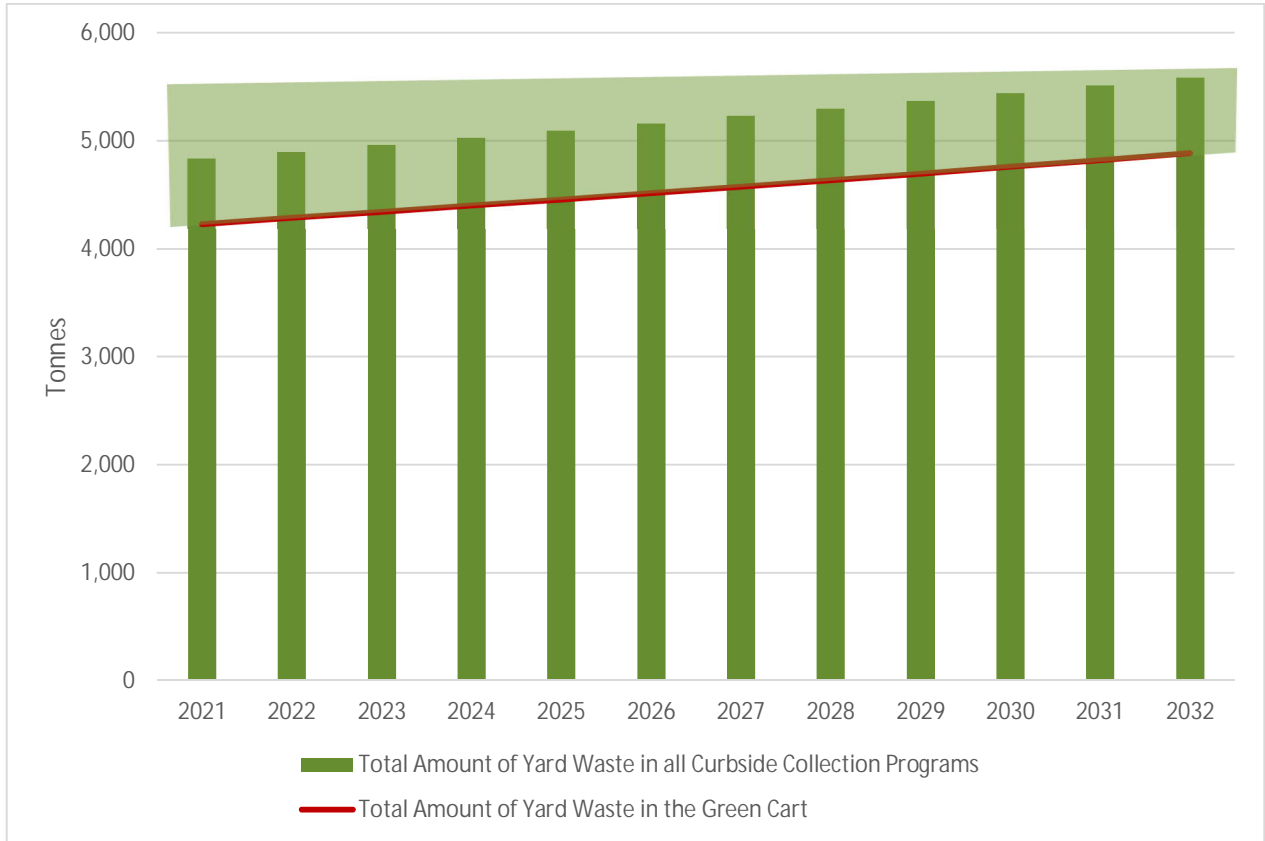


Curbside Yard Waste

Figure 13 estimates the amount of yard waste found in all the City’s curbside waste collection programs that are estimated to be disposed (bar chart), compared to the amount of yard waste in the green cart that are estimated to be diverted (linear line). The shaded area of the figure highlights the yard waste that is estimated to be disposed of as garbage that could have been diverted in the green cart based on current trends.

In 2021, the total amount of yard waste generated in all the City’s curbside collection programs was 4,836 tonnes, of that amount 4,292 tonnes ended up in the green cart and were diverted from the landfill. It is projected that by 2032, 5,600 tonnes of yard waste will be generated in the curbside collection program with 4,900 tonnes diverted through the green cart. On average, the difference between the generated and actual diverted yard waste is 700 tonnes.

Figure 13: Breakdown of the Total Amount of Yard Waste found in all City Curbside Collection Programs vs the Total Amount of Yard Waste found in the City’s Green Cart Collection Program (2021 to 2032)

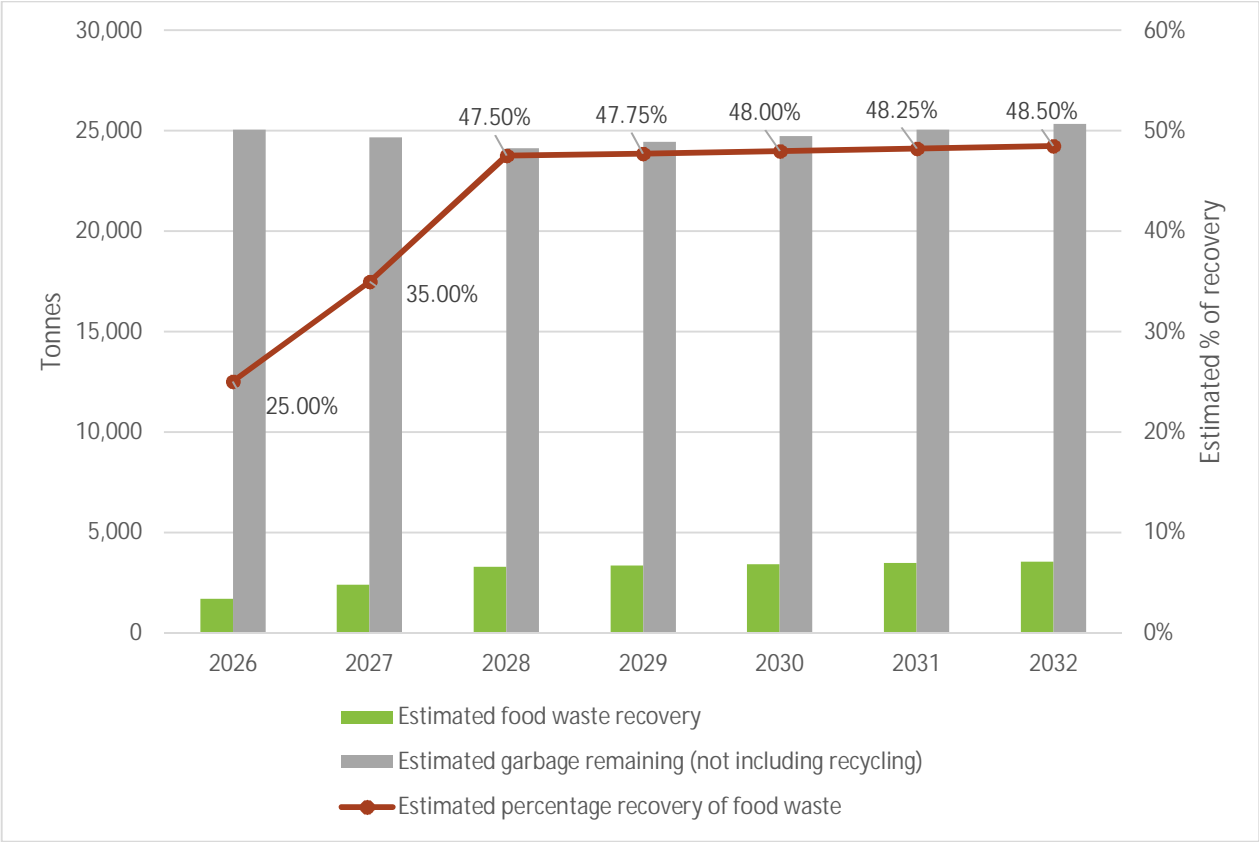


Curbside Food Waste Collection

Similar municipalities within Alberta that have had food waste collection programs in place for five years are collecting, on average, between 45% and 55% of the total amount of food waste generated in their curbside solid waste programs. However, it can take two to three years post implementation for a municipality to collect this amount, on average. Figure 14 estimates the amount of food waste that is estimated to be recovered from the City’s garbage stream as well as the recovery rate (percentage) for the first to seventh years post implementation of a food waste curbside collection program. The estimates are based on the amount of food scraps in the City’s waste stream from the recently completed waste composition study results (Table 1 and Table 2). Additional analysis through additional

waste composition studies (Option 20 in Section 4.3) should be completed to further estimate the amount of food waste that could be potentially recovered through a food waste collection program. The analysis is based on 2026 waste projections as it is assumed that a food waste collection program would be implemented in 2026 (see Section 5.0).

Figure 14: Estimated Food Waste Recovery in a Food Waste Curbside Collection Program



4.0

Options Development

This section highlights the development of the final short list of proposed options. Background information such as the previous Waste Management Strategy and 5-Year Progress Report were considered as well as discussions with the City in the Vision Workshop and update meetings.

4.1

Long List of Options

With an understanding of the City's current position and priorities, a long list of 23 options were developed based on the discussions in the Vision Workshop. Table 7 outlines these options, the timeline (short, medium or long term) and category of each option.

Table 7: Long List of Options

Category	Option	Timeline
Program Development	Develop a HSP drop-off depot	Short
	Pilot a food waste program	Medium
	Expand and improve education programs and outreach	Short
	Explore developing an e-waste central collection point	Short
Operational Impact and/or Improvement	Expand MR and commercial recycling collection	Short
	Explore a SUI ban	Medium
	Explore a cardboard landfill disposal ban	Medium
	Develop bylaw amendments to increase enforcement capabilities	Medium
	Explore options to optimize landfill airspace	Long
	Explore options to develop a green City fleet	Long
	Explore additional tipping rates for C&D materials	Short
	Conduct a cost-benefit analysis of reducing collection of food waste	Short
	Identify impacts EPR will have on current operations	Medium/Long
	Explore ways to reduce wind impact at landfills and decrease closure	Short
Education and Partnerships	Explore upgrades available for anaerobic digestion (AD)	Short
	Explore interest from neighboring municipalities for a regional partnership	Medium/Long
	Develop a strategy for promotion of non-profits that accept and sell reusable items	Medium/Long
	Create joined effort with the Wastewater Treatment Plant (WWTP) on how to manage biosolids	Long
	Improve participation in litter reduction education programs	Short
Research and Other	Explore waste-to-energy (WTE) options	Short
	Identify environmental benefits and/or credit opportunities related to waste management for the City	Medium
	Explore glass recycling marketability	Long
	Identify funding and grant opportunities that the City is eligible for	Medium

4.2

Criteria for Options Evaluation

In collaboration with the City, evaluation criteria was developed using a triple bottom approach. Table 8 presents the criteria and indicators used to evaluate the options along with descriptions of rationale to give for each of the rankings. The rankings range from 1 to 3 where 1 indicates the least favourable outcome and 3 indicates the most favourable outcome; therefore, the higher an option scores the more favourable it is.

Table 8: Evaluation Criteria

Evaluation	Indicator	Rank
Economic Feasibility	Annual Operational Costs	Low: \$5,000,000 or greater
		Medium: \$1,000,000 to \$5,000,000
		High: Less than \$1,000,000
	Capital Costs	Low: \$20,000,000 or greater
		Medium: \$5,000,000 to \$20,000,000
		High: Less than \$5,000,000
Level of Risk – liability or environmental	Low: Very high risk (e.g., results, liability, environmental impacts, City control)	
	Medium: Moderate risk (e.g., some risks but can be mitigated)	
	High: Very low risk (e.g., good results, good for environment, limited liability)	
Social Impact	Public Acceptance	Low: Potential for opposition to the option
		Medium: No public perception of the option
		High: Option anticipated to be accepted/encouraged by the community
	Proven or Unproven	Low: Unproven (e.g., at pilot stage or small scale, no full scale implementation)
		Medium: Proven in jurisdictions smaller than the City and/or in other jurisdictions in Canada (not necessarily in Western Canada)
		High: Proven in jurisdictions like the City or larger in western Canada
Level of effort to develop, implement, operate and maintain	Low: High level of effort to develop and implement (e.g., more than 5 years, additional resources may be needed)	
	Medium: Moderate effort to implement (e.g., some additional resources are needed, can be implemented in 3 to 5 years)	
	High: Easy to implement (e.g., can use existing staff and/or resources)	
Environmental Impacts	Climate Change impacts	Low: Results in little to no reduction in GHG emissions
		Medium: Results in a moderate reduction in GHG emissions
		High: Results in significant reduction in GHG emissions
	Land Requirements	Low: Additional land required
		Medium: Minimal to no additional land required
		High: Optimize existing asset, use existing site/building and/or potential to make land available
	Nuisance Impacts	Low: Will increase nuisance impacts
		Medium: Minimal to no change in nuisance impacts
		High: Will reduce nuisance impacts
	Potential for diversion from landfill disposal	Low: 2% diversion or less, difficult to measure
		Medium: 2% to 5% diversion
		High: More than 5% diversion/reduction

Preferred Options

The long list of 23 options were presented to the City for review. A feedback session was completed which involved identifying which options were the highest priority to include in the Strategy, which options might be beneficial to explore in the future and which should be removed. The City narrowed this long list down to 20 options to explore in this Strategy. The 20 finalized options were evaluated against the finalized criteria. Table 9 provides a summary of the evaluation. A detailed evaluation with rationale is provided in Appendix A.

Table 9: Preferred Options Summary

Option 1: Develop a Food Waste Curbside Collection Pilot Program	
Description	Conduct a cost-benefit analysis to assess the feasibility of a food waste curbside collection pilot program and begin planning the pilot. Prior to the implementation of the food waste curbside collection pilot program, the City may choose to develop a P&E campaign to help inform the public on the upcoming pilot program and build awareness of food waste and its impacts.
Supporting Rationale	<p>The previous Waste Management Strategy included exploring a food waste collection and composting program as an option. It was deferred until after 2017 due to budget cuts. At the time, more funding, monitoring of technology improvements and operational costs were needed. Implementing a food waste collection program could also increase the City's diversion rate. Several communities have implemented successful pilot projects and green cart programs including:</p> <ul style="list-style-type: none"> • City of Calgary. One-year pilot in 2012 resulted in approximately 1.9 million kilograms of food and yard materials, reducing black cart materials by 40%. • City of Red Deer. Two-year pilot in 2015 to 2,000 households. Reduced food waste found in the garbage by 39%. A full program was implemented in 2018. • City of Airdrie. Five-month pilot in 2013 to 400 households. Cost benefit analysis identified reduction in garbage disposal costs by \$50 per tonne.
Option 2: Expand and Improve Education Programs and Outreach	
Description	Develop an ongoing promotion strategy for engagement and determination of promotion objectives. Various approaches may be taken, including increased social media presence, paid social media advertising and establishing a dedicated webpage to promote waste reduction. Promotion could be conducted via social media and through businesses, community organizations and schools. The first step would involve conducting a study with focus groups to better understand resident and customers' needs, then design the promotional program accordingly.
Supporting Rationale	<p>Expanding and improving the City's P&E of current waste management programs can help increase participation and compliance of the City's waste management programs and/or services. There is an aging community within the City that may have a tendency to resist change. This is one demographic the P&E efforts can target to reach. Examples of successful P&E programs from other communities include:</p> <ul style="list-style-type: none"> • City of Lethbridge. Offers online resources, including educational videos, to residents as part of their waste reduction promotion plan.

Option 2: Expand and Improve Education Programs and Outreach

- City of Calgary. Developed an online game teaching youth and adults how to sort waste materials into their designated carts and how to manage HSP and landfill items. The City also created a Food Waste Reduction Lesson Plan for educators.
- City of Edmonton. A program was developed to record home addresses where residents set out five or more bags of garbage on collection day. Within a few hours of collection pickup households were provided education through a household visit. Follow-up showed that 69% of targeted households reduced their garbage set out after the visits.

Option 3: Consider Expanding MR and Commercial Recycling Collection

Description	Explore the feasibility and level of effort to expand MR and commercial recycling collection. The City may consider an opt-in option for commercial units to gauge level of interest and participation. As a part of this option, a negotiation with the current service provider (GFL) would need to occur to expand the existing programs.
Supporting Rationale	Commercial waste management continues to be a challenge, specifically in the downtown core. To date, there has been no movement towards replacing the current commercial waste bin system with an automated cart collection system. Many municipalities in Alberta have a commercial program. In many jurisdictions, MR buildings fall under commercial waste. Municipalities can decide to collect MR waste as a separate entity or include with current commercial garbage collections. Examples of commercial programs from municipalities in Alberta include: <ul style="list-style-type: none"> • City of Calgary. The City has a MR recycling requirement under Bylaw 20M2001, stating that all MR complexes must provide recycling for residents. It is up to the complex owner to find collection services through a private hauler or use the City of Calgary's collection services. • City of Edmonton. Currently developing a MR mandatory waste sorting program, requiring MR properties to provide containers for recyclables that are accessible to residents, or co-located in the same vicinity. • City of Red Deer. Offers recycling and garbage services to residents living in MR properties by providing properties with shared recycling bins or carts.

Option 4: Develop a C&D Policy

Description	Develop a C&D Policy, involving developing minimum service level requirements for generators of C&D waste (e.g., Demolition Waste Management Plans). The plans may require a breakdown of tonnage of C&D waste materials from local demolition and/or deconstruction activities. Examples of key initiatives for developing a C&D Policy could include disposal bans, land use zoning requirements and deconstruction/recycling bylaws.
Supporting Rationale	There is a need to improve the diversion and management of C&D waste. As a result, wood and asbestos type materials have differential tipping rates at the landfill. A C&D Policy can help further improve the management of C&D waste materials. Several communities throughout Canada have implemented C&D policies and initiatives: <ul style="list-style-type: none"> • City of Lethbridge. Created an ICI Implementation Strategy to promote and provide opportunities for waste diversion. A mandatory recycling and source separation program for the ICI sector requires businesses to separate wood, cardboard and paper materials. • Town of Cochrane. The Town requires all municipal construction, demolition and renovation projects to include a provision to recycle as much materials as possible and to separate materials for reuse, recycling or alternative use.

Option 4: Develop a C&D Policy

- City of Calgary. The campaign “Reconstruct Calgary” was developed to divert C&D waste generated in construction projects and practices from landfills. Currently, the City recycles 20 to 30% of the C&D waste they manage.
- Metro Vancouver, British Columbia. Metro Vancouver disposal facility loads are inspected for banned materials that should not be in the garbage waste stream, such as clean wood, gypsum and recyclable metals. Surcharges are applied if these materials are found in the garbage at Metro Vancouver disposal facilities.

Option 5: Explore Additional Tipping Rates for Certain Materials (e.g., cardboard, C&D materials)

Description	Explore implementing a tipping fee strategy for the landfill that would incentivise and reduce the generation and disposal of difficult to manage materials. This could include incentives such as decreasing tipping fees for materials that could be beneficially reused, removing tipping fees for certain materials (e.g., scrap metals, electronic wastes) to encourage source separation and increasing tipping fees for certain materials to discourage generators from disposing of these materials (e.g., C&D waste). Consider developing a consistent policy that would apply to the disposal of materials those non-profit and charitable organizations are not able to sell.
Supporting Rationale	Evidence from other jurisdictions illustrates a strong link between higher disposal fees and reductions in landfilled waste. Several communities that have implemented tipping fee strategies include the following: <ul style="list-style-type: none"> • City of Calgary. The City uses landfill tipping fees and surcharges to support its waste management programs and policies. Materials that can be recycled or composted are subject to a surcharge. This currently includes food and yard waste, paper and cardboard, concrete, brick and masonry block, road asphalt, scrap metal, recyclable wood, drywall. • Metro Vancouver, British Columbia. To support a recyclable materials ban, loads containing more than 5% of recyclable materials, other than food waste and clean wood, have a 50% tipping fee surcharge. Food waste and clean wood disposal was banned in 2015 and polystyrene packaging was banned in 2018.

Option 6: Explore Options to Optimize Landfill Airspace

Description	Develop a strategy to optimize landfill operations over and above what is currently completed on-site to increase the remaining capacity and extend the life of the landfill. Consider optimization approaches such as shredding/baling operations for bulky waste to reduce volume or soil loading opportunities to increase settlement.
Supporting Rationale	Identified as a City priority. There have been expansion studies demonstrating there is vertical expansion potential; however, there is more support for optimizing the existing site until expansion is necessary. The following communities have implemented approaches for optimizing landfill operations: <ul style="list-style-type: none"> • City of Red Deer. The City has a number of strategies to optimize landfill space including reducing cell size and working areas, maximizing lift thickness and conducting annual topographical plans generated from aerial survey data to allow staff to closely monitor and verify fill progress and airspace consumption. • Town of Okotoks. Utilizes the Foothills Regional Landfill and Resource Recovery Centre which consists of a landfill operation, throw and go recycling area and a salvage and recycling non-profit organization called The Foothills Salvage and Recycling Society. Annually, the site diverts over 20,000 tonnes of material due to these additional services and programs.

Option 6: Explore Options to Optimize Landfill Airspace

- Halton Region, Ontario. Recently developed a solid waste management strategy. As part of the short-term options, the Region considered measures that would optimize landfill operations, including leachate recirculation and use of GPS system to upgrade equipment operations.
- Fredericton Region, New Brunswick. 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. Approximately 120,000 bales of solid waste can fit in one cell where they are covered with gravel.

Option 7: Explore Ways to Reduce Wind Impact at Landfills and Decrease Closure

Description	<p>Explore different approaches on how to reduce the impact that wind has on landfill closure as well as litter off site. The following best practices should be continued or considered to manage windy environments and reduce blowing waste:</p> <ul style="list-style-type: none"> ● Continue implementing alternative daily covers such as grizzly plates to avoid blowing of materials and/or pests; ● Look at construction of a large tent structure to be utilized as a transfer site during windy conditions. Material could be transferred to working face when conditions improved. This option would require additional equipment and resources. Bale waste on windy days to reduce the amount of small, lightweight materials from blowing around the site; ● Continue the use of portable litter catching fences which are a reactive measure used to catch any airborne litter. By installing a wind fence on the prevailing wind side and a debris catch and control fence on the opposite side, material can be contained within the immediate recycling or landfill areas. Having a wind fence or portable panels can prevent temporary landfill shutdowns due to excessive wind and can be moved as close to the working area as needed; and ● Increase the height of the permanent fence.
Supporting Rationale	<p>Due to regular closures of the landfill caused by wind, there is an impact on operational costs. Several communities have implemented the following best practices:</p> <ul style="list-style-type: none"> ● City of Brooks: Newell Regional Landfill experiences sudden shifts in wind direction with speeds up to 70 km per hour and gusts past 90 km per hour. During the planning period of the landfill, it was identified that wind management was crucial to avoid future issues. The implementation of portable wind screens to shelter the working face and the use of portable chain link mesh catch fences helps control blowing litter. ● Cardston County: The Transfer Station in Cardston County utilizes wind fences to control debris and wind around the transfer station.

Option 8: Explore Upgrades Available for AD

Description	Consider a high-level feasibility study of the scale required to develop an AD facility and whether it is a viable option for the City. The feasibility study could include an analysis of the organic waste feedstock, consideration of available end markets, an assessment of the effort required for planning, siting, approval processes and the procurement of a design, build and operate contract.
Supporting Rationale	<p>A feasibility study can inform and support planning and decision making for waste management system upgrades. Communities with AD processing include:</p> <ul style="list-style-type: none"> • City of Airdrie. The City has a comparable population to Medicine Hat. Organic waste from the City was sent to an approved processing facility. However, due to odour concerns, the contracted organic waste processor was denied a permit. This meant that the City ceased its organic waste contract and instead began to send it to Calgary. It is recommended that the City of Medicine Hat collaborate with the City of Airdrie to further understand the market for organic waste processing. • City of Edmonton. The City invested in an AD facility called the High Solid Anaerobic Digestion Facility (ADF) located at the Edmonton Waste Management Centre. The facility can process 40,000 tonnes of residential food waste per year. • Foothills County. Catapult Environmental Inc. is constructing a composting and renewable natural gas facility. It will be a large-scale commercial organic waste processing hub that will be available for contract to Calgary and southern Alberta. It will be able to process 20,000 tonnes per year and once anaerobic digesting is online, an additional 70,000 tonnes per year can be processed.

Option 9: Develop Bylaw Amendments to Increase Enforcement Capabilities

Description	Develop bylaw amendments to increase enforcement capabilities. This option may increase participation in current waste management programs, specifically the curbside recycling collection program. The intent is to decrease unacceptable materials using periodic visual curbside audits and compliance blitzes to provide residents with direct and immediate feedback on their unacceptable materials using tags or notices.
Supporting Rationale	<p>Residential compliance to waste management programs and/or services has been identified as an issue. Several communities have implemented bylaw amendments, including:</p> <ul style="list-style-type: none"> • City of Surrey, British Columbia. The City has been completing curbside organic waste and recycling cart “blitz audits” for the past several years to check for contamination and to tag carts where contamination was observed. Since the blitz audits were implemented, the City has observed up to 50% reduction in contamination along audited routes. • City of Coquitlam, British Columbia. The City has completed several collection audit blitzes for household waste set out times to reduce garbage as a bear attractant. Residents are not allowed to set-out their garbage or green waste containers before 5 a.m. on the day of collection. • Town of Markham, Ontario. The Town enforces compliance in recycling programs by requiring clear bags to be used for waste materials. While the City of Medicine Hat does not have a clear bag program, some insights can be gained from Markham’s enforcement efforts, which are conducted by their waste collection operators.

Option 10: Explore Options to Develop a Green City Fleet

Description	Consider options to reduce GHG emissions from solid waste collection trucks and landfill equipment. Considerations may include exploring different fuel usage, including renewable natural gas (RNG) and hybrid or electric vehicles for municipally-owned and contracted collection service fleets. A current state analysis to understand which vehicles can be replaced and a review of jurisdictional scans that fit Canadian context and climate could be completed.
Supporting Rationale	<p>The City is continuing to utilize compressed natural gas (CNG) collections trucks where possible and the possibility of electric trucks has been examined. The City would like to continue pursuing these endeavours. Solid waste collection vehicles are among some of the heaviest fuel users in the automotive industry. As a result, waste collection vehicles offer the greatest opportunity for achieving GHG emission reductions. Examples of communities with GHG emissions reduction initiatives for fleets include:</p> <ul style="list-style-type: none"> • City of Calgary. The City's procurement processes considers all available fuel types when purchasing new vehicles and equipment. One of the procurement strategies is to add clauses to Request for Proposals (RFP) to enable them to try new green solutions and technologies as they become available in the market. In 2018, the City carried out an Alternative Fuel Study to explore opportunities for expansion of alternative fuels, especially for their waste collection and recycling fleet. Starting in 2022, the City of Calgary will be implementing a pilot project to investigate the suitability and economic benefits of using electric and hybrid trucks to collect waste. • City of Vancouver, British Columbia. In 2018, the City shifted to 100% renewable diesel fuel. A dedicated natural gas compression station allows the City's vehicles to be operated on 100% compressed natural gas. In 2021, the City issued an open call for innovation through Project Greenlight for transportation, zero-waste, buildings and rainwater solutions. The call seeks transportation solutions that support the City's pursuit of a zero-emissions fleet.

Option 11: Develop a Circular Economy Roadmap

Description	Develop a Circular Economy Strategy that aligns with Provincial and Federal efforts and be the primary framework and action plan for how the City could work towards its diversion goals. By embedding circular economy principles into policy levers, cities can bring about changes to the use and management of materials in cities.
Supporting Rationale	<p>Many municipalities are demonstrating leadership in circular economy strategies. It may benefit the City to explore how a circular economy framework can improve its current operations, provide cost-benefits and help achieve reduction and diversion targets. The following municipalities have developed circular economy strategies:</p> <ul style="list-style-type: none"> • City of Calgary. The City participated in the recent Federation of Canadian Municipalities (FCM) Circular Cities and Regions Initiative (CCRI) which was a pilot to advance circular economy knowledge in the Canadian local government sector. Through two workshops, the City developed a roadmap that focused on innovation, economic diversification, sharing and reuse. • Town of Canmore. The Town participated in CCRI and identified the <i>Sharing and Reuse Economy</i> and <i>Regenerative Visitor Economy</i> as two actionable circular opportunities. The Town seeks to promote sustainable and eco-friendly tourism and develop 'how to' guides for residents to improve their personal reuse habits. • City of Victoria, British Columbia. The City's Zero Waste and the Circular Economy Plan aims to reduce waste disposal by 50% by 2040. The Circular Economy Plan has five major actions which include: developing a new four-stream waste and recycling system; using a rewards return program called "cash for cans"; implementing new infrastructure and innovative

Option 11: Develop a Circular Economy Roadmap

solutions; supporting best practices through legislation; and implementing a statewide ban of single-use plastics.

Option 12: Explore a SUPs Ban

Description	Consider exploring a SUP ban by conducting a jurisdictional review to better understand where SUP bans have been implemented and what lessons were learned. It would assess how a ban could align with recent federal Canadian Environmental Protection Act (CEPA) legislation changes. The City can consider how it might prepare for the federal bans, such as increasing P&E to address the use of alternative products. The City may also wish to gather baseline data and develop a monitoring plan to assess the impact of the federal ban.
Supporting Rationale	<p>There appears to be merit in allowing the government and retail industry a fair opportunity to advance their education and incentives to decrease in the use of plastic bags. The following communities have implemented SUI bans and reduction strategies:</p> <ul style="list-style-type: none"> • City of Victoria, British Columbia. Adopted by-law banning single-use retail checkout bags. • Prince Edward Island (PEI). The <i>Plastic Bag Reduction Act</i> came into force on July 1, 2019. Like the federal regulation, it applies to plastic checkout bags and includes biodegradable or compostable checkout bags; but not paper bags. Unlike the federal regulation, it requires that businesses charge customers for both paper alternatives and reusable checkout bags. • City of Edmonton. The City's <i>Plan to Reduce Single-use Items</i> (published March 2022) is geared towards reduction from residents and businesses and includes both regulatory and voluntary actions. • City of Kingston, Ontario. The City (population approximately 130,000) created a bylaw in 2019 that banned plastic straws, cups and forks from the City-owned Grand Theatre and Invista Sports Complex.

Option 13: Identify Impacts EPR will have on Current Operations

Description	<p>The Environmental Protection and Enhancement Amendment Act (EPEAA) is a recent legislation that came into effect in 2021. The EPEAA is a province-wide system for the management of SUP, packaging, paper and hazardous and special products. Under the EPEAA, that the City's obligation to provide recycling services to residents will cease.</p> <p>Consider developing an EPR roadmap (or action plan) that would work as a guidance document to prepare for upcoming changes under the EPEAA. In developing the roadmap, the City would liaise with other jurisdictions to identify potential impacts.</p>
Supporting Rationale	<p>The City's statutory requirement to provide services will change and planning is required to understand the impact to the integrated waste management system. The following jurisdictions have implemented EPR initiatives:</p> <ul style="list-style-type: none"> • Ontario. In 2016, the Waste-Free Ontario Act was passed by the Legislative Assembly of Ontario. That year, it also enacted the Resource Recovery and Circular Economy Act and the Waste Diversion Transition Act which authorized the transition of the financial and operational responsibility for waste diversion programs in Ontario from municipalities to product and packaging producers. • British Columbia. A move towards an EPR-based regulatory structure was first announced in 2003 and is organized in a way that favours a single entity (Recycle-BC) that is responsible for the provision of service to the public. The Environmental Management Act, 2018, set the course for Recycling Regulation 162/2020 to establish the duties of producers.

Option 13: Identify Impacts EPR will have on Current Operations

- City of Calgary. The City is preparing for the introduction of EPR and provides a fact sheet on its website. The site also encourages people to become advocates by contacting their Member of the Legislative Assembly (MLA) and contacting manufacturers and/or brand owners to request that they improve the recyclability and sustainability of their products and packaging.

Option 14: Develop a Strategy for Promotion of Non-Profits that Accept and Sell Reusable Items

Description	Support and promote community-based initiatives and organizations to increase reuse and recycling and avoid waste. This could include developing a database of organizations that participate in reuse, donation, recycling, second-hand and/or repair and establishing a funding program to support local non-profit organizations and community groups that help reduce residential waste and encourage new initiatives.
Supporting Rationale	<p>There are initiatives which enable the City to participate in increased diversion through reuse, donation or repair; however, it can be challenging for residents to access these services. The development of a promotion strategy for these programs may increase access to these services by the public and may present opportunities for partnership between organizations. Several communities have explored the following initiatives:</p> <ul style="list-style-type: none"> • Strathcona County. Developed its "Hodge Podge Lodge" which collects various items and materials that can be reused or repurposed. The items accepted are often difficult to recycle through traditional curbside collection programs. • City of Toronto, Ontario. Businesses and non-profits can participate in the Materials Exchange program. The Material Exchange team facilitates the exchange of the materials to organizations for reuse or recycling. The program is inter-municipal with funding for the program being received from partnering municipalities. • City of Vancouver, British Columbia. The Shareable Cities Network connects sharing initiatives from around the world to sharing resources and ideas. In Vancouver, using the Shareable Cities Network platform, a group of volunteers created The Sharing Project which allows users to post about sharing opportunities in the City.

Option 15: Create a Joint Effort with the Wastewater Treatment Plant on how to Manage Biosolids

Description	Conduct a feasibility study involving best practices and innovation in the management of biosolids. This option could consider forming a cross-departmental working group or committee with the Wastewater Treatment Utility team and the City Assets, Waste and Recycling Utilities team.
Supporting Rationale	<p>Volumes of biosolids from the City's WWTP combined with the leaf and yard waste collected puts the facility very near the feedstock maximum as set out in the Compost Facility Code of Practice. There is also currently no market for the finished biosolids compost produced. Continuing to compost the biosolids currently brought to the site may pose more challenges considering regulatory challenges. Several municipalities that have programs to manage biosolids include:</p> <ul style="list-style-type: none"> • City of Kelowna, British Columbia. The Regional Biosolids Compost Facility in Vernon, BC is jointly owned by the City of Kelowna and the City of Vernon. It receives sewage sludge from Kelowna, Vernon, Silver Hawk Utilities and Lake Country Wastewater Treatment Facilities. Biosolids are mixed with wood chips and clean ground dimensional lumber. • City of Calgary. The City has a biosolids management program dedicated to biosolids management research. Municipal biosolids can be used as fertilizer at the plantation project to improve soil quality that is considered "marginal" for agricultural purposes.

Option 15: Create a Joint Effort with the Wastewater Treatment Plant on how to Manage Biosolids

Biosolids from the City's wastewater treatment facility (45,000 tonnes per year) are processed anaerobically with municipal organic waste received from the green bin program (100,000 tonnes per year).

Option 16: Improve Participation in Litter Reduction Education Programs

Description	Develop a litter strategy to achieve waste avoidance, reduction and diversion goals and objectives with a focus on behavioural change. The strategy could include community partnerships, a P&E campaign and policy development.
Supporting Rationale	<p>Expanding and improving education of litter reduction programs may help increase participation of the programs and/or services which may improve diversion rates in the City and reduce litter. The following are examples of municipalities with proactive litter strategies:</p> <ul style="list-style-type: none"> • City of Edmonton. The City has receptacles for garbage and recycling and cigarette butt receptacles in some locations heavily used by residents. Capital City Clean Up is a litter reduction and prevention program to help keep the City clean over the summer months. • Cape Breton Regional Municipality, Nova Scotia. The Trashformer Program is a partnership formed between the Cape Breton Regional Municipality Solid Waste Department and ACAP Cape Breton to remove litter and debris from the community. Each summer a group of dedicated students collect trash throughout the community. A litter strategy has undergone the research and planning phase to continue to address ongoing litter challenges. • Township of Langley, British Columbia. The Litter and Illegal Waste Management Strategy is based on three pillars: education, infrastructure and enforcement. Solutions for dealing with and mitigating litter and illegal dumping included: bylaw enforcement and reporting, education, awareness and campaigns, infrastructure and staffing, new programs and developing a public space solid waste management strategy.

Option 17: Explore Potential Revenue Streams for the City Related to Waste

Description	Conduct research to identify opportunities for the City to receive funding that could support its waste management system. Renewable energy certificates may be generated from landfill gas or AD. A high-level feasibility study could be conducted to evaluate the potential revenues of crediting against implementation costs. The City's research could include GHG credits and provincial funding.
Supporting Rationale	<p>The Alberta government provides grants through its Emissions Reduction Alberta (ERA) program. The program is funded through Alberta's Technology Innovation and Emissions Reduction (TIER) fund into which large industrial emitters contribute. TIER is an example of an industrial GHG emissions pricing regulation and emissions trading system. The following are examples of communities which received funding for waste management systems:</p> <ul style="list-style-type: none"> • Town of Vegreville. Alberta-based ATCO Energy Solutions constructed its first renewable natural gas system near the Town. The facility will receive feedstock that is a combination of local manure and municipal green bin waste. The sale of gas from the facility will be a revenue stream. ERA committed \$7.9 million to this project through its Natural Gas Challenge, which is funded through the Government of Alberta's TIER fund. • Town of Strathmore. Wheatland Biofuel in Strathmore (underway - 2024 expected) is a \$285 million project that received \$5 million in funding from ERA. The project will create low carbon intensity ethanol (that meets Alberta's renewable fuel standards) from biogas.

Option 17: Explore Potential Revenue Streams for the City Related to Waste

- City of Medicine Hat. In addition to TIER, Alberta's Renewable Electricity Program allows companies to bid on new energy projects in the province, including geothermal, hydro, solar, sustainable biomass and wind. As another revenue stream, the City could explore the possibility of solar power installations being built at its waste management facilities in order to recover costs.

Option 18: Explore WTE Options

Description	Review current WTE information, consider feasibility of WTE in relation to other disposal options and communicate findings to decision makers, such as senior management or Council.
Supporting Rationale	<p>The previous Waste Management Strategy mentioned that as WTE technologies become more widespread and supported in comparative Canadian municipalities, it may be considered. From an environmental perspective, energy derived from waste can displace the need for energy from fossil fuels and therefore decrease greenhouse gas emissions. Examples of municipalities exploring waste WTE options include:</p> <ul style="list-style-type: none"> • City of Leduc. The City of Leduc issued a Request for Information in 2022 to seek information on alternative technologies to process residual municipal solid waste. The call requested information from companies offering biological treatment, thermal treatment and/or refuse derived fuel technologies. • Durham-York, Ontario. The most common alternative disposal technology used to process municipal solid waste is mass burn incineration. In Ontario, the Durham-York Energy Centre can process 140,000 tonnes per year while generating electricity for 10,000 homes. • Pasco County, Florida. As well as determining feedstock requirements and available technologies, WTE systems require end markets or disposal for ash coming out of the process. In 2014, Pasco County and the University of Florida began to investigate the use of ash for road construction, which would offset the need for limestone and were awarded a permit by the state government for the use of bottom ash to be used as road aggregate.

Option 19: Explore Glass Recycling Marketability

Description	Conduct a current state review and jurisdictional scan of best practices for the marketability of glass recycling.
Supporting Rationale	<p>Glass has been identified as a 'problem' material, especially in the recycling drop off depots. The marketability of glass for several jurisdictions include:</p> <ul style="list-style-type: none"> • Alberta. Many jurisdictions in Alberta do not collect glass in their recycling program. The only glass processing company in Alberta is Vitreous Glass Inc., which turns post-consumer glass into glass cullets. When glass is collected and processed, it is typically re-used and not fully recycled. Cleaning, smashing and sorting the glass materials into pure silica is too expensive for most businesses. • Niagara Recycling, Ontario. Niagara Recycling is the only Materials Recovery Facility (MRF) in Ontario that produces an end product from a recyclable material (Niagara Ecoglass). • Ontario. NexCycle Industries, located near Guelph, Ontario, processes both post-consumer and post-industrial scrap glass from residential curbside collection, deposit return programs and from bottle, plate and automotive manufacturers. The primary challenges of marketing Ontario's glass are distance to end markets and meeting end market specifications.

Option 19: Explore Glass Recycling Marketability

- Quebec. In 2016, Éco Entreprises Québec (ÉEQ) launched and financed its Innovative Glass Works Plan, an initiative devised to modernize Québec sorting centres and support growth of markets to give glass a new life, with the goal of recycling 100% of glass collected from curbside bins. The project has shown that it is possible to recycle 100% of the glass collected via curbside recycling in Québec and the solutions are feasible.

Option 20: Continue Conducting Waste Composition Studies (Curbside and Landfill)

Description	Conduct waste composition studies in SF, MR and ICI sectors. This may be completed on a quarterly basis every two to four years to obtain seasonal data trends.
Supporting Rationale	<p>More waste composition studies in all sectors (SF, MR and ICI) could help establish a better understanding of the current trends and problem areas. Diversion targets and methods could be determined based off of findings pre-collection. Municipalities in Canada have been conducting waste composition studies for decades as they provide valuable insights into program operations, aid in directing P&E resources and assist in developing long-term waste management strategies. Examples of municipalities include:</p> <ul style="list-style-type: none"> • City of Calgary. Waste composition studies are periodically conducted to help assess the performance of diversion and education programs and inform improvements and new program design. In 2019, the City assessed the waste composition of black carts and garbage bins in the residential sector and for businesses and organizations. • City of Lethbridge. The City requires businesses to conduct waste composition studies and develop waste reduction plans. Waste composition studies in 2019 showed that 57% of materials currently landfilled through black carts could be diverted and recovered through an organic treatment system. • Strathcona County. Waste composition studies are used as a performance management tool to methodically analyze each waste stream. The data gathered from these studies is used in the development on long-term planning and ongoing reporting for regional waste management trends and goals.

4.4

Preferred Options Evaluation

As previously noted, the options evaluation used a triple bottom line approach to factor in various indicators measuring economic feasibility, environmental and social impact for each option. Table 10 outlines the final results of the evaluation for each of the 20 preferred options. The highest (most favourable) overall score that could be achieved was 30 and the lowest (least favourable) overall score that could be achieved was 10.

The most favourable options were:

- Option 1: Develop a food waste curbside collection pilot program (25);
- Option 4: Develop a C&D Policy (26);
- Option 5: Explore additional tipping rates for certain materials (e.g., cardboard, C&D materials) (25);
- Option 6: Explore options to optimize landfill airspace (26);
- Option 7: Explore ways to reduce wind impact at landfills and decrease closures (25); and

- Option 11: Develop a circular economy roadmap (25).

The least favourable options were:

- Option 10: Explore options to develop a green city fleet (19);
- Option 18: Explore waste to energy options (19); and
- Option 19: Explore glass recycling marketability (19).

It is recommended that the City prioritizes the top six options.

Table 10: Evaluation Summary

Option	Economic Feasibility				Social Impact				Environmental Impact					TOTAL
	Operating Costs	Capital Costs	Level of Risk	Subtotal:	Public Acceptance	Proven/Unproven	Level of Effort	Subtotal:	Climate Impacts	Land Requirement	Nuisance Impact	Diversion Impact	Subtotal:	
1: Develop a food waste curbside collection pilot program	3	3	2	8	3	3	2	8	2	2	2	3	9	25
2: Expand and improve education programs and outreach	3	3	3	9	2	3	2	7	1	3	2	1	7	23
3: Consider expanding multi-residential and commercial recycling collection	3	3	2	8	1	2	2	5	2	3	2	3	8	21
4: Develop a C&D Policy	3	3	3	9	3	3	2	8	1	3	2	3	9	26
5: Explore additional tipping rates for certain materials	3	3	2	8	2	3	3	8	1	3	2	3	9	25
6: Explore options to optimize landfill airspace	3	3	2	8	3	3	3	9	2	3	2	2	9	26
7: Explore ways to reduce wind impact at landfills and decrease closure	3	3	3	9	3	3	3	9	1	2	3	1	7	25
8: Explore upgrades available for anaerobic digestion	3	3	3	9	3	3	3	9	1	2	2	1	6	24
9: Develop bylaw amendments to increase enforcement capabilities	3	3	3	9	2	3	2	7	1	2	1	1	5	21
10: Explore options to develop a green city fleet	3	3	1	7	3	1	1	5	2	1	3	1	7	19
11: Develop a circular economy roadmap	3	3	3	9	3	3	2	8	2	2	2	2	8	25
12: Explore a single use plastic item ban	3	3	3	9	3	2	3	8	1	2	2	1	6	23
13: Identify impacts extended producer responsibility will have on current operations	3	3	3	9	2	3	3	8	1	2	2	1	6	23
14: Develop a strategy for promotion of non-profits that accept and sell reusable items	3	3	2	8	3	3	2	8	2	2	2	1	7	23
15: Create a joint effort with the wastewater treatment plant on how to manage biosolids	3	3	3	9	2	3	3	8	1	1	2	1	5	22
16: Improve participation in litter reduction education programs	3	3	3	9	3	3	2	8	1	2	2	1	6	23
17: Explore potential revenue streams for the City related to waste	3	3	3	9	3	3	1	7	1	2	2	1	6	22
18: Explore waste-to-energy options	3	3	3	9	2	1	1	4	1	2	2	1	6	19
19: Explore glass recycling marketability	3	3	3	9	1	1	2	4	1	2	2	1	6	19
20: Continue conducting waste composition studies (curbside and landfill)	3	3	2	8	2	3	3	8	1	2	2	1	6	22

*The rankings range from 1 to 3 where 1 indicates the least favourable outcome and 3 indicates the most favourable outcome; therefore, the higher an option scores the more favourable it is.

Additional Options for Consideration

As noted in Section 2.2.3 the Alberta provincial government approved a regulatory framework for establishing EPR in the province on October 3, 2022 which will come into force on November 30, 2022. Transition and implementation will be a continued effort between government, the oversight organization and stakeholders with ongoing consultation starting fall 2022.

This Regulation will have an impact on the City as Designated Materials become the responsibility of the producing industry rather than the City. Ongoing review and monitoring will be required to understand the impacts that this will have to the City. The City will also need to develop a comprehensive transition plan that enables a harmonious transition to this new EPR system. This includes understanding and identifying the following:

- What the future may look like for the City with this new regulation;
- How EPR-related changes affect the rest of the City's solid waste management system;
- What needs to be addressed based on what is/is not the City's obligations;
- Whether the City may continue to be a service provider for any services under the regulation; and
- Additional planning areas required as a result of the transition.

The long list of options developed by the City and Dillon identified some options that would not be included in the Strategy for evaluation; however, they may be considered for future implementation and/or as part of the next Waste Management Strategy. These options include the following:

- Develop a HSP drop-off depot;
- Develop an e-waste central collection location; and
- Explore interest from neighbouring municipalities to form a regional partnership with waste management facilities and/or contracts.

5.0

Implementation Plan

Figure 15 outline the proposed implementation timeline for the 20 preferred options. The light blue colour represents the planning period or exploration of the option, whereas the dark blue represents the execution of the option action (e.g., pilot program launches). It should be noted that not all options require in-depth planning periods as they may be already occurring within the City. Similarly, some options will not move past the exploration stage as the findings may not be suitable to the City. However, the timeline does assume that all options will move forward into an execution phase to show how options may overlap.

Figure 15: Preferred Options Implementation Timeline

Option	Short Term			Medium Term				Long Term		
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1: Develop a food waste curbside collection pilot program	Light Blue	Dark Blue								
2: Expand and improve education programs and outreach	Light Blue	Dark Blue								
3: Consider expanding multi-residential and commercial recycling collection		Light Blue	Dark Blue							
4: Develop a C&D Policy					Light Blue	Dark Blue				
5: Explore additional tipping rates for certain materials								Light Blue	Dark Blue	
6: Explore options to optimize landfill airspace	Light Blue	Dark Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue
7: Explore ways to reduce wind impact at landfills and decrease closure		Light Blue	Dark Blue							
8: Explore upgrades available for AD							Light Blue	Dark Blue		
9: Develop bylaw amendments to increase enforcement capabilities				Light Blue	Dark Blue					
10: Explore options to develop a green city fleet							Light Blue	Dark Blue		
11: Develop a circular economy roadmap									Light Blue	Dark Blue
12: Explore a single use plastic item ban				Light Blue	Dark Blue					
13: Identify impacts EPR will have on current operations					Light Blue	Dark Blue				
14: Develop a strategy for promotion of non-profits that accept and sell reusable items					Light Blue	Dark Blue				
15: Create a joint effort with the WWTP to manage biosolids								Light Blue	Dark Blue	
16: Improve participation in litter reduction education programs			Light Blue	Dark Blue						
17: Explore potential revenue streams for the City related to waste						Light Blue	Dark Blue			
18: Explore waste-to-energy options	Light Blue	Dark Blue								
19: Explore glass recycling marketability							Light Blue			
20: Continue conducting waste composition studies (curbside and landfill)	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue

Planning Period
 Implementation Period

Conclusions and Next Steps

The intent of the Strategy was to evaluate the current waste management services in the City and review the previous Waste Management Strategy to develop options to explore and implement in the future. The Strategy identified additions, enhancements and new programs which strengthen the City's waste management systems and services. These options, if implemented, could enhance the effectiveness, operational and cost saving efficiencies in meeting solid waste management service needs and diversion targets.

The updated Waste Management Strategy provides a 10-year roadmap for executing the preferred options. Recommendations are not all deliverables; briefing notes and business cases are anticipated to be created as these options are researched and deemed feasible.

Appendix A

Detailed Preferred Options Evaluation

Option 1	Develop a Curbside Food Waste Collection Pilot Program
Description	<p>There is potential for the City to increase its diversion rate by implementing a curbside food waste collection program. Careful planning would need to occur and include the identification of food waste end markets to determine processing options, potential partnerships and collection options. The City could perform a cost-benefit analysis to assess if a curbside food waste collection program is feasible. Based on the results of the cost-benefit analysis, the City could start planning for the pilot program, including details such as collection frequency, number of households, acceptance criteria and promotion materials. Collection frequency of the pilot program depends on the material type, quantity, processing, end of life management and budget. The City may decide to charge a fee for separate collection of food waste, or the cost may be built into the overall solid waste management fees charged to residents. A promotion and education (P&E) campaign could be developed and would help inform the public about the pilot program and build awareness of food waste and its impacts. P&E activities could include:</p> <ul style="list-style-type: none"> ● Virtual or in-person cooking classes or events; ● Rapid messaging about food waste; ● Educational material regarding meal planning, tailoring grocery shopping to avoid impulse purchasing, proper transport and storage of perishable foods; ● Partnerships with food waste initiatives such as "Love Food, Hate Waste"; ● Collaboration with local restaurants; ● Backyard composting education; or ● A "Grow Your Own Food" initiative or workshops to educate residents on best practices for growing their own gardens. This could include outlining which fruits, vegetables, herbs, etc. grow best in their environment and seasonal concerns to be made aware. <p>This option will not include:</p> <ul style="list-style-type: none"> ● Building a processing facility for the pilot program; and ● The entire population of Medicine Hat.
Assumptions	<ul style="list-style-type: none"> ● Provincial and federal changes will occur that will impact the management of food waste; ● For the pilot, the City will compost the collected materials and if it results in compost quality A they will sell it to residents and local businesses, if it results in compost quality B then it will be added to the existing pile of quality B compost; ● The City will use the Compost Site for the pilot program and will assess the feasibility of building a processing facility based on the expected amount of food waste; and ● Food waste material will be beneficially used. ● The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (1 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> ● Alberta-based examples; and ● Jurisdictions that have conducted a curbside food waste collection pilot program, whether they moved forward with a full collection program and if so, the results.
Proposed Timing	<p>Cost-Benefit Analysis: Planning 2025 and implementation 2026 - 2027 Pilot Food Waste Program: Planning 2025 and implementation 2026 – 2027</p>

Option 1	Develop a Curbside Food Waste Collection Pilot Program
Supporting Rationale (City)	<p>The previous Waste Management Strategy included exploring a food waste collection and composting program as an option which explored the viability, diversion potential and financial feasibility. It was deferred until after 2017 due to financially fit budget cuts. At the time, more funding, monitoring of technology improvements and operational costs was needed.</p> <p>Implementing a food waste collection program could increase the City's diversion rate.</p>
Supporting Rationale (Research)	<p><u>Pilot:</u> There are many food waste processing types and technologies utilized throughout Canada, some of which include the following: in-vessel aerated static pile processing, open windrow organics processing and AD. End-use for compost may also be used for commercial or residential applications, depending on the quality.</p> <p>When exploring collection approaches, curbside food waste collection program bins generally use compostable or plastic liners; however, other alternatives include paper bags or newspaper. Collection of food waste may occur through curbside collection on a weekly basis or through public drop-off depots. It is suggested to also have backyard composters available for purchase by residents. Methods of collecting and transporting food waste to the processing facilities can vary depending on collection vehicle compartment capacities, frequency of collection and distance from transfer stations. Collection trucks may be capable of co-collecting recycling and organics that include food waste and transporting them to a waste site. For this approach, transportation would be needed to move the food waste to a processing facility.</p> <p>Curbside food waste collection pilot programs rely heavily on data retrieved from monitoring to evaluate success. Monitoring activities may include annual diversion and collected tonnage, comparisons of annual tonnage quantities, audits and participation rates. Participation rates can be evaluated using a collection contractor to conduct a participation study or assessing information retrieved from curbside audits.</p> <p><u>Food Waste P&E Campaign:</u> Based on a best practices review, program promotion should generally occur 6 to 12 months before the program's launch and implementation. Full campaign multimedia launches often use partnerships with organizations such as third party marketing and communications companies, local suppliers and/or corporate sponsors. Media events such as print and broadcasting, advertisements, newsletters, billboards and any commonly-viewed waste management magazines can help promote the program within the community. Public events should also be used as much as possible and as long as the proper health and safety measures are taken. These events help inform residents about proposed new practices and address any questions or concerns they may have, showcase new food waste collection program mascots where applicable and include free giveaways to achieve the highest participation. Waste apps are also good tools for P&E during the campaign and throughout the program to help residents with their waste questions long term.</p> <p>Calgary, AB: The City of Calgary implemented a curbside food and yard waste collection pilot project in 2012 in four communities where 7,500 homes were given an organics cart, a kitchen pail for food scraps, compostable bags to line the kitchen pails and paper yard waste bags. The pilot lasted one year and resulted in approximately 1.9 million kilograms of food and yard waste being collected, reducing materials in the black cart by 40%, therefore allowing the garbage collection program to scale back to bi-weekly collection. The curbside food and yard waste collection program collects food and yard waste every week and takes it to a transfer station outside of the City of Calgary, to then be trucked to a composting facility in Strathmore.</p>

Option 1	Develop a Curbside Food Waste Collection Pilot Program
	<p>Residents currently pay \$6.50 per month for the food and yard waste cart pickup. A survey that launched in 2018 showed that 95% of Calgarians are supportive to participate in the food and yard waste program and 86% are satisfied with the program. The City of Calgary's website includes ample information on simple food waste reduction practices including shopping and meal planning, expiration date information, storage techniques and making the most of leftovers. The City of Calgary also uses a waste app which informs residents of collection days with reminders and other useful information such as proper sorting techniques of materials. The "Calgary Food Action Plan" builds on existing community-led efforts to create sustainable food systems and educates residents about food waste prevention.</p> <p>Red Deer, AB: In 2015, the City of Red Deer implemented its 2 year green cart pilot program with the aim to reduce the amount of pet waste, kitchen scraps, yard waste and soiled paper entering the landfill by 40%. Approximately 2,000 households were given carts to use; households were selected based on factors such as age, lot size, front and back street pickups and landscaping. The successful program resulted in a 39% reduction of organic material in the garbage, which resulted in the roll out of a full curbside green cart curbside collection program in 2018, which cost an estimated \$7.1 million. The City of Red Deer uses a waste sorting tool on its website to bolster resident awareness of where materials should go.</p> <p>Airdrie, AB: The City of Airdrie conducted a curbside food and yard waste collection pilot program, which ran from May to September of 2013. The pilot involved 400 single family households, each receiving one organics cart. Kitchen pails were used with compostable liners that would then be transferred into their 240L organics cart, which would be picked up on a weekly basis. A cost-benefit analysis was conducted which identified a reduction in garbage disposal costs of \$50 per tonne.</p>
KPIs	<ul style="list-style-type: none"> ● Reach of P&E initiatives (e.g., participation/number of events); ● Food waste diversion (e.g., tonnages of food waste in garbage); ● Public support/acceptance; and ● Success of pilot.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - The operational costs will be under \$1,000,000. Pilot program operational costs are estimated to be approximately \$70,000 which includes weekly food waste collection for 500 households (100 households per collection day) using a fully automated truck.
	Capital Costs	3 - The capital costs will be under \$1,000,000. A food waste collection pilot program is estimated to have \$37,000 capital costs which includes wheeled carts and repair/replacement costs. If the City were to decide to move forward with a full curbside food waste collection program with a City-owned processing facility, capital expenses are estimated to be approximately \$8,000,000.
	Level of Risk	2 - The collection and processing of food waste typically has a moderate level of risk associated with it. Environmental issues related to processing of food waste such as odours can be mitigated through proper design, management and maintenance of the processes and facilities.
Social Impact	Public Acceptance	3 - The option of exploring the feasibility of a curbside food and waste collection system is expected to be accepted by the public. Similar programs piloted and implemented in jurisdictions throughout Alberta as well as Canada have seen widespread support from the public.
	Proven or Unproven	3 - Food waste curbside collection has been proven in similar Alberta jurisdictions to Medicine Hat and throughout Canada.
	Level of Effort	2 - A moderate level of effort would be expected to implement a curbside food waste collection program. The City of Medicine Hat will need to determine details of the program, including: method(s) of collection, number of additional collection vehicles required. Timelines for ordering carts, securing new vehicles, building a processing facility and ensuring end markets are available will also need to be taken into consideration. Successful planning, implementation, execution, and monitoring of this pilot program will require an additional solid waste staff.
Environmental Impacts	Climate Change Impacts	2 - There will be an increase in GHG emissions due to the addition of a food waste stream requiring collection. Methane emissions will decrease at landfills in correlation with the quantity of food waste that is diverted through the curbside food waste collection program.
	Land Requirements	2 - This option assumes the use of an existing processing facility for food waste will be used and does not need any additional land. If the City decides to move forward with a full curbside food waste program, more land may be required.
	Nuisance Impacts	2 - There will be minimal impacts to nuisances. The presence of pests (dogs, raccoons, coyotes, bears) is not expected to increase or decrease with the implementation of a curbside food waste collection program.
	Diversion Potential	3 - Implementing a curbside food waste collection program will be expected to decrease the amount of material entering the landfill. Studies from similar jurisdictions showed up to a 50% decrease of food and yard waste in garbage bins.

Option 2	Expand and Improve Education Programs and Outreach
Description	<p>This option could involve the development of an ongoing promotion strategy for engagement and determination of promotion objectives. There are various approaches that may be taken, some of which include following:</p> <ul style="list-style-type: none"> • Increasing social media presence, which could involve developing social media kits that provide consistent information and messaging to various sectors (e.g., community organizations, businesses, schools, etc.) and potentially in different languages, if necessary; • The City could also consider using paid social media advertising that can reach social media users in specific geographic locations without the need for personal information and reach a broader demographic; and • Establishing a dedicated webpage that promotes waste reduction by providing tools and resources for specific waste reduction categories including food waste, buy smart, supporting reuse initiatives in the city, etc. Website tools could include a calendar that posts all fix-it, swap, City and organizations' events relating to waste reduction and diversion; maps showing businesses that support reduction and reuse; social media posts; etc. Promotion could be conducted via social media and through businesses, community organizations, schools, etc. A first step would be to conduct a study which conducts focus groups to better understand resident and customers' needs and design the promotional program accordingly.
Assumptions	<ul style="list-style-type: none"> • Accessibility for online users will be included in the strategy; • A waste management budget earmarked for P&E related activities will be assigned; and • The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (1 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> • Alberta based examples; • Provide educational resources; • Easily accessible; • Cost effective; • Higher recycling participation rate; and • Increase in waste diversion.
Proposed Timing	Planning 2023 and implementation 2024.
Supporting Rationale (City)	Expanding and improving the City's P&E of current waste management programs can help increase participation and compliance of the City's waste management programs and/or services. There is an aging community in the City whom may have a tendency to resist change. This is one demographic the P&E efforts can target to reach.
Supporting Rationale (Research)	Lethbridge, AB: The City of Lethbridge offers online resources for its residents as a part of their waste reduction promotion plan. Resources are provided on topics such as reducing single-use items, reducing food waste, rethinking shopping, reuse and repair resources, recycling, composting and grass cycling, and holiday and celebration waste reduction. The types of resources include tips, facts and downloadable activity books. The City of Lethbridge has a series of online videos that can be found on the Education and Events section of their website or their YouTube channel. The videos include various topics such as how to sort recycling properly and what the material recovery facility (MRF) does.

Option 2	Expand and Improve Education Programs and Outreach
	<p>Calgary, AB: The City of Calgary created an online game which teaches youth and adults how to sort waste materials into their black, green or blue carts, and what to do with household hazardous waste drop-off and landfill items. This game is available on the City of Calgary's website and can be accessed through any internet browser. It is available in several languages including English, French, Spanish, Korean, Punjabi and Chinese. The City of Calgary has created a Food Waste Reduction Lesson Plan for educators. The lesson plan aims to decrease the amount of food waste in students' homes and includes conversation starters and informative tips.</p> <p>Region of Peel, ON: The Region of Peel undertook a campaign to reduce contamination in their recycling stream in 2017. The purpose of the campaign was to test a digital marketing approach, focusing on one contamination issue at a time, over two phases of the campaign. The first campaign "Let them Loose!" aimed to educate residents about the impacts of placing recyclables inside plastic shopping bags and tying them shut before placing them into their recycling cart. Tactics used included an online video, website, social media (Google, Twitter and Facebook) and emails. The video showed what happens to recyclables placed in small shopping bags at the Materials Recovery Facility (MRF) and how ultimately, the bags then end up in landfills. The video had 1.9 million views. This campaign resulted in a 50% reduction of bagged recyclables entering the MRF; as a result, the MRF experienced savings in residue disposal costs and revenue from the sale of the additional recycled materials. This financial impact was estimated at \$55,000 in avoided residue disposal costs and \$57,000 in added sales revenue.</p> <p>Edmonton, AB: The City of Edmonton's Community Relations Social Marketing Group and their GIS/Mapping group have partnered on a project called "One Household at a Time". Launched in 2014, City staff use GIS-equipped computer tablets to record home addresses where residents set out five or more bags of garbage on collection day. Within a few hours of collection pickup, trained canvassers visit those targeted households providing immediate feedback on the issue. During the visit, canvassers work with residents to develop a waste reduction approach that helps the residents to reduce their waste and participate more in the City of Edmonton's waste diversion services. The use of the GIS mapping software on tablets in the field provides a seamless transition between collection identification in the morning and direct feedback canvassing that evening. The program runs twice a year and uses a commitment strategy which aims in supporting residents to commit to adapt their disposal behaviour. "We know people are more likely to adopt a new behaviour if they've made a commitment and our staff are able to get commitments from 80% of residents in a brief five-minute conversation!" Since 2014, canvassers have spoken with 4,000 residents and visited 7,000 homes. Follow-up has shown that 69% reduced their garbage set out after the feedback visits.</p>
KPIs	<ul style="list-style-type: none"> ● Website hits, views or comments; ● Positive and supportive public feedback; ● Increase in recycling participation rate; ● Increase in diversion from landfill rate; ● Decrease in recycling contamination rate; ● Decrease in disposal costs; and ● Increase in recycling sales revenues.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - Capital costs are estimated to be less than \$5,000,000.
	Level of Risk	3 - The implementation of expanded and improved education programs and outreach has a low level of risk associated with it. The City will have full control of the P&E programming and content.
Social Impact	Public Acceptance	2 - There may be neutral or mixed feedback from the public in regards to the P&E content produced in this option. Some aging residents may not want to change their current waste behaviour. Some residents could be very accepting of more education and clarity about current waste management services, such as proper or updated recycling practices. The public may be accepting of more digital modern information, more frequent updates or reminders, and accessibility features (e.g., large font, visual pictures and videos).
	Proven or Unproven	3 - Proven in smaller municipal governments and also in Western Canada jurisdictions. The City of Lethbridge, which has similar demographics as Medicine Hat has extensive P&E efforts for residents online and in-person. The City of Calgary and Peel Region experience can be scaled down to meet Medicine Hat's demographics.
	Level of Effort	2 - A moderate level of effort will be required for improved and expanded education and promotion plans to be implemented. The implementation of selected activities will require an additional staff member to be hired. Other specific tasks such as the setup of new online sites and/or public engagement can be carried out by staff or contracted out at the discretion of Medicine Hat City resources and budgeting.
Environmental Impacts	Climate Change Impacts	1 - The expansion and improvement of educational programs and outreach results in little to no direct reduction in GHG emissions. However, if it impacts a reduction in recycling contamination and increases recycling activity, this will result in some indirect reduction in GHG emissions.
	Land Requirements	3 - This option will not need any additional land.
	Nuisance Impacts	2 - There would be no nuisance impacts anticipated as a result of this option.
	Diversion Potential	1 - The potential diversion from landfill disposal as a direct result of P&E is difficult to measure; however, improvement of diversion is anticipated.

Option 3	Consider Expanding Multi-Residential (MR) and Commercial Recycling Collection
Description	This option explores the feasibility of and level of effort necessary to expand recycling collection MR and commercial. The City may consider an opt-in option for commercial units to gauge level of interest and participation. As a part of this option, a negotiation with the current service provider (GFL) would need to occur to expand the existing programs.
Assumptions	<ul style="list-style-type: none"> • The negotiation with GFL for expanded services will be successful; • Assumes offering all MR and commercial spaces with the same recycling services as curbside (i.e., collecting same materials); and • The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.5 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> • Alberta-based examples.
Proposed Timing	Planning 2023 and implementation 2025.
Supporting Rationale (City)	As mentioned in the previous Waste Management Strategy, commercial waste management continues to be a challenge, specifically in the downtown core. To date, there has been no movement towards replacing the current commercial waste bin system with an automated cart collection system.
Supporting Rationale (Research)	<p>Many municipalities in Alberta have a commercial program whether it is for MR or commercial. The City of Lethbridge has a Business Waste Diversion Strategy which helps to reduce commercial and industrial waste. It states that 60% of the waste going into the landfill is generated by the commercial industry. In Alberta, 66% of non-hazardous waste is generated by the commercial sectors including ICI. In many jurisdictions, MR buildings fall under commercial waste. Municipalities can decide to collect MR waste as a separate entity or include with current commercial garbage collections.</p> <p>Calgary, AB: The City of Calgary added a MR recycling requirement under Bylaw 20M2001. The Bylaw states that all MR complexes (including condos, apartments, townhouses or any building with five or more units) must provide recycling for residents. It is up to the complex owner to find collection services through a private hauler or use the City of Calgary's collection services. Collection services provided by the City of Calgary are collected through the commercial program. These services include flexible service agreements, customer service and cost effective options. The City of Calgary also offers bins, carts and dumpsters for temporary or permanent disposal needs. A service request form is available on the City of Calgary's website.</p> <p>Edmonton, AB: The City of Edmonton is in the process of developing a MR mandatory waste sorting program with the aim to implement by 2023 per the 25-year Waste Strategy. This means MR properties (including apartment and condo buildings, four-story walk-ups, high rise apartments, townhomes and detached or semi-detached condominiums) will be required to provide containers for recyclables that are accessible to residents, or co-located in the same vicinity. The communal collection program will be run by the City of Edmonton using one collection contractor so that data reporting is consistent and routes are fuel efficient. As of October 1, 2019, The City of Edmonton has started to wind down its commercial collection services. The City of Edmonton is no longer accepting new commercial collection clients and current clients are asked to transition to new service providers.</p>

Option 3	Consider Expanding Multi-Residential (MR) and Commercial Recycling Collection
	<p>Red Deer, AB: The City of Red Deer offers recycling and garbage services to residents living in MR properties (including apartments, townhouses, condominiums and four-plexes). The City of Red Deer provides these properties with shared recycling bins or carts. In 2021, the City of Red Deer delivered reusable recycling bags and recycling information to residents as an engagement effort to help residents to better use their MR recycling program. The reusable recycling bags are for residents to carry recyclables to the appropriate recycling areas. The City of Red Deer only provides commercial garbage collection. They also have two, three, four and eight cubic yard bins to choose from. The contact process is much simpler than ones from private services and clients can cancel at any time. The City of Red Deer currently does not have a commercial recycling collection program.</p>
KPIs	<ul style="list-style-type: none"> ● Waste diversion; ● Public awareness; ● Recycling participation rate; and ● Accessibility to recycling programs.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - Capital costs are estimated to be less than \$5,000,000. Additional bins will need to be purchased. On average, 1.5 cubic yard bins cost \$3,000 per unit.
	Level of Risk	2 - Implementing MR and commercial recycling collection services will add risks to the collection program. The City may have to negotiate a separate contract with current collection contractor (GFL).
Social Impact	Public Acceptance	1 - If there are additional costs to the program, there is a potential for opposition to the option. Changes to the program may also affect public perception. There also may be opposition from competitors (i.e., private sector).
	Proven or Unproven	2 - There are similar jurisdictions that have implemented a similar options. Other options provided by larger jurisdictions can be scaled down to meet Medicine Hat needs.
	Level of Effort	2 - A moderate level of effort will be required to implement MR and commercial recycling. Additional staff and resources are needed to implement this option. This option can be implemented in 3 to 5 years.
Environmental Impacts	Climate Change Impacts	2 - Implementation of MR and commercial recycling will result in a moderate reduction in GHG emissions based on diversion of recyclable materials.
	Land Requirements	3 - Optimize existing asset (contract with MRF) and negotiate for the additional materials to be included within the contract.
	Nuisance Impacts	2 - Minimal to no change to nuisances will be expected, with the exception of a possible increase in traffic from additional collections.
	Diversion Potential	3 - There is a potential for >5% waste diversion/reduction.

Option 4	Develop a Construction and Demolition Policy
Description	<p>This option explores the City developing of a Construction and Demolition (C&D) Policy which could include developing minimum service level requirements for generators of C&D waste (e.g., Demolition Waste Management Plans). The plans may require a breakdown of tonnage of C&D waste materials from local demolition and/or deconstruction activities. Key initiatives could include a combination of the following:</p> <ul style="list-style-type: none"> ● Land use zoning requirements; ● Deconstruction and recycling bylaws; ● Encouraging design-for-disassembly practices; ● Providing business incentives and support to improve the markets for recycled products (e.g., through procurement policies); and ● Developing disposal bans of some C&D materials.
Assumptions	<ul style="list-style-type: none"> ● There is no province wide landfill ban on C&D waste, as of 2022; ● Private sector will have interest and willingness to participate in local developed programs for C&D; ● There will be available and potential markets for C&D material recycling; and ● The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.25 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> ● Alberta based examples.
Proposed Timing	Planning 2024 and implementation 2026 (timing is aligned with Option 5 “Explore Additional Tipping Rates for Certain Materials”).
Supporting Rationale (City)	The previous Waste Management Strategy identified a need to improve the diversion and management of C&D waste. As a result, wood and asbestos type materials have differential tipping rates at the landfill. A C&D Policy can help further improve the management of C&D waste materials.
Supporting Rationale (Research)	<p>There are cities across Canada that have enacted bylaws to reduce the amount of C&D materials sent for disposal. It should be recognized that established recycling facilities and end markets for the recycled materials may need to be in place before any C&D policy, such as landfill bans, could be successfully implemented.</p> <p>In Alberta, sources of non-hazardous solid waste generated include 27% C&D, 49% ICI and 24% residential (Stats Can, 2016). The breakout of C&D waste has a composition of 33% wood, 13% drywall, 10% roofing, 10% concrete, 6% metal and 28% other materials. Creating a municipal policy to help with C&D waste can help diversion and preserve landfill space.</p> <p>Lethbridge, AB: In 2015, the City of Lethbridge created an Industrial, Commercial and Institutional Implementation Strategy to promote and provide opportunities for waste diversion. The strategy took into consideration the roles of the City of Lethbridge, including the generator, the hauler and the processor, all working collectively. The strategy focuses on certain materials that can be separated and recycled including wood, drywall, metal, asphalt shingles and aggregates. As of March 1, 2020, Lethbridge businesses who unload waste at the Lethbridge Waste and Recycling Centre (LWRC) are charged \$50 per tonne on the entire load if the load contains a combination of more than 25% commercially recyclable materials. A mandatory recycling and source separation program for the ICI sector requires businesses to not wood, cardboard and paper materials.</p>

Option 4

Develop a Construction and Demolition Policy

To support the disposal operations at the LWRC, business can self-report on material loads being dropped off. This allows the business to show their compliance without requiring inspections by City staff. Businesses can register on the City of Lethbridge's website for self-reporting. Registration allows the City of Lethbridge to directly update businesses on future changes to the program.

Cochrane, AB: The Town of Cochrane Strategic Plan identifies the need to investigate, monitor and implement standards for construction waste management. The Town requires all municipal construction, demolition and renovation projects to include a provision to recycle as much materials as possible and to separate materials for reuse, recycling, or alternative use. A Green Building Strategy for ICI Uses (2013) requires a construction waste management plan. The plan includes a minimum of 75% waste diversion during construction and 80% diversion during occupancy.

Calgary, AB: The campaign "Reconstruct Calgary" was developed in 2007 and had the target to divert 80% of C&D waste, generated in construction projects and practices, from landfills. In 2014, this target was rolled back to a more achievable 40% diversion target to be achieved by 2025. Currently, the City of Calgary recycles 20 to 30% of C&D waste they manage; however, recycling by the private sector is voluntary.

Port Moody, BC: The City of Port Moody passed a bylaw to reduce the amount of C&D materials sent to landfills in 2011. The bylaw required a waste management plan be part of both the building permit application and the demolition permit application. The cost for a Demolition Permit is based on the square footage of the building being demolished. To receive the maximum refundable deposit amount, at least 70% of recyclable or reusable C&D waste must be recycled or reused. A compliance report with receipts from recycling facilities and landfills must be submitted to and approved by the City of Port Moody.

Metro Vancouver, BC: Metro Vancouver disposal facility loads are inspected for banned materials that should not be in the garbage waste stream, such as clean wood, gypsum and recyclable metals. Surcharges are applied if these materials are found in the garbage at Metro Vancouver disposal facilities. A \$65 minimum surcharge, plus the potential cost of removal, clean-up or remediation is applied to loads containing banned hazardous and operational impact materials or product stewardship materials.

Vancouver, BC: Vancouver's Green Demolition Bylaw aims to preserve and renew character homes, encourage reuse of C&D materials and reduce the amount of landfilled and incinerated C&D waste. The Bylaw establishes different reuse and recycling requirements depending on the type and age of the building being demolished. Mandatory minimum reuse and recycling rates are applied to character homes and houses built prior to 1950; however, contractors are encouraged to voluntarily meet the minimum rates for all houses being demolished. As part of the Bylaw, contractors must apply for a demolition permit. The permit has four components: a demolition permit fee, a building permit fee, cost-of-work fee. And a demolition waste compliance fee. In addition, a \$14,650 deposit is required for applicable buildings types and is refunded if the minimum rates are met. Since its adoption in June 2014, the Green Demolition Bylaw has diverted nearly 40,000 tonnes (roughly 10,000 tonnes per year) of demolition waste from the landfill and incinerator. The average diversion rate for pre-1940 homes has been 86% which is significantly higher than the typical rate of 40% to 50% for traditional residential demolitions.

Option 4	Develop a Construction and Demolition Policy	
KPIs	<ul style="list-style-type: none"> • Waste diversion rate of C&D materials; • Waste diverted tonnes of C&D materials; and • Building/demolition permit deposits and refunds. 	
Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	3 - Developing a C&D policy is not anticipated have many economic risks or liability concerns associated with it. It can have a positive impact on the environment and landfill space due to potential for increased diversion of C&D material from the landfill.
Social Impact	Public Acceptance	3 - It is anticipated that the public will be in support of a C&D policy as it increases sustainability and diversion. Initially, as the new policy is implemented and transitions, the private sector may oppose the changes; however, the policy would be applicable to all C&D businesses in the City.
	Proven or Unproven	3 - C&D policies have been developed and implemented in municipalities in Alberta with success and positive impact.
	Level of Effort	2 - A moderate level of effort will be required to implement the proposed C&D policy. The effort is due to developing a new bylaw and initiatives, public and business buy-in, as well as supporting and developing an understanding of the current C&D recycling local markets and potential. This option can be implemented in three to five years.
Environmental Impacts	Climate Change Impacts	1 - This option is unlikely to make any significant direct impact to GHG emission as it is a policy development option. Indirectly, reduced C&D waste can impact GHG positively.
	Land Requirements	3 - A C&D policy will preserve landfill space.
	Nuisance Impacts	2 - A C&D policy will not impact nuisances.
	Diversion Potential	3 - Developing a C&D policy can significantly impact increased recycling, reuse and secondary market development for C&D materials locally. C&D waste can be up to 30% of landfill waste disposed.

Option 5	Explore Additional Tipping Rates for Certain Materials (e.g., cardboard, C&D materials)
Description	<p>This option involves the City exploring a tipping fee strategy for the landfill that would create incentives to reduce waste disposal of difficult to manage materials. Evidence from other jurisdictions illustrates a strong link between higher disposal fees and reductions in landfilled waste. This option could include:</p> <ul style="list-style-type: none"> ● 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 landfill daily cover); ● Remove tipping fees for certain materials to encourage source separation (i.e., in addition to the materials for which there is currently no tipping fee (e.g., scrap metals and electronic wastes); ● Review the policy to tipping fees charged to registered charities and non-profit organizations; and ● Develop a consistent policy that would apply to the disposal of materials those non-profit and charitable organizations are not able to sell.
Assumptions	<ul style="list-style-type: none"> ● Neighbouring landfills will maintain their current tipping fee structure; ● The City would advertise the changes to tipping fees on their website; ● The extent to which the strategy could impact diversion and extend the life of the 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 landfill; and ● The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.25 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> ● Alberta based examples.
Proposed Timing	Planning 2023 and implementation 2025 (timing is aligned with or follows Option 4 “Develop a C&D Policy”).
Supporting Rationale (City)	<p>A key consideration in the setting of landfill tipping fees is the fees of neighbouring landfills. Neighbouring landfills’ tipping fees have traditionally been lower than the City landfill’s tipping fees. While there is a financial advantage to commercial waste haulers going to another landfill location for a lower tipping fee, this is beneficial to the City in the preservation of its landfill airspace. However, tipping fees need to be considered in order to balance the need to generate revenue at the City landfill.</p>

Option 5	Explore Additional Tipping Rates for Certain Materials (e.g., cardboard, C&D materials)
Supporting Rationale (Research)	<p>Tipping fees are charged to users for the cost of waste disposal services and are based on the type, volume, or weight of material. The City has the ability to set its fees and update them on an annual basis. The City's current approach to setting tipping fees is based on a cost recovery basis and also considers local market factors such as the tipping fees charged by other local area landfills.</p> <p>Calgary, AB: The City of Calgary uses landfill tipping fees and surcharges to support its waste management programs and policies, which will help achieve its waste diversion goal of 70% by 2025. Following the implementation of a curbside Green Cart program in 2017 and a Food and Yard Waste Bylaw requiring multi-residential complexes and businesses to divert food and yard waste, the City initially increased disposal rates for ICI loads containing food and yard waste at disposal facilities, before implementing an organics disposal ban at City landfills. Since the disposal ban took effect (October 1, 2018), loads of ICI garbage containing more than 20% 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. This currently includes food and yard waste, paper and cardboard, concrete, brick and masonry block, road asphalt, scrap metal, recyclable wood and drywall. The City's waste bylaw includes definitions for recyclable, food and yard waste materials. 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.</p> <p>Metro Vancouver, BC: In Metro Vancouver, to support a recyclable materials ban, loads containing more than 5% of recyclable materials, other than food waste and clean wood, have a 50% tipping fee surcharge. In 2015, food waste and clean wood disposal was banned which was supported by a 50% tipping fee increase for loads containing more than 25% food waste and/or 5% wood waste. Lastly, polystyrene packaging was banned in 2018 and had a 100% tipping fee increase for loads containing more than 20% of expanded polystyrene packaging.</p> <p>Orillia, ON: The City of Orillia implemented differential landfill tipping fees to promote recycling in February of 2022. The minimum fee charged at their Waste Diversion Site (landfill) increased from \$15 to \$20 and the following materials increasing tipping rates by \$5 to \$20: regular garbage, C&D wood, mixed waste, difficult waste (e.g., insulation and asbestos), shingles and refrigeration units.</p>
KPIs	<ul style="list-style-type: none"> ● Percent change in tonnes disposed (e.g., fee changes); ● Tipping fee revenue at the landfill; ● Material specific tipping fees; and ● Waste diversion rate.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	2 - There is moderate risk associated with tipping fee changes. The right balance of tipping fees and policy will need to be met to mitigate loss of revenue while still preserving City landfill space.
Social Impact	Public Acceptance	2 - There may be mixed feedback from the public in regards to this option as the disposal fees will increase.
	Proven or Unproven	3 - Tipping fee strategies are proven in similar jurisdictions including Western Canadian cities.
	Level of Effort	3 - A minimal level of effort will be required for this option. Staff time will be needed to develop new approach to landfill tipping fees and understand local market rates.
Environmental Impacts	Climate Change Impacts	1 - The system remains essentially unchanged by the exploration/introduction of additional tipping fees for certain materials 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 if organics are targeted.
	Land Requirements	3 - This option may help extend the landfill's remaining capacity and optimize management of the landfill asset due to increased diversion due to tipping fee incentives.
	Nuisance Impacts	2 - Additional tipping fees will not impact nuisances.
	Diversion Potential	3 - Additional tipping fees and incentives for divertible materials may induce increased diversion of certain materials from the landfill, especially C&D waste. There is the potential for >5% waste diversion/reduction.

Option 6	Explore Options to Optimize Landfill Airspace
Description	<p>This option involves the consideration of a strategy and alternative approaches to optimizing landfill operations over and above what is currently done to increase the remaining capacity and extend the life of the landfill. Optimization approaches could include the following:</p> <ul style="list-style-type: none"> ● Continue upgrading the GPS system on the landfill equipment (e.g., compactor and/or dozer) with new technology to optimize compaction rates and closely monitor the side slopes to meet or exceed the Province's approved final contours. As new GPS technologies emerge over time (i.e., accuracy improvements) the landfill operation could be improved by using modern equipment and up-to-date technologies; ● Continue to assess options which minimize the amount of bulky waste (e.g., mattresses, appliances) being landfilled to increase waste compaction and maximize air space usage; ● Continue implementing shredding/baling operations for bulky waste to reduce waste volume prior to final disposal. It should be noted that not all bulky waste should be shredded and bulky waste management should be spread out in various active cells; ● Continue following fill Sequence Plan and Capital Cost Analysis to optimize landfill space and surplus soil disposal. The Fill Sequence Plan could include exploring temporary closures of cells to allow for settling of waste and optimizing air space. The Capital Cost Analysis will estimate the costs for the identified course of action (e.g., cell development). Based on the 2020 Annual Landfill Report there is approximately 28 years of remaining airspace; if the City decides to pursue developing a new cell, it is recommended to build a 5 year cell based on the remaining air space and fill rate. ● Continue to regularly review 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 soil loading opportunities to increase settlement and methods to optimize airspace potential and slope optimization; ● Continue to explore and enhance current operations contracts to confirm they are structured to incentivize optimization of landfill space; ● Continue Annual Surveys to track density and consider increasing surveys to a quarterly or semi-quarterly frequency; and ● Continue to explore disposal bans for waste including ICI, C&D, multi-residential, farm waste and residuals.
Assumptions	<ul style="list-style-type: none"> ● 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.
Area(s) of Focus	<ul style="list-style-type: none"> ● Alberta based examples, if possible.
Proposed Timing	Planning 2028 and implementation 2030.
Supporting Rationale (City)	Identified as a City priority. There have been expansion studies which showed there is vertical expansion potential; however, there is more support for optimizing the existing site until expansion is necessary. Currently utilizing a fill sequencing plan along with GPS technology.
Supporting Rationale (Research)	Red Deer, AB: In the 2013 Waste Management Master Plan a number of recommendations were made to optimize landfill space including:

Option 6	Explore Options to Optimize Landfill Airspace
	<ul style="list-style-type: none"> ● Seasonal use of alternative daily cover could be used on a daily basis six days a week with soil used for daily cover on the seventh day; ● Annual topographical plans generated from aerial survey data which would allow staff to closely monitor and verify fill progress and airspace consumption; ● Reduce the size of cells and working areas; ● Maximize lift thickness; ● Maximize interim and final slopes; and ● Stage filling to achieve final contours as soon as possible. <p>Okotoks, AB: The Town of Okotoks utilizes the Foothills Regional Landfill and Resource Recovery Centre (LRRC) which consists of a landfill operation, throw and go recycling area and a salvage and recycling non-profit organization called The Foothills Salvage and Recycling Society. Annually, the site diverts over 20,000 tonnes of material due to these additional services and programs.</p> <p>Halton Region, ON: The Region is recently developed 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:</p> <ul style="list-style-type: none"> ● 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. <p>Fredericton, NB: 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.</p>
KPIs	<ul style="list-style-type: none"> ● Compaction rates; and ● Landfill airspace.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 – Capital costs are estimated to be \$1.3 million. A fill Sequence Plan and Cost Estimate will cost approximately \$20,000 and a Soil Management Plan would be \$15,000. If the City moves forward to develop a Fill Sequence Plan, cost estimates will be more conclusive. The City has indicated an estimate of \$10 million for the cell expansion, however costs will be minimal is the expansion occurs vertically.
	Level of Risk	2 - There is some risk involved with proposed optimization approaches; however, all selected approaches will need to have strict requirements so that no environmental impacts are seen. Approaches which have potential negative impacts on the environment will require studies and approvals.
Social Impact	Public Acceptance	3 - The public is anticipated to support measures to optimize the City's largest solid waste management asset. 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.
	Proven or Unproven	3 - The Region of Halton and the City of Fredericton are exploring options to optimize their landfill operations to maximize compaction and prolong the life of their landfills.
	Level of Effort	3 - Wood chipping, baling, GPS systems, surveys and slope adjustments only depend on financial constraints; there are no major contract issues.
Environmental Impacts	Climate Change Impacts	2 - The anticipated 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. The increase on the life of the landfill reduces GHG emissions associated with siting and developing a new landfill; however, it is noted that this option delays the siting and developing versus elimination.
	Land Requirements	3 - The intention of this option is to optimize currently used landfill space.
	Nuisance Impacts	2 - Grizzly plates will reduce the amount of litter, while shredding and chipping may increase the amount of litter.
	Diversion Potential	2 - Optimization approaches may 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 ongoing basis.

Option 7	Explore Ways to Reduce Wind Impact at Landfills and Decrease Closure
Description	<p>This option explores different approaches on how to reduce the impact that wind has on landfill closure as well as litter off site. Best practices to management windy environments include:</p> <ul style="list-style-type: none"> ● Tighten active work areas on a day-to-day basis; ● Continue implementing alternative daily covers such as grizzly plates to avoid blowing of materials and/or pests; ● Consider utilizing larger tents to protect the active cell (however not a recommended approach); ● Bale waste on windy days to reduce the amount of small, lightweight materials from blowing around the site; ● Implement the use of portable litter catching fences which are a reactive measure used to catch any airborne litter. By installing a wind fence on the prevailing wind side and a debris catch and control fence on the opposite side, material can be contained within the immediate recycling or landfill areas. Having a wind fence or portable panels can prevent temporary landfill shutdowns due to excessive wind and can be moved as close to the working area as needed; and ● Increase the height of the permanent fence.
Assumptions	<ul style="list-style-type: none"> ● Wind causes issues with regular operations in the landfill site. ● There is an appropriate facility for the Baler to be stored and used.
Area(s) of Focus	<ul style="list-style-type: none"> ● Alberta based examples, if possible.
Proposed Timing	Planning 2024 and implementation 2024.
Supporting Rationale (City)	It was highlighted that due to regular closures of the landfill due to wind there is an impact on operational costs.
Supporting Rationale (Research)	<p>Brooks, AB: Newell Regional Landfill experiences sudden shifts in wind direction with speeds up to 70 km per hour and gusts past 90 km per hour. During the planning period of the landfill, it was identified that wind management was crucial to avoid future issues. The implementation of portable wind screens to shelter the working face and the use of portable chain link mesh catch fences helps control blowing litter.</p> <p>Cardston County, AB: The Transfer Station in Cardston County utilizes wind fences to control debris and wind around the transfer station.</p>
KPIs	<ul style="list-style-type: none"> ● Number of landfill closures due to wind; ● Reduction of complaints regarding litter; and ● Reduction of off-site litter.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - Capital costs are estimated to be less than \$5,000,000. Balers cost up to \$1.2 million including engineering services and transportation to site.
	Level of Risk	3 - Wind management has minimal risk factors and could improve environmental conditions as less litter would end up off site.
Social Impact	Public Acceptance	3 - Mitigating issues wind can have in the landfill will likely receive a positive response due to decreasing litter off site.
	Proven or Unproven	3 - Wind management methods have been used in similar jurisdictions to Medicine Hat and have been proven successful.
	Level of Effort	3 - Implementing wind management equipment or approaches is low effort due to limited ongoing maintenance.
Environmental Impacts	Climate Change Impacts	1 - Wind management will have no impact on GHG emissions.
	Land Requirements	2 - No additional land is required for this option.
	Nuisance Impacts	3 - Wind management will reduce off site litter.
	Diversion Potential	1 - Wind management will have no impact on the diversion of waste.

Option 8	Explore Upgrades Available for Anaerobic Digestion (AD)
Description	<p>Several Canadian municipalities have developed AD facilities for organics processing to produce renewable energy from the AD's biogas. This option could involve a high-level feasibility study of the scale required to develop an AD facility and whether it is a viable option for the City. The feasibility study could research the following areas:</p> <ul style="list-style-type: none"> • An analysis of the amount of source separated organics (SSO) material generated in the City would need to occur to build a business case for the need of an AD facility; • Consideration would be given to if the organic waste feedstock would be of optimal quality for biogas to be generated (e.g., organic waste that includes oils and meats generates more biogas than paper products or plant matter); • Considerations should be given to end markets available for the digestate (the by-product from an AD facility) and the viability of co-digestion of wastewater treatment plant biosolids with an organic waste feedstock. This may include assessing whether the market has a sufficient number of proponents that would be available locally and that the costs are reasonable; and • Assessment of the effort required for planning, siting, approval processes and the procurement of a design, build and operate contract. A similar effort would be required to establish infrastructure and agreements to potentially refine and sell the renewable gas, establish a cogeneration facility or directly use the biogas at neighbouring facilities.
Assumptions	<ul style="list-style-type: none"> • The City will establish a food waste collection program; • A food waste program would also need to include P&E elements to encourage public participation in the program; • The City will acquire council approval for capital investment in an AD processing facility for organic waste feedstocks; • The City would find capacity to manage its food waste collected during the planning, building and commissioning stages of a new AD facility, since development of an AD organics facility would take a several years; • The City's current facility processes organic waste received through the yard waste collection program as well as some biosolids waste; and • The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.1 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> • Alberta based examples if possible; and • Understanding existing market for the end product and availability of anaerobic digesters.
Proposed Timing	Planning 2023 (timing is aligned with or follows Option 15 "Create Joint Effort with the Wastewater Treatment Plant (WWTP) on How to Manage Biosolids") and implementation 2024.
Supporting Rationale (City)	A feasibility study can inform and support planning and decision making for waste management system upgrades. The City currently has waste composition study information that separates 'dry' and 'wet' waste and indicates that just over 20% is 'wet' (i.e., putrescible). This data can be reviewed in the feasibility study to estimate potential green cart waste capture rates.
Supporting Rationale (Research)	Airdrie, AB: The City has a comparable population to Medicine Hat. The City of Airdrie introduced their curbside organics (food and non-food items) program in early 2014 upon successful completion of a pilot project. The collection and processing of organic waste was outsourced in early 2014 for a five (5) year term (to 2019). Upon contract expiration, a new contract was re-tendered with a five (5) year term (to 2024). In both occasions, GFL Environment Inc. was selected as the preferred service provider. As part of both contracts, it is the responsibility of the service provider to select an approved processing facility.

Option 8	Explore Upgrades Available for Anaerobic Digestion (AD)
	<p>In 2019 due to odour concerns, the contracted organic waste processor, Thorlakson Nature's Call, was denied a permit from Rocky View County. This meant that the City of Airdrie ceased its organic waste contract and instead began to send it to Calgary. It is recommended that the City of Medicine Hat collaborate with the City of Airdrie to further understand the market for organic waste processing.</p> <p>Edmonton, AB: To support their 90% waste diversion goal, the City of Edmonton invested in an AD facility called the High Solid Anaerobic Digestion Facility (ADF) located at the Edmonton Waste Management Centre. Following an investment of approximately \$40 million, the facility became operational in 2020 and can process 40,000 tonnes of residential food waste per year. The digestate is transferred to the compost cure site where it breaks down into a soil amendment that is appropriate for agricultural and horticultural application. The ADF generates energy in the form of electricity and heat from the biogas captured from the digester.</p> <p>Foothills County, AB: Catapult Environmental Inc., which acquired Highwood Organics Processing in June 2022, is constructing the "Aldersyde Composting & Renewable Natural Gas Production Facility". The site will be located in Abilds Industrial Park, north of Cargill, AB. It will be a large-scale commercial organics processing hub that will be available for contract to Calgary and southern Alberta. It will be able to process 20,000 tonnes per year and once anaerobic digesting is online, an additional 70,000 tonnes per year can be processed. Its feedstock will include residential food waste, ICI food waste including expired food from grocery stores and manure from area ranchers. Its renewable natural gas (RNG) equipment will be able to produce heat for over 2,500 homes year-round. The estimated cost for the facility is \$25 million and it is expected to be operational in 2023.</p> <p>Surrey, BC: The City owns a dry AD facility that produces biofuel and 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. It can process up to 115,000 tonnes per year of yard and food waste from household and commercial sources. The facility is sized to process yard and food waste from surrounding municipalities.</p>
KPIs	<ul style="list-style-type: none"> ● Cost of feasibility study; and ● Timeline (schedule) for results.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - Capital costs are estimated to be less than \$5,000,000.
	Level of Risk	3 - There is very low risk associated with an AD feasibility study. The feasibility study is anticipated to deliver good results (i.e., a comprehensive report for City planning) and has limited liability to procure an experienced consultant.
Social Impact	Public Acceptance	3 - The feasibility study is anticipated to be accepted/encouraged by the community. It is anticipated the public would support procurement of a feasibility study to support City decision making regarding an AD facility.
	Proven or Unproven	3 - Proven in jurisdictions smaller than the City and/or in other jurisdictions in Canada. Feasibility studies on AD facilities are a proven pre-planning approach to waste management capital projects and are undertaken across municipal jurisdictions of varying sizes, including Western Canadian City jurisdictions.
	Level of Effort	3 - An AD feasibility study is anticipated to be easy to implement. Existing staff resources can be used to procure the study, manage the consultant and present findings and briefings to management.
Environmental Impacts	Climate Change Impacts	1 - A feasibility study is not anticipated to impact GHG emissions.
	Land Requirements	2 - A feasibility study is not anticipated to impact land use.
	Nuisance Impacts	2 - A feasibility study is not anticipated to impact nuisances.
	Diversion Potential	1 - A feasibility study is not anticipated to impact diversion rates.

Option 9	Develop Bylaw Amendments to Increase Enforcement Capabilities
Description	<p>This option involves developing bylaw amendment to increase enforcement capabilities. This option may increase participation in current waste management programs, specifically the curbside recycling collection program. The intent is to decrease unacceptable materials using periodic visual curbside audits and compliance blitzes to provide residents with direct and immediate feedback on their unacceptable materials using tags or notices. A bylaw officer or waste team could visually inspect curbside collection cart content before collection time and provide information on how to sort materials. Areas selected may be based on reviewing collection routes and loads to identify areas and neighbourhoods with low participation and/or high contamination rates.</p> <p>Another alternative to enhancing compliance in current waste programs is to implement a clear bag program. This type of program may require residents to place garbage in a clear or transparent bag at the curb and there could be either a zero tolerance or maximum acceptable limit for divertible materials in the clear garbage bag allowed.</p>
Assumptions	<ul style="list-style-type: none"> • There will be consistency in determining non-compliance, which could be challenging for collection staff and/or Waste Inspectors to apply in the field if a certain level of contamination (e.g., 5 to 15% divertible materials) is permitted in clear bags); • There will be a change to the current waste bylaw; and • A full time waste bylaw officer will be hired or reallocation of solid waste staff to waste inspections will be available if needed (1 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> • Alberta based examples, if possible.
Proposed Timing	Planning 2025 and implementation 2026.
Supporting Rationale (City)	It was highlighted during the Vision Workshop that residential compliance to waste management programs and/or services is an identified issue.
Supporting Rationale (Research)	<p>Surrey, BC: The City of Surrey has been completing curbside organics and recycling cart “blitz audits” for the past several years. The intent of the audits is to check for contamination and to tag carts where contamination was observed, primarily along routes where a high amount of contamination has been observed in the collection vehicles. Since the blitz audits were implemented, the City has observed up to 50% reduction in contamination along audited routes and an up to 65% reduction in repeat offenders (households that receive a tag multiple weeks during the blitzes). In some instances, the blitzes are sustained and routes are not selected for auditing the following year; however, in some instances routes are re-selected as reinforcement is required.</p> <p>Coquitlam, BC - The City of Coquitlam has completed several collection audit blitzes when households set out their containers at the curb. They have specific set-out requirements in relation to early set-outs. Residents are not allowed to set-out their garbage or green waste containers before 5 a.m. on the day of collection. The blitzes are completed for all waste collection routes in the City. The number of recorded non-compliances decreased by 64% from 2018 to 2019 and decreased an additional 40% from 2019 to 2020. The overall blitz of the City is used as a first warning to residents. If the same households have materials set-out prior to 5 a.m. again, they will receive a fine.</p>

Option 9	Develop Bylaw Amendments to Increase Enforcement Capabilities
	<p>Markham, ON - The Town of Markham enforces compliance in recycling programs by requiring clear bags to be used for waste materials. While the City of Medicine Hat does not have a clear bag program, some insights can be gained from Markham's enforcement efforts, which are conducted by their waste collection operators. Waste collection staff place stickers on dark bags that are placed at the curb, indicating that they will not be collected. The tagged waste bag is left at the curb and residents are required to place the waste in a clear bag and set it out the following week for collection. The Town of Markham also monitors waste collection operators and audit collection vehicles to see if there are any dark bags in the loads when they are unloaded on the tipping floor.</p>
KPIs	<ul style="list-style-type: none"> ● Number of residents requiring correction for improper sorting of waste; ● Number of clear bags sold; ● Number of fines and/or penalties; ● Change in contamination rate; ● Change in participation (recycling); and ● Change of recycling and garbage quantities in tonnes.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - Capital costs are estimated to be less than \$5,000,000.
	Level of Risk	3 - There is minimal risk associated with developing bylaw amendments to increase enforcement capabilities.
Social Impact	Public Acceptance	2 - Increased enforcement may initially be met with public resistance and increased customer service calls and complaints. Some residents may oppose visual audits due to privacy concerns; however this can be mitigated with the allowance of opaque 'privacy' bags. Acceptance can be achieved after transition time of the new changes and effective communication during the initial roll out of the program.
	Proven or Unproven	3 - Increased enforcement capabilities have been proven in similar jurisdictions in western Canada.
	Level of Effort	2 - A moderate level of effort will be required to implement increased enforcement capabilities. An additional bylaw officer will need to be hired to carry out enforcement duties. There will also need to be a promotion campaign for the new programs and expectations from residents.
Environmental Impacts	Climate Change Impacts	1 - The increased enforcement capabilities result in little to no reduction in GHG emissions. It is not anticipated that this option will significantly decrease GHG emissions. There may be some overall reduction from landfills if more recyclables are diverted due to improved sorting at the curb.

Evaluation Criteria	Indicator	Evaluation
	Land Requirements	2 - There is no additional land required to increase enforcement capabilities.
	Nuisance Impacts	1 - A bylaw for a clear bag program for garbage (without the use of grey carts) may increase the presence of pests such as raccoons on set out days and generate more litter in the community.
	Diversion Potential	1 - Increased enforcement capabilities create the potential to see some increase in diversion of recyclables if the option was fully enforced (i.e., collection staff do not collect clear bags containing more than the allowable amount of divertible materials). However these impacts will be minimal.

Option 10	Explore Options to Develop a Green City Fleet
Description	<p>This option considers how solid waste collection trucks, landfill equipment, trucks are used to collect waste from parks and other public spaces (e.g., transit stops) by the solid waste staff to carry out their work and explores options to reduce the GHG emissions resulting from these activities.</p> <p>Considerations may include exploring different fuel usage, including renewable natural gas (RNG) and hybrid or electric vehicles for municipally-owned and contracted collection service fleets. The focus should be on proven technologies that will meet service delivery needs including climate conditions and geography. A current state analysis to understand which vehicles can be replaced and a review of jurisdictional scans that fit Canadian context and climate would be completed.</p> <p>Canada's Greening Government Strategy was released in December 2017 and includes clear commitments to reduce emissions from government fleets. Some provinces in Canada have begun to establish their own greening strategies which include fleet targets and actions. Québec, for example, developed a target of adding 1,000 electric or hybrid vehicles into their fleet by 2020. The high up-front costs are a major barrier to adopt lower-carbon vehicles; however, some studies have suggested that financial incentives such as rebates and tax credits help build support towards increasing the deployment of low carbon vehicles in the private sector. Incentives may still not be enough to encourage low carbon government fleets; however, bulk purchases could provide another option which government fleets at all levels could support. Access to refuelling and charging infrastructure where and when needed is another challenge which must be considered. More recently, electric vehicles (EV) have proven to operate effectively in the harsh weather conditions of Canadian winters, due to their active thermal management systems which has the battery sitting in a glycol bath that is connected to the heat pump which allows it to stay warm. Calgary currently has over 200 charging stations and Edmonton has approximately 70.</p>
Assumptions	<ul style="list-style-type: none"> • There will be access to refuelling and charging infrastructure; and • Electric vehicles will be able to operate in Alberta's winter conditions; and • The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.1 FTE recommended).

Option 10	Explore Options to Develop a Green City Fleet
Area(s) of Focus	<ul style="list-style-type: none"> • Alberta based examples.
Proposed Timing	Cost-Benefit Analysis: Planning 2027 and implementation 2028. Pilot Green Fleet Program: Planning 2028 and implementation 2029.
Supporting Rationale (City)	The City is continuing to utilize compressed natural gas (CNG) collections trucks where possible and the possibility of electric trucks has been examined. The City would like to continue pursuing these endeavours.
Supporting Rationale (Research)	<p>Solid waste collection vehicles are among some of the heaviest fuel users in the automotive industry. As a result, waste collection vehicles offer the greatest opportunity for achieving GHG emission reductions. A phased approach towards a zero emissions solid waste fleet should be taken. 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. The City's Fleet Services should actively monitor technologies available and implement them only once they have been demonstrated in a jurisdiction comparable to Medicine Hat. Fleet Services would need to undertake trials to test new technologies and alternate fuels. These trials should be implemented where funding is available and operations will not be negatively affected. It is critical that vehicles and equipment can operate in the City's climate, geography and suit operational needs. Some municipalities are using biodiesel (20% biodiesel, 80% fossil diesel); however, it can only be used through warmer months. 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, at the same time, the high cost of early versions of these heavy electric vehicles is trending downwards.</p> <p>Calgary, AB: The City of Calgary is implementing new practices and technologies for a greener fleet. Their procurement processes ensures compliance with the Environmental Protection Agency (EPA) standards and considers all available fuel types when purchasing new vehicles and equipment. One of the City of Calgary's procurement strategies for greening their fleet is to add clauses to Request for Proposals (RFP) to enable them to try new green solutions and technologies as they become available in the market. The City of Calgary received funding in 2020 to test energy-saving options by piloting electric and hybrid waste collection trucks. They are testing one Class 7 cab-over hybrid waste collection truck and one Class 7 cab-over battery-electric waste collection truck for one year. In 2018, they 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. Starting in 2022, the City of Calgary will be implementing a pilot project to investigate the suitability and economic benefits of using electric and hybrid trucks to collect waste.</p> <p>Vancouver, BC: The City of Vancouver has committed to reducing fleet emissions to 30% below 2007 levels by 2020, 50% below 2007 levels by 2030 and transitioning to 100% renewable energy usage by 2050. In 2018, the City of Vancouver shifted to 100% renewable diesel fuel provided by Suncor. This was a major step towards renewable fuels as 55% of the city's fleet is fuelled by diesel. A dedicated natural gas compression station allows the city's vehicles (including 33 garbage trucks) to be operated on 100% compressed natural gas.</p>

Option 10	Explore Options to Develop a Green City Fleet
	<p>The city 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 transportation, zero-waste, buildings and rainwater solutions. The call seeks transportation solutions that support the City of Vancouver's pursuit of a zero-emissions fleet (medium- to heavy-duty), including changing infrastructure, pick-up trucks, garbage and recycling trucks, utility vans and emergency response vehicles.</p>
KPIs	<ul style="list-style-type: none"> ● Driver time (drivers may need to make additional stops for refuelling); ● Greenhouse gas emissions; and ● Fuel consumption.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000. If the City decides to move forward with this option, there will impacts to current operating costs as collection routes may change and collection contracts will likely be impacted.
	Capital Costs	3 - There are no expected capital costs during the exploration stage, however if the City decides to move forward with this option there will be significant investment required. It is difficult to estimate capital costs for this option, however when comparing current low or zero emission vehicles to traditional diesel vehicles, the difference in cost is in the order of two and half to three times the cost.
	Level of Risk	1 – Significant investment will be required for infrastructure to support electrification of future waste collection fleet and its supporting charging infrastructure. Current infrastructure is not available for a rapid shift to electric. With the introduction of new technology under a new collection contract, contractors bidding will likely submit conservative bids to address any uncertainties and risk associated with the implementation of this new technology.
Social Impact	Public Acceptance	3 - The public will likely be supportive of the development of a green fleet; however, if maintenance issues cause ongoing collection interruptions, this may negatively impact public perception of the option.
	Proven or Unproven	1 - Currently, municipalities are exploring options to develop green fleets. Vancouver has 50 hybrid vehicles currently in use.
	Level of Effort	1 - A high level of effort will be required for the development of a green fleet. Continuous monitoring of technologies and applicability to the City of Medicine Hat is needed before moving forward with this option.
Environmental Impacts	Climate Change Impacts	2 - There is potential for moderate to significant GHG reductions by developing a green fleet. The magnitude of GHG reductions is dependent on the type of current and future collection vehicles used.
	Land Requirements	1 - A green fleet may require additional land for vehicle fueling stations.
	Nuisance Impacts	3 - Electric collection vehicles could reduce noise and odours from waste collection in residential areas.
	Diversion Potential	1 - The development of a green fleet will have no impact on waste diversion.

Option 11	Develop a Circular Economy Roadmap
Description	<p>This option involves the development of a Circular Economy Strategy that may align with Provincial and Federal efforts and be the primary framework and action plan for how the City could work towards its diversion goals. The strategy may be developed based on the three core principles of a circular economy:</p> <ol style="list-style-type: none"> 1. Designing out waste and pollution; 2. Keeping products and materials in use; and 3. Regenerating natural systems. <p>According to the Ellen MacArthur 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 policy levers, cities can bring about changes to the use and management of materials in cities. City priorities around access to housing, mobility and economic development can also be met in a way that supports prosperity, jobs, health and communities. At a high level, the strategy could:</p> <ul style="list-style-type: none"> • Develop a dedicated cross-departmental City Circular Economy Committee with support from external stakeholders and industry experts that would work to develop a community and action plan; • Explore and develop a circular framework that can be embraced across all the City's facilities and operations; • Develop a list of opportunities and challenges to implement circularity in the City; and • Establish a list of potential initiatives the City could implement.
Assumptions	<ul style="list-style-type: none"> • The City departments will buy in and want to participate in the Circular Economy Committee; • Coordination between different City departments will occur; • The impacts of Provincial Extended Producer Responsibility (EPR) (e.g., compostable packaging) will be unknown; • The types of opportunities that could be developed for zero waste and circular economy strategies will need to be identified; and • The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.25 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> • Alberta based examples.
Proposed Timing	Planning 2023 and implementation 2024.
Supporting Rationale (City)	<p>Many municipalities, in Canada and globally, are demonstrating leadership in Circular Economy strategies (such as focusing on "zero waste"), implementation and local business development. A circular economy aims to reduce waste and maximize use of resources by moving away from the linear take-make-dispose approach, to an innovative system that focuses on product longevity, renewability, reuse and repair. It may benefit the City to explore how a circular economy framework can improve its current operations, provide cost-benefits and help achieve reduction and diversion targets.</p>
Supporting Rationale (Research)	<p>Calgary, AB: The City of Calgary participated in the recent Federation of Canadian Municipalities (FCM) Circular Cities and Regions Initiative (CCRI) which was a pilot to advance circular economy knowledge in the Canadian local government sector.</p>

Option 11	Develop a Circular Economy Roadmap
	<p>Through two workshops, the City of Calgary was able to develop a roadmap which identified challenges currently faced and circular solutions. Areas of interest for Calgary, included the development of a green fleet, food systems, built environment, economic diversification, sharing and reuse. The final focus areas selected were innovation and economic diversification, sharing and reuse. Actions intended to be taken to build the circular economy in Calgary include determining circular priorities internally, leveraging existing networks and organizing information sessions to improve circular understanding, building partnerships, exploring financial support options and expanding existing reuse programs.</p> <p>Canmore, AB: The Town of Canmore participated in CCRI and identified the <i>Sharing and Reuse Economy</i> and <i>Regenerative Visitor Economy</i> as two actionable circular opportunities to engage in. Canmore seeks to promote sustainable and eco-friendly tourism benefiting seasonal and permanent populations through developing waste free visitor experiences, enhancing public transportation and increasing diversion programs in restaurants and hotels in the area. The cost of living in Canmore results in limited options for expansion which presents an opportunity for circular actions in the reuse and sharing economy through comparative analysis and developing 'how to' guides for residents to improve their personal reuse habits.</p> <p>Okotoks, AB: The Town of Okotoks has recently included developing a circular economy strategy into their Waste Management Strategy Update in 2021.</p> <p>Victoria, BC: The City of Victoria's Zero Waste and the Circular Economy Plan (approved in December 2020) aim to reduce waste disposal by 50% by 2040. The Circular Economy Plan has five major actions which include: developing a new four-stream waste and recycling system; using a rewards return program called "cash for cans"; implementing new infrastructure and innovative solutions; supporting best practices through legislation; and implementing a statewide ban of single-use plastics.</p>
KPIs	<ul style="list-style-type: none"> ● Baseline circularity measurement of the City; ● Reduction in waste generated; ● Participation in reuse programs; and ● Number of circular partnerships developed.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	3 - There is minimal economic risk anticipated with developing a circular economy roadmap as it seeks to improve partnerships and sustainability in the City. Participation in circular economy initiatives hosted by the City will be within the City's budgetary control, procurement and spending.
Social Impact	Public Acceptance	3 - It is anticipated that the public will be receptive to a more circular city due to the socio-economic benefits to the community and enterprises.
	Proven or Unproven	3 - Over the past five years there has been uptake of circular economy principles around the world. Municipalities have started developing or adopting circular economy strategies. Governments at all levels have been implementing policy initiatives. An increasing amount of research is being conducted and companies have been innovating ideas and business plans.
	Level of Effort	2 - Developing a circular economy roadmap will require moderate effort over time by the City, its departments and its partners. More circular adjustments to City business processes, procurement and policies will be needed to support circular economy initiatives.
Environmental Impacts	Climate Change Impacts	2 - As the City works toward more circularity, a decrease in GHG emissions is anticipated, particularly due to resource and energy reduction, reuse and recycling.
	Land Requirements	2 - No additional land is required to develop a circular economy roadmap.
	Nuisance Impacts	2 - No nuisance impacts are expected to occur from developing a circular economy roadmap.
	Diversion Potential	2 - It is anticipated that the development of a circular economy roadmap will lead to an increase in diversion of waste and avoidance of waste entering the system through circular economy initiatives over time.

Option 12	Explore a Single-Use Plastics Ban
Description	<p>Exploring a single-use plastics (SUP) ban would explore a jurisdictional review to better understand where SUP bans have been implemented and what lessons were learned. It would assess how a ban could align with recent federal Canadian Environmental Protection Act (CEPA) legislation changes. The changes include:</p> <ul style="list-style-type: none"> As of January 1, 2023, federal bans will be in place to prohibit the manufacture and import of plastic checkout bags, cutlery, straws and flexible straws, foodservice ware, ring carriers and stir sticks; and As of January 1, 2024, the sale of these items will be prohibited. <p>The City can consider how it might prepare for the federal bans, such as increasing P&E to address the use of alternative products. The City may also wish to gather baseline data and develop a monitoring plan to assess the impact of the federal ban.</p>
Assumptions	<ul style="list-style-type: none"> Introducing a bylaw to expand the list of prohibited additional single-use items (such as plastic water bottles) will be challenging; There will be a transition time before the public and businesses fully comply with the bans; and The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.1 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> Alberta based examples; and Cities that have provided promotional and educational materials to the public and business.
Proposed Timing	Planning and Implementation: Immediately to 2024.
Supporting Rationale (City)	Since the Provincial and Federal government is working with the retail industry on this issue, there appears to be merit in allowing the government and retail industry a fair opportunity to advance their education and incentives to result in a decrease in the use of plastic bags. This option was included in the City's previous Waste Management Strategy.
Supporting Rationale (Research)	<p>Victoria, BC: In 2018, The City of Victoria, BC, adopted a bylaw to ban single-use retail checkout bags. This Bylaw prohibited businesses from offering or selling plastic bags to consumers and requires that businesses charge customers for reusable cloth bags and paper bags, which are also required to contain post-consumer recycled content.</p> <p>Prince Edward Island (PEI): In PEI, the <i>Plastic Bag Reduction Act</i> came into force on July 1, 2019. Like the federal prohibition, it applies to plastic checkout bags and includes biodegradable or compostable checkout bags; but not paper bags. Unlike the federal regulation, it requires that businesses charge customers for both paper alternatives and reusable checkout bags.</p> <p>Edmonton, AB: The City of Edmonton's <i>Plan to Reduce Single-use Items</i> (published March 2022) is geared towards reduction from residents and businesses and includes both regulatory and voluntary actions. The products identified for banning include plastic shopping bags, foam cups, containers, straws, pre-packaged condiments and napkins and SUP shopping bags. The plan also includes having staff ask first before providing utensils and imposing minimum fees on paper shopping bags and new reusable shopping bags. Edmonton published a Fact Sheet to educate the public (last updated May 2022).</p>

Option 12	Explore a Single-Use Plastics Ban
	Kingston, ON: The City of Kingston (population approximately 130,000) created a bylaw in 2019 that banned plastic straws, cups and forks from the City-owned Grand Theatre and Invista Sports Complex. The Bylaw was intended to show leadership in targeting plastics that tend to become litter.
KPIs	<ul style="list-style-type: none"> ● Public Feedback: <ul style="list-style-type: none"> ○ Number of people reached through an information campaign; ○ Quantity of questions asked; and ○ Quality (nature / intention) of questions asked; ● Change in quantity of alternative products entering garbage and diversion stream (comparing to before the federal ban's implementation date); ● Litter audit results; ● Number of businesses aware of bans (survey); and ● Number of businesses in compliance with the bans (survey).

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	3 - Exploring a SUP plan mitigates the risk of the City being ill-prepared for statutory changes rather than posing any new risks.
Social Impact	Public Acceptance	3 - Exploring a SUP ban is expected to include a transition period for the public during which time businesses and residents may have questions. Communications should be in alignment with the messaging of the federal government. A considerable amount of media attention has been directed to the associated environmental, marine litter and plastics pollution. Overall, after a transition time period, anticipate public acceptance.
	Proven or Unproven	2 - Actions to address on SUP through education, outreach and voluntary measures have been implemented in other jurisdictions.
	Level of Effort	3 - Exploring a SUP ban is considered a low effort to implement. Includes a jurisdictional scan and P&E that can be achieved with existing staff resources.
Environmental Impacts	Climate Change Impacts	1 - Exploring a SUP ban aims to reduce the rise of alternative materials in the waste stream once federal prohibitions are in place for SUP. The changes aim to reduce litter and the materials are relatively small in size. The changes result in little to no reduction in GHG emissions.
	Land Requirements	2 - No additional land is required to explore a ban on SUP.
	Nuisance Impacts	2 - No nuisance impacts are expected to occur from exploring a SUP ban.

Evaluation Criteria	Indicator	Evaluation
	Diversion Potential	1 - A ban on SUP aims to create a culture of reuse, rather than reliance on alternative products. The impact on diversion is expected to be minimal due to the small tonnage of associated lightweight materials.

Option 13	Identify Impacts Extended Producer Responsibility will have on Current Operations
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Description	<p>Extended Producer Responsibility (EPR) addresses concerns about leakage of materials in the recycling system and aims to “close the loop” on products and packaging so that the value of material is retained and end markets for recyclable material grow. This policy approach makes recycling the responsibility of producers rather than governments and aims to address the issue that producers are driven to use new materials due to its relative low price, as compared to materials that come from recycling markets. An EPR system would have producers obligated to coordinate and operate recycling systems that keep materials in circulation and incorporated in new packaging and products.</p> <p>On March 18, 2021, the Alberta Environment and Parks (AEP) released a discussion Paper to inform stakeholders of its intention to introduce EPR to Alberta and initiate a consultation process. On November 15, 2021, Bill 83 introduced EPR to Alberta and set the course for AEP to create and implement an EPR framework. This framework aims to establish a province-wide systems for the management of SUP, packaging, paper and hazardous and special products (e.g., lawn pesticides and solvents). After receiving Royal Assent on December 2, 2021, Bill 83 became the Environmental Protection and Enhancement Amendment Act (EPEAA) and came into force. The EPEAA means that the City’s obligation to provide recycling services to residents will cease.</p> <p>This option develops an EPR roadmap (or action plan) that would work as a guidance document that would:</p> <ul style="list-style-type: none"> ● Provide understanding of the AEP framework for implementing EPR regime in the province and what may change within the waste management system when an EPR regulation is introduced provincially; ● Establish a communications plan for ensuring that the appropriate internal and external stakeholders know of what will change with respect to collections, contracts and business processes, and to confirm that assets are well managed when responsibility changes hands; ● Plan what the City will do to prepare for coming changes; and ● Plan how to transition its program in such a way that residents are not impacted and there is no increase in materials entering other waste streams (e.g., recycling in the garbage). <p>In developing the roadmap, the City would liaise with other jurisdictions to identify potential impacts. The roadmap could include a timeline with a task schedule, a "to-do" list of activities and a jurisdictional scan to identify municipal neighbours who are also developing transition management plans. The City can determine whether to procure an EPR specialist to provide guidance on the roadmap development.</p>
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Option 13	Identify Impacts Extended Producer Responsibility will have on Current Operations
Assumptions	<p>Regulations will be provided under the Environmental Enhancement and Protection Act (EPEA) and will clarify details about producers' responsibilities and how the new recycling system will work. Regulations are also expected to inform municipalities of the timeline for implementation. It is assumed that:</p> <ul style="list-style-type: none"> ● The EPEA will mean that the City is no longer involved in the collection and management of recycling (i.e., as opposed to continuing operations per the status quo and receiving funding through the EPR model); ● EPR transition will involve a full transition of the Blue Box program to producers; ● The City will adjust the roadmap as more information is provided by the province and Blue Box program regulations are released; and ● The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.5 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> ● Alberta based examples; ● Municipalities had been selected to provide examples of what could be included in road-mapping for a transition to EPR; and ● As the EPR legislation and regulations are developed, the City can refer to these examples to engage in their planning process.
Proposed Timing	Planning 2023 and implementation to be determined based on the progress at the provincial level.
Supporting Rationale (City)	The City's statutory requirement to provide services will change and planning is required to understand the impact to the integrated waste management system.
Supporting Rationale (Research)	<p>Ontario: In 2016, the Waste-Free Ontario Act was passed by the Legislative Assembly of Ontario. That year, it also enacted the Resource Recovery and Circular Economy Act and the Waste Diversion Transition Act which authorized the transition of the financial and operational responsibility for waste diversion programs in Ontario from municipalities to product and packaging producers. Independent Producer Responsibility programs exist for hazardous waste, electronics, batteries, tires and Blue Box recycling. The Blue Box Regulation 391/21 (as amended by Blue Box Regulation 349/22) is the regulation that details how the transition of responsibility for the municipal Blue Box program to producers across the province will occur and includes the timeline for transition, which is between July 1, 2023 and December 31, 2025.</p> <p>Barrie, ON: In 2022, The City of Barrie (population of 147,800) developed comprehensive transition plan that identifies what the City needs to do with regards to the transition of the Blue Box program to Ontario's producer responsibility program. The plan includes a timeline with critical path milestones and activities that need to be completed before and after the transition, as well as key decision points. A transition tool spreadsheet was also used to support decision making in the lead up to the transition.</p> <p>British Columbia: In BC, EPR (once referred to as Industry Product Stewardship) is an environmental policy approach in which the producer's responsibility for reducing environmental impact and managing the product is extended across the whole lifecycle of the product, from selection of materials and design to its end-of-life. (Definition by the BC Ministry of Environment and Climate Change Strategy. A move towards an EPR-based regulatory structure was first announced in 2003 and is organized in a way that favours a single entity (Recycle-BC) that is responsible for the provision of service to the public.</p>

Option 13	Identify Impacts Extended Producer Responsibility will have on Current Operations
	<p>The Environmental Management Act, 2018, set the course for Recycling Regulation 162/2020 to establish the duties of producers.</p> <p>Richmond, BC: In BC, RecycleBC is responsible for the coordination of recycling services pursuant to provincial regulations. Recycle BC requires remediation efforts if recycling contamination are over 3% in any municipality. The City of Richmond implemented curbside audits of recyclable material and a door-to-door educational campaign to reduce contamination in single-family recycling.</p> <p>Calgary, AB: The City of Calgary is preparing for the introduction of EPR and provides a fact sheet on its website. The site also encourages people to become advocates by contacting their Member of the Legislative Assembly (MLA) and contacting manufacturers and/or brand owners to request that they improve the recyclability and sustainability of their products and packaging.</p> <p>Prince Edward Island (PEI): In September 2021, PEI announced that regulations under the EPA will be amended to introduce a program for the collection and recycling of agricultural plastics.</p> <p>This is noted to demonstrate that EPR can be applied to specific- non Blue Box items, as is fitting for specific communities. The department of Environment, Energy and Climate Action has also implemented EPR programs for electronics, paint and lamp products.</p>
KPIs	<ul style="list-style-type: none"> ● Council will receive roadmap for the City's transition to EPR; and ● Decision makers will be aware of the issues and able to make informed decisions.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	3 - The financial risk to the City is low as a result of the transition to EPR, due to the City being able to proactively anticipate risks and mitigate them.
Social Impact	Public Acceptance	2 - This option involves developing a roadmap. Selecting this option will not draw public attention.
	Proven or Unproven	3 - EPR impact plans and studies have been used by other municipalities to respond to the introduction of EPR frameworks in other provinces.
	Level of Effort	3 - The level of effort required to identify the impacts of EPR on the City's current system will be low, however a solid waste staff should continue to monitor the transition and impacts.
Environmental Impacts	Climate Change Impacts	1 - Developing an EPR transition roadmap is not anticipated to impact GHG emissions.

Evaluation Criteria	Indicator	Evaluation
	Land Requirements	2 - Developing an EPR transition roadmap is not anticipated to impact GHG emissions.
	Nuisance Impacts	2 - Developing a roadmap for an EPR transition is not anticipated to impact nuisances.
	Diversion Potential	1 - Developing a roadmap for an EPR transition is not anticipated to impact diversion rates.

Option 14	Develop a Strategy for Promotion of Non-Profits that Accept and Sell Reusable Items
Description	<p>This option involves the City supporting community-based initiatives and organizations that increase reuse and recycling and avoid waste. Some examples include the following:</p> <ul style="list-style-type: none"> • Create a dedicated Team/Group/Committee to implement waste avoidance, reduction and reuse options in the community (e.g., thrift markets and second-hand reuse strategy); • Support local waste avoidance, reuse, reduction and recycling initiatives through promotion on City website, offering free or reduced cost space, social media or procurement; • Develop a database of all organizations (non-profits and for profits) which participate in reuse, donation, recycling, second-hand and/or repair; • Establish a funding program to support local non-profit organizations and community groups that help reduce residential waste and encourage new initiatives; and • Organize a waste recovery "shopping" event which could be held at a community center and allow non-profits to sell their materials and promote their organization.
Assumptions	<ul style="list-style-type: none"> • A variety of organizations will be available to participate in strategies and develop partnerships to implement programs; • The City will support and allow the use of a City-owned facility for a waste "shopping" event; • The majority of residents in the City will have access to the internet and a computer to access the central database; and • The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.25 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> • Alberta based examples.
Proposed Timing	Planning 2024 and implementation 2026.
Supporting Rationale (City)	There are initiatives which enable the City to participate in increased diversion through reuse, donation or repair; however, it can be challenging for residents to access these services. The development of a promotion strategy for these programs, including creating a central database with information on diversion efforts in the City may increase access to these services by the public and may present opportunities for partnership between organizations.
Supporting Rationale (Research)	Strathcona, AB: Strathcona County developed its "Hodge Podge Lodge" which collects various items and materials that can be reused or repurposed. The items accepted are often difficult to recycle through traditional curbside collection programs.

Option 14	Develop a Strategy for Promotion of Non-Profits that Accept and Sell Reusable Items
	<p>The Enviroservice Station uses waste wizard on the County's website to help residents determine what can be dropped off. The Broadview Enviroservice Station received a 2018 Collection Site Award of Excellence from the Alberta Recycling Management Authority and experiences over 38,000 visits each year.</p> <p>Toronto, ON: Businesses and non-profits in the Toronto area can participate in the Materials Exchange program offered by Partners in Project Green (a partnership between the Greater Toronto Airports Authority and the Toronto and Region Conservation Authority). Organizations provide information on the type and quantity of materials needed or in surplus to the Material Exchange team and the team facilitates the exchange of the materials for reuse or recycling. Charitable organizations that can reuse the materials are prioritized. Materials are not exchanged for money, instead organizations save on the cost related to disposal or purchase of new materials. The program is inter-municipal with funding for the program being received from partnering municipalities.</p> <p>Vancouver, BC: The Shareable Cities Network connects sharing initiatives from around the world to sharing resources and ideas. In Vancouver, using the Shareable Cities Network platform, a group of volunteers created The Sharing Project which allows users to post about sharing opportunities in the City such as community gardens, car shares and other non-profit organizations that promote the sharing economy. Users are able find the map on the shareable website and it can be updated by users to add locations and events. There is a private Facebook page called Share Vancouver that residents can request to join to add additional sharing organizations. The group services as a resource centre for sharing organizations, people interested in sharing, community groups and partner organizations keen to facilitate sharing.</p> <p>Vancouver, BC: Vancouver Coastal Health created the Food Asset Maps. These maps are snapshots of food-related resources to better serve the Metro Vancouver area. It is used to provide a tool to community members and partners for locating community food assets that is current, easy to use and easily updated. Food Asset Maps are available in health unit jurisdictions of Vancouver, Richmond, North Shore and Coastal (Sunshine Coast and Squamish-Lillooet). On these maps, there are locations for no cost or low cost means, kitchen and cooking, no cost or low cost grocery items, schools, retail stores or markets, community food organizations, and gardening and growing food. These categories are mapped along with filter options to layer what the resident is looking for.</p>
KPIs	<ul style="list-style-type: none"> ● Public awareness; ● Website visits; ● Number of inputs from the public; and ● Partner organization feedback and foot traffic.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - Capital costs are estimated to be less than \$5,000,000.
	Level of Risk	2 - Additional website design is low risk for the City. Liability concerns, such as hazardous waste management and excess waste management/disposal, can be easily mitigated.
Social Impact	Public Acceptance	3 - With proper promotion and education, the new database will be very helpful for residents to use.
	Proven or Unproven	3 - Many communities across Canada support similar programs.
	Level of Effort	2 - Dependent on staff resources and the number of partnerships with community organizations.
Environmental Impacts	Climate Change Impacts	2 - Sharing items in the community or buying second hand could decrease the amount of GHG emissions by reducing the amount of raw materials needed to create brand new products.
	Land Requirements	2 - This option has the possibility to utilize existing space; however, this may also require temporary or long term rental space depending on the length of the program and the City involvement.
	Nuisance Impacts	2 - Some social media promotion may be needed which can be a nuisance to residents.
	Diversion Potential	1 - 2% diversion or less or is difficult to measure.

Option 15	Create a Joint Effort with the Wastewater Treatment Plant on how to Manage Biosolids
Description	<p>This option could conduct feasibility research involving best practices and innovation in the management of biosolids. This option could consider forming a cross-departmental working group or committee with the Wastewater Treatment Utility team and the Environmental Utilities team. The objectives of the working group or committee may be to find solutions for managing and reducing biosolid piles, such as blending biosolid compost with Class A compost at ratios that maintain Class A quality, exploring sales/end use markets outside of the surrounding region and evaluating operations at the WWTP to improve downstream biosolids compost quality. It should be noted that compost in Alberta must be compliant with the National Standard: CAN/BNQ 0413-200/2005, Organic Soil Conditioners - Compost. Also, pursuant to Alberta regulation, the permitted application/ end use of compost will depend on its category. Category AA compost cannot contain biosolids and has unrestricted use; whereas category A and B compost can contain up to 25% biosolids as part of the feedstock blend (on a dry weight basis) and have restricted use.</p>
Assumptions	<ul style="list-style-type: none"> ● The research findings will need to benefit both wastewater treatment utility and solid water management services department; ● The City is considering a collection program for household organic waste (SSO) and may be able to provide this for the WWTP. As an alternative, if the City does not proceed with the option to collect food waste, wood waste could be provided to the WWTP; and ● The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.25 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> ● Alberta based examples; and ● Biosolids management with and without mixing with compost waste streams.
Proposed Timing	<p>Planning 2023 (timing is aligned with Option 8 “Explore upgrades available for AD” so that the findings can complement one another) and implementation 2024.</p>
Supporting Rationale (City)	<p>Volumes of biosolids from the City’s WWTP combined with the leaf and yard waste collected puts the facility very near the feedstock maximum as set out in the Compost Facility Code of Practice. There is also currently no market for the finished biosolids compost produced and the material is currently being stockpiled. Continuing to compost the biosolids currently brought to the site may pose more challenges considering regulatory challenges. Therefore, the City requires an option that provides a solution for biosolids as well as municipal solid waste.</p>
Supporting Rationale (Research)	<p>Kelowna, BC: The Regional Biosolids Compost Facility in Vernon, BC is jointly owned by the City of Kelowna and the City of Vernon. It receives sewage sludge from Kelowna, Vernon, Silver Hawk Utilities and Lake Country Wastewater Treatment Facilities. Biosolids are mixed with wood chips and clean ground dimensional lumber. Class A compost (defined by the Organic Matter Recycling Regulation, BC) is produced using Extended Aerated Static Pile system.</p> <p>Calgary, AB: Calgary has a biosolids management program dedicated to research into biosolids management (see Expansion of Calgary Demonstration Program SYLVIS). Municipal biosolids can be used as fertilizer at the plantation project, to improve soil quality that is considered “marginal” for agricultural purposes. Biosolids from the City’s Bonnybrook wastewater treatment facility (45, 000 tonnes per year) are processed anaerobically along with municipal organics received from the green bin program (100,000 tonnes per year) and their final destination is to be provided to farmers participating a program called “Calgro”. Facility capital costs were \$143 million (2015) and annual operating costs are approximately \$12 million per year.</p>

Option 15	Create a Joint Effort with the Wastewater Treatment Plant on how to Manage Biosolids
	Stratford, ON: Serving a population of approximately 31,465 people, the City of Stratford, Ontario, upgraded its Water Pollution Control Plant (WPCP) following research and consultation in 2019 to treat solid and liquid organic waste from both residential and commercial sources and co-digest this waste with sewage sludge. The capital costs of the project were approximately \$22.7 million, but the cost was offset by funding received through the Ontario Clean Water Agency (OCWA) and the Ontario Centre of Excellence (\$5 million). The facility is operated by the OCWA.
KPIs	<ul style="list-style-type: none"> • Successful onboarding of working group members that represents needs of both waste and water sections; and • Cost required for the study.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - Capital costs are estimated to be less than \$5,000,000.
	Level of Risk	3 - The City has control over the costs and risks associated with this option.
Social Impact	Public Acceptance	2 - There are no anticipated public perceptions with this option.
	Proven or Unproven	3 - There are examples of other cities that have investigated biosolids and organics co-processing operations.
	Level of Effort	3 - The option to research solutions is easy to implement and will have no anticipated social impacts.
Environmental Impacts	Climate Change Impacts	1 - A feasibility study is not anticipated to impact GHG emissions.
	Land Requirements	1 - A feasibility study is not anticipated to impact land use.
	Nuisance Impacts	2 - A feasibility study is not anticipated to impact nuisances.
	Diversion Potential	1 - A feasibility study is not anticipated to impact diversion rates.

Option 16	Improve Participation in Litter Reduction Education Programs
Description	<p>The City would develop a litter strategy to achieve waste avoidance, reduction and diversion goals and objectives with a focus on behavioural change. 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.</p> <p>The strategy could include:</p> <ul style="list-style-type: none"> ● Community partnerships (e.g., local business participation in promotion and education campaign); ● Promotion and education campaign (e.g., pop-up booths at community events, signage, advertisements, etc.); and ● Policy development (e.g., fiscal measures, regulation, service provision and marketing).
Assumptions	<ul style="list-style-type: none"> ● The City will enter into community partnerships that will help facilitate behaviour change needed to achieve waste avoidance, reduction and diversion goals; and ● The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.5 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> ● Alberta based examples.
Proposed Timing	Planning 2023 and implementation 2025 (timing is aligned with or follows Option 12 “Explore a Single Use Plastic Item Ban”).
Supporting Rationale (City)	Expanding and improving education of litter reduction programs may help increase participation of the programs and/or services which may improve diversion rates in the City and reduce litter.
Supporting Rationale (Research)	<p>Edmonton, AB: The City of Edmonton Public Places Bylaw #14614 Section 4 states that a person shall not leave any garbage litter or other refuse in a public place except in a receptacle designed and intended for use. The City of Edmonton has waste receptacles throughout the city with receptacles for garbage and recycling. Within the downtown core there are also 11 receptacles for cigarette butts in various locations that are heavily used by residents. Capital City Clean Up is a litter reduction and prevention program developed by the City of Edmonton to help keep the city clean, safe and attractive over the summer months. Citizens, community groups, schools and businesses work with Capital City Clean Up to make Edmonton sparkle. Litter Kits provided by the City help reduce the amount of litter in your community. An online form is used to sign up for individual/household clean up as well as event organizers and larger groups who wish to participate.</p> <p>Cape Breton Regional Municipality, NS: The Trashformer Program is a partnership formed between the Cape Breton Regional Municipality Solid Waste Department and ACAP Cape Breton to remove litter and debris from the community. Each summer since 2011, a new group of dedicated, hardworking students are trash-formed into a group of litter busters. The group’s mission is to win the battle against litter. A litter strategy has undergone the research and planning phase to continue to address ongoing litter challenges.</p> <p>Township of Langley, BC: In April, 2015 the Township on Langley, BC approved their Litter and Illegal Waste Management Strategy. This strategy was developed with input from the public and is based on three pillars: education, infrastructure and enforcement.</p>

Option 16	Improve Participation in Litter Reduction Education Programs
	<p>To effectively deal with increases in litter and illegal dumping, a comprehensive Township-wide strategy was created to focus on a proactive approach. Solutions for dealing with and mitigating litter and illegal dumping included: bylaw enforcement and reporting, education, awareness and campaigns, infrastructure and staffing, new programs and developing a public space solid waste management strategy. In 2016 the Township rolled out a Litter and Illegal Waste Communications Campaign that included litter blitzes, tip lines and surveillance cameras. The Township also used a catchy slogan for the campaign ""Don't be an IDIOT"" which stood for illegal dumper in our Township. To kick off the campaign the Township stuck a couch on the sidewalk of one of the Township's busiest intersections during rush hour with a sign that had the campaign slogan in bright, bold lettering.</p>
KPIs	<ul style="list-style-type: none"> ● Public feedback; ● Amount of litter on the streets and other public spaces; and ● Participation in litter reduction programs.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operational costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	3 - Low risk to explore and conduct a review of current litter practices and develop a litter strategy.
Social Impact	Public Acceptance	3 - The public will see firsthand the benefits of a litter strategy. Cleaner streetscapes will help decrease call volume for reports.
	Proven or Unproven	3 - Larger municipalities have used a litter audit to categorize and study litter behaviours and types of waste involved. Litter strategies are used throughout Canadian municipalities.
	Level of Effort	2 - May need assistance from a third party contractor or consultant to develop a litter strategy. Implementation will depend on City resources and Council approval.
Environmental Impacts	Climate Change Impacts	1 - No reduction in GHG emissions during planning phase.
	Land Requirements	2 - No additional land required during the planning phase.
	Nuisance Impacts	2 - No change to nuisances during the planning phase.
	Diversion Potential	1 - No waste diversion change during the planning phase.

Option 17	Explore Potential Revenue Streams for the City Related to Waste
Description	<p>This option is to conduct research to identify opportunities for the City to receive funding that could support its waste management system. It should be noted that environmental credits may include carbon offsets and renewable energy certificates. The City currently generates carbon offsets for the compost facility, though the crediting period for this is expiring at the end of 2024. Other carbon offset projects could include landfill gas to energy (federal or Alberta programs), aerobic landfill bioreactor, biomass/biogas combustion and energy generation. Renewable energy certificates may be generated from landfill gas or AD. A high-level feasibility study could be conducted to evaluate the potential revenues of crediting against implementation costs.</p>
Assumptions	<ul style="list-style-type: none"> • The City’s integrated waste management system will consider programs and/or facilities that can qualify for energy and GHG credits; and • The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.1 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> • Alberta based examples; and • Revenue streams or programs that are applicable to solid waste management providers in Alberta.
Proposed Timing	<p>Planning 2022 and implementation 2023 (timing is aligned with research conducted in Option 8 “Explore AD Upgrades”).</p>
Supporting Rationale (City)	<p>The City’s research could include GHG credits and provincial funding. The Alberta government provides grants through its Emissions Reduction Alberta (ERA) program. The program is funded through Alberta’s Technology Innovation and Emissions Reduction (TIER) fund into which large industrial emitters contribute. TIER is an example of an industrial GHG emissions pricing regulation and emissions trading system. If entities reduce emissions beyond their benchmark, credits are provided. Credited facilities are then exempt from paying the federal fuel charge.</p>
Supporting Rationale (Research)	<p>Vegreville, AB: Alberta-based ATCO Energy Solutions constructed its first renewable natural gas system near Vegreville. The facility will receive feedstock that is a combination of local manure and municipal green bin waste. Pacific Northern Gas, based in BC, is a project partner and the sale of gas from the facility will be a revenue stream. ERA committed \$7.9 million to this project through its Natural Gas Challenge, which is funded through the Government of Alberta’s TIER fund.</p> <p>Strathmore, AB: Wheatland Biofuel in Strathmore (underway - 2024 expected) is a \$285 million project that received \$5 million in funding from ERA. The project will create low carbon intensity ethanol (that meets Alberta’s renewable fuel standards) from biogas. \$12.1 million announced for projects worth over a half billion dollars.</p> <p>Medicine Hat, AB: In addition to TIER, Alberta’s Renewable Electricity Program, which is administered by the Alberta Electric System Operator (AESO) allows companies to bid on new energy projects in the province, including geothermal, hydro, solar, sustainable biomass and wind. Capital Power’s wind project in Medicine Hat (2019) and EDF Renewables Canada’s Cypress Wind Power project (2018) are examples of local recipient projects. As another revenue stream, the City could explore the possibility of solar power installations being built at its waste management facilities in order to recover costs.</p>
KPIs	<ul style="list-style-type: none"> • Funding and/or credits potential per scenario; • GHG emissions per scenario;

Option 17	Explore Potential Revenue Streams for the City Related to Waste
	<ul style="list-style-type: none"> Public feedback (e.g., number of residents who express interest if research includes public engagement); and Partnership interest (e.g., number of respondents in a Request for Information (RFI), survey or stakeholder process that gauges potential energy-industry interest).

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operational costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	3 - There are no anticipated risks involved with conducting the background study. The costs of the study are within the City's control.
Social Impact	Public Acceptance	3 - It is most anticipated that the community will be accepting of this option to conduct research.
	Proven or Unproven	3 - Funding sources are available to municipalities throughout Canada.
	Level of Effort	1 - The City would need to use internal resources and staff, or hire a consultant to do the research and analysis of this study.
Environmental Impacts	Climate Change Impacts	1 - No anticipated GHG impacts of conducting this study.
	Land Requirements	2 - No anticipated land requirements for this study.
	Nuisance Impacts	2 - No anticipated nuisance impacts from this study.
	Diversion Potential	1 - No anticipated diversion impacts from this study.

Option 18	Explore Waste to Energy Options
Description	To explore this option the City could review the information it has, consider feasibility of WTE in relation to other disposal options and communicate findings to decision makers, such as senior management or Council. This communication may take the form of a memo that describes WTE and other available disposal options and considers the resource and implementation requirements, such as costs and timing. It should be noted that this option should be explored only when the landfill begins to reach capacity and requires alternative approaches to increase landfill life expectancy.
Assumptions	<ul style="list-style-type: none"> • There is no WTE facility in proximity to Medicine Hat that could receive the City's waste under contract; • The costs and timeline for a new facility would be prohibitive for a municipality the size of Medicine Hat without extensive agreements from other jurisdictions or private partners for the receipt of waste from other sources; and • The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.1 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> • The jurisdictional scan is aimed to demonstrate WTE technologies that are available in Alberta. WTE is more common in Europe and Asia, with some in USA and very few in Canada, which has larger land mass and therefore more overall options for disposal.
Proposed Timing	Planning 2022/2023 (research can begin immediately; however, the feasibility and planning process to identify costs, timelines, approvals, siting and construction requirements is a lengthy process) and implementation 2032
Supporting Rationale (City)	<p>WTE options were not proposed in the previous Waste Management Strategy; however, it does mention that as WTE technologies become more widespread and supported in comparative Canadian municipalities, it may be considered. It has been identified as an option to explore to highlight its efficacy in Medicine Hat at its current state.</p> <p>From an environmental perspective, energy derived from waste can displace the need for energy from fossil fuels and therefore decrease greenhouse gas emissions.</p>
Supporting Rationale (Research)	<p>Leduc, AB: Commercial viability of any technology would need to be confirmed as part of the process of examining various options. The City of Leduc issued a Request for Information to seek information on alternative technologies to process residual municipal solid waste. The call requested information from companies offering biological treatment, thermal treatment and/or refuse derived fuel technologies. The Call was posted on July 12, 2022 and 18 have registered as plan takers for the bid. While the reason for a company's interest in the bid and the specific technologies they might offer is unavailable, the following potential suppliers are listed under an Alberta address: 2 Point 0 Ltd, 360 Energy Liability Management, Energy Capital Inc., Akamihk Kanataskiy Ventures Ltd., Ketek Group Inc., ONEC Group, Project Mountain, Stantec and Waste Management of Canada Corp.</p> <p>Durham-York, ON: The most common alternative disposal technology used to process municipal solid waste is mass burn incineration. In Ontario, the Durham-York Energy Centre is operated by new Jersey-based Covanta Energy Corp and can process 140,000 tonnes per year while generating enough electricity for 10,000 homes. This disposal option was included in Durham Region Long Term Waste Management Strategy Plan, which was endorsed by Durham Regional Council in 1998. Operations began in 2016.</p>

Option 18	Explore Waste to Energy Options
	<p>Toronto, ON: The business case for a facility typically relies on a constant supply and somewhat homogenous feedstock that can recover the desired output(s) (e.g., fuel, steam, electricity, metals) and the corresponding revenue from the outputs in order to make it viable. Conducting a waste characterization and forecasting study prior to further consideration of this option should be considered. An example of a jurisdiction that completed such a study prior to further consideration of a technological solution, is the City of Toronto who conducted a Mixed Waste Processing Study Update Mixed Waste Processing Study Update. Note that Task 1 included a waste characterization and waste forecasting exercise prior to a jurisdictional scan and vendor/market research to better understand the need and feasibility of available technologies.</p> <p>Pasco County, Florida: As well as determining feedstock requirements and available technologies, WTE systems require end markets or disposal for ash coming out of the process. In 2014, Pasco County and the University of Florida began to investigate the use of ash for road construction, which would offset the need for limestone and were awarded a permit by the state government for the use of bottom ash to be used as road aggregate. In 2020 the Conanata Pasco facility received approximately 42,905 collection trucks and produced enough electricity to power 18 thousand homes for a year.</p>
KPIs	<ul style="list-style-type: none"> • Public feedback; and • Waste diversion.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	3 - This option engages in research and preparing information; therefore, has no liability or environmental risk.
Social Impact	Public Acceptance	2 - At this stage of the option due to only being to conduct research on available options for WTE, public perception does not factor into the evaluation. If the option develops and a site is considered, the public would become a significant element in the evaluation. Common environmental concerns for WTE options include the dioxins released into the air. There is also a need for more feedstock to run the equipment, which means a lower diversion rate which may impact resident behaviour in regards to reuse.
	Proven or Unproven	1 - Given the size of the City, there are no full scale examples of implementation of WTE facilities within Alberta; however, other municipalities are beginning to show interest within Alberta and there could be proven implementation within the next 10 years.
	Level of Effort	1 - Developing this option further would be a complex undertaking; however, at this stage it is only a research-based option.
Environmental Impacts	Climate Change Impacts	1 - This option is research-based, therefore does not impact GHG emissions.

Evaluation Criteria	Indicator	Evaluation
	Land Requirements	2 - Land requirements will be a significant factor in later stages; however, due to being a research-based option, there are minimal land requirements.
	Nuisance Impacts	2 - This option is research-based and therefore will not impact nuisances.
	Diversion Potential	1 - This option is research-based and therefore will not impact diversion. Research should; however, include impacts on diversion to understand resident changes of behaviour due to requiring higher amounts of feedstock as well as understanding the pre-screening requirements of feedstock and if there is any diversion potential.

Option 19	Explore Glass Recycling Marketability
Description	This option may include conducting a current state review and jurisdictional scan of best practices for the marketability of glass recycling.
Assumptions	<ul style="list-style-type: none"> • Glass is not currently accepted into the City's curbside recycling program (but is accepted at the depots); and • The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.1 FTE recommended)
Area(s) of Focus	<ul style="list-style-type: none"> • Alberta based examples.
Proposed Timing	Planning 2023 and implementation 2026.
Supporting Rationale (City)	Glass has been identified as a 'problem' material, especially in the recycling drop off depots.
Supporting Rationale (Research)	<p>Alberta: Many jurisdictions in Alberta do not collect glass in their recycling program. Alberta Depot takes glass beverage bottles and exchange for a deposit; \$0.10 for < 1L bottles and \$.025 for >1L bottles. Glass containers are crushed and the glass is formed into tiny glass beads. In Alberta, the glass is spun into thin strings (like cotton candy) and used to make fiberglass insulation. Glass is typically re-used and not fully recycled to make new post-consumer glass items. The only glass processing company in Alberta is Vitreous Glass Inc., which turns post-consumer glass into glass cullets. There are only seven recycling plants in Canada for glass processing, which makes glass recycling an issue for most municipalities. The colour of glass is an issue when sorting at the material recovery facilities as well as contamination. Other issues with glass recycling is the marketability in Alberta along with weight of transportation.</p> <p>It costs approximately \$29/tonne to move and process glass; however, Calgary and many municipalities in North America have found little demand for pulverized glass. Cleaning, smashing and sorting the glass materials into pure silica is too expensive to be appealing to most businesses. There are currently 3 fiberglass processing plants and 0 glass processing plants located near Red Deer and Edmonton according to the Glass Recycling Coalition. These plants include: Certaineed Corp, Owens Corning and Johns Manville.</p>

Option 19	Explore Glass Recycling Marketability
	<p>The City of Calgary mixes glass materials into an aggregate which is used as a base layer for roads; approximately 10% of recycled glass is combined with 90% aggregate. Pure, clean and separated glass gathered through bottle depots is often used to make reflective road paint or as fibreglass insulation.</p> <p>Manitoba: Due to cheaper transportation and amalgamation of the glass industry, most glass processing facilities have closed in Western Canada. It is currently cheaper to ship finished containers than glass cullets; a study (2018) stated that the closest glass cullet buyer for Winnipeg was in Minneapolis and paid \$21/ton while transportation costs are estimated to be \$120/ton. The cost of transportation seems to be the major deciding factor of whether to pursue glass recyclability. There is a market for clear cullets in Moose Jaw, Saskatchewan for reflective road paint and Edmonton, AB and Quesnel, BC for sandblasting media; however, the plant in Quesnel pays \$0/ton while transport cost are up to the Alberta recyclers.</p> <p>Niagara Recycling, ON: Niagara Recycling is the only Materials Recovery Facility (MRF) in Ontario that produces an end product from a recyclable material called Niagara Ecoglass. Ecoglass is created through an innovative process of cleaning, grinding, drying, screening and packaging glass that is received through the blue box collection program. Niagara Ecoglass is sold across Ontario and Quebec in 50 lb bags or 3,000 lb super sacs. Ecoglass is used most commonly for sandblasting but can also be used for landscaping applications.</p> <p>Ontario: NexCycle Industries, located near Guelph, Ontario, processes both post-consumer and post-industrial scrap glass from residential curbside collection, deposit return programs and from bottle, plate and automotive manufacturers. Scrap glass is processed into cullet which is then sold back to the glass manufacturing industry to be used as a raw material. The most common material that is collected at the local municipal material recovery facilities is mixed broken glass (MBG). The primary challenges of marketing Ontario's glass are distance to end markets and meeting end market specifications. The majority of glass end markets that may be able to process glass are located in the United States. Cost to transport Ontario glass to these end markets may be significant. In addition to the transportation cost, there is likely a processing fee for mixed broken glass which may further make these options cost prohibitive. Therefore, municipal MRF's generally prefer to market glass to facilities located closest to their MRF to minimize their overall cost. Glass end markets require suppliers to provide them with material that is of a quality that can be processed by the current equipment in their facilities. Unfortunately, curbside glass is often contaminated with other materials such as paper and plastic.</p> <p>Quebec: In 2016, Éco Entreprises Québec (ÉEQ) launched and financed its Innovative Glass Works Plan, an initiative devise to modernize Québec sorting centres and support growth of markets to give glass a new life, with the goal of recycling 100% of glass collected from curbside bins. ÉEQ invested \$12.2 million in the Innovative Glass Works Plan, including the implementation of major pilot projects. The project has shown that it is possible to recycle 100% of the glass collected via curbside recycling in Québec. The solutions are feasible, along with the expertise and knowledge necessary to implement them. The deployment of measures to reach this goal requires global investments of approximately \$50 million to equip all sorting centres with glass processing machinery, develop the various glass markets, carry out a Québec-wide awareness campaign on glass recovery and recycling, as well as implement measures to monitor and control quantities sorted and recycled.</p>
KPIs	<ul style="list-style-type: none"> • Glass diversion.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	3 - Low risk to explore and conduct a feasibility study on the end markets for glass.
Social Impact	Public Acceptance	1 - Public may not know the current issues with glass recycling and could oppose the study if costs are high.
	Proven or Unproven	1 - Currently there is not a market glass recycling that is feasible, the largest deterrent is the cost of transportation. Most glass processing facilities are located in the United States which pay less for the materials than the transportation costs.
	Level of Effort	2 - Implementation to conduct a feasibility study could go through a third party contractor or consultant. Could also be done with existing staff depending on resources and capabilities.
Environmental Impacts	Climate Change Impacts	1 - A feasibility study will have no impact on GHG emissions.
	Land Requirements	2 - A feasibility study will have no land requirements.
	Nuisance Impacts	2 - A feasibility study has no impact on nuisances.
	Diversion Potential	1 - A feasibility study has no impact on waste diversion.

Option 20	Continue Conducting Waste Composition Studies (Curbside and Landfill)
Description	The City could conduct waste composition studies in SF, MF and ICI sectors. This may be completed on a quarterly basis every two to four years to obtain seasonal data trends. The neighbourhoods / buildings to audit could be selected through a route analysis that can consider historical tonnages, demographics, owned/rented units, etc. The frequency and type of future waste composition studies may depend on program or policy changes and/or address compliance issues; however, with the fast-paced changes in material composition, it is recommended to conduct some form of waste composition studies every two years. A trained subject matter expert may be utilized to confirm data is collected and calculated accurately.
Assumptions	<ul style="list-style-type: none"> ● The proper use of safety equipment is used during the waste composition studies; ● The staff conducting the waste composition studies are properly trained; ● Accurate data is gathered during the waste composition study; and ● The City will retain additional staff to conduct this option based on current labour resourcing analysis and needs (0.1 FTE recommended).
Area(s) of Focus	<ul style="list-style-type: none"> ● Alberta based examples.
Proposed Timing	Planning 2023 and implementation 2024.
Supporting Rationale (City)	More waste composition studies in all sectors (SF, MF and ICI) could help establish a better understanding of the current trends and problem areas. Diversion targets and methods could be determined based off of findings pre-collection.
Supporting Rationale (Research)	<p>Municipalities in Canada have been conducting waste composition studies for decades as they provide valuable insights into program operations, aid in directing promotion and education resources and assist in developing long-term waste management strategies. For most municipalities, it will be more important to focus efforts on obtaining sample distribution across the community, especially if the data is being used for program planning. Recognizing that many communities have distinct demographic groups, it's typically easiest to divide a community based on income levels as a surrogate for demographic differences. This can be done by obtaining Statistics Canada data on household income levels and proportioning it out into low, medium and high income.</p> <p>Waste composition studies are a scientific approach aimed at collecting precise data about the characteristics of waste. This includes weight, composition, waste stream and disposal streams. To be credible, composition studies should be conducted using a trustworthy methodology and audit team. Most waste composition study methodologies indicate that physical waste sorting is more accurate than visual assessments alone; however, visual assessments can be used to have a relative understanding of materials impacting waste streams.</p> <p><u>Standard Waste Composition Study Methodologies:</u></p> <ul style="list-style-type: none"> ● ASTM D5231-92(2008) - This test method describes procedures for measuring the composition of unprocessed municipal solid waste (MSW) by employing manual sorting. This test method applies to determination of the mean composition of MSW based on the collection and manual sorting of a number of samples of waste over a selected time period covering a minimum of one week; and

Option 20	Continue Conducting Waste Composition Studies (Curbside and Landfill)
	<ul style="list-style-type: none"> ● BOMA BEST Methodology - BOMA BEST is a national green building certification program launched by BOMA Canada in 2005 to address an industry need for realistic standards for energy and environmental performance of existing buildings based on accurate, independently verified information. BOMO has published waste composition study guidelines and guiding principles for ongoing monitoring of waste composition and understanding waste. BOMA indicates that at a minimum, a waste composition study should be carried out every three years; although, annual waste composition studies are recommended. <p>Calgary, AB: Waste composition studies are periodically conducted by Waste and Recycling Services to help assess the performance of diversion and education programs and inform improvements and new program design. In 2019, the City assessed the waste composition of black carts and garbage bins, in the residential (single family and multi-family) sector and for businesses and organizations. The single family sector results represent the pooled average of 20 to 25 samples collected in 18 communities in each of the four seasons of 2019 (72 samples). The communities sampled were selected to collectively represent the range of housing types and demographics in Calgary. The multi-family results represent garbage bin waste from multi-family complexes and represents the pooled average of samples in each of the four seasons of 2019 (40 samples). The multi-family developments sampled included both low rise and high rise types and all were customers of the City’s Commercial Collections service. The weight percent composition is provided for a number of material categories and subcategories.</p> <p>Lethbridge, AB: The City requires businesses to conduct waste composition studies and develop waste reduction plans. Waste composition studies in 2019 showed that 57% of materials currently landfilled through black carts could be diverted and recovered through an organic treatment system. Research shows that this is not uncommon, as similar waste composition study results are found in similar Canadian communities. This data supports the implementation of an organics diversion program in Lethbridge. The research also demonstrates a need to provide a convenient collection program to obtain satisfactory customer participation.</p> <p>Strathcona, AB: Waste composition studies are used as a performance management tool in Strathcona County to methodically analyze each waste stream. The data gathered from these waste composition studies is used in the development on long-term planning and ongoing reporting for regional waste management trends and goals. Overall, from 2017 to 2019 waste composition study results demonstrated that there was still a significant amount of divertible materials found in the waste (black cart) stream, confirming there is room for improvement in waste diversion in the County and that not all households are participating in the black cart program. In 2019, waste compositions studies showed the black cart contents included organic waste, textiles and recyclables such as plastic.</p>
KPIs	<ul style="list-style-type: none"> ● Number of waste composition studies; and ● Waste composition findings including waste diversion rate.

Evaluation Criteria	Indicator	Evaluation
Economic Feasibility	Annual Operational Costs	3 - Operating costs are estimated to be less than \$1,000,000.
	Capital Costs	3 - There are no expected capital costs for this option.
	Level of Risk	2 - There is always risk involved with waste composition studies; however, the can be mitigated using safety equipment. Waste composition studies help develop an understanding of waste consumption habits and identify areas for improvement which could benefit the environment in the long term.
Social Impact	Public Acceptance	2 - Some residents may feel their privacy is being compromised by having their waste sorted and analyzed.
	Proven or Unproven	3 - The majority of municipalities in Canada conduct waste composition studies to understand their residents waste habits and develop programs based on the outcomes.
	Level of Effort	3 - Implementation and level of effort required to conduct waste composition studies is relatively easy.
Environmental Impacts	Climate Change Impacts	1 - Waste composition studies have little to no impact on GHG emissions; however, their findings may impact future waste diversion programs.
	Land Requirements	2 - Waste composition studies do not require additional land.
	Nuisance Impacts	2 - Waste composition studies do not have any related nuisance impacts, they are typically completed at a waste disposal site.
	Diversion Potential	1 - Waste composition studies do not impact waste diversion; however, their results may help shape future diversion programs.

Evaluation Summary

Option	Economic Feasibility				Social Impact				Environmental Impact				TOTAL	
	Operating Costs	Capital Costs	Level of Risk	Subtotal:	Public Acceptance	Proven/Unproven	Level of Effort	Subtotal:	Climate Impacts	Land Requirement	Nuisance Impact	Diversion Impact		Subtotal:
1: Develop a food waste curbside collection pilot program	3	3	2	8	3	3	2	8	2	2	2	3	9	25
2: Expand and improve education programs and outreach	3	3	3	9	2	3	2	7	1	3	2	1	7	23
3: Consider expanding multi-residential and commercial recycling collection	3	3	2	8	1	2	2	5	2	3	2	3	8	21
4: Develop a C&D Policy	3	3	3	9	3	3	2	8	1	3	2	3	9	26
5: Explore additional tipping rates for certain materials	3	3	2	8	2	3	3	8	1	3	2	3	9	25
6: Explore options to optimize landfill airspace	3	3	2	8	3	3	3	9	2	3	2	2	9	26
7: Explore ways to reduce wind impact at landfills and decrease closure	3	3	3	9	3	3	3	9	1	2	3	1	7	25
8: Explore upgrades available for anaerobic digestion	3	3	3	9	3	3	3	9	1	2	2	1	6	24
9: Develop bylaw amendments to increase enforcement capabilities	3	3	3	9	2	3	2	7	1	2	1	1	5	21
10: Explore options to develop a green city fleet	3	3	1	7	3	1	1	5	2	1	3	1	7	19
11: Develop a circular economy roadmap	3	3	3	9	3	3	2	8	2	2	2	2	8	25
12: Explore a single use plastic item ban	3	3	3	9	3	2	3	8	1	2	2	1	6	23
13: Identify impacts extended producer responsibility will have on current operations	3	3	3	9	2	3	3	8	1	2	2	1	6	23
14: Develop a strategy for promotion of non-profits that accept and sell reusable items	3	3	2	8	3	3	2	8	2	2	2	1	7	23
15: Create a joint effort with the wastewater treatment plant on how to manage biosolids	3	3	3	9	2	3	3	8	1	1	2	1	5	22
16: Improve participation in litter reduction education programs	3	3	3	9	3	3	2	8	1	2	2	1	6	23
17: Explore potential revenue streams for the City related to waste	3	3	3	9	3	3	1	7	1	2	2	1	6	22
18: Explore waste-to-energy options	3	3	3	9	2	1	1	4	1	2	2	1	6	19
19: Explore glass recycling marketability	3	3	3	9	1	1	2	4	1	2	2	1	6	19
20: Continue conducting waste composition studies (curbside and landfill)	3	3	2	8	2	3	3	8	1	2	2	1	6	22

*The rankings range from 1 to 3 where 1 indicates the least favourable outcome and 3 indicates the most favourable outcome; therefore, the higher an option scores the more favourable it is.

Evaluation Total Range: 10 to 30