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Business Case for Residential Communal Collection

Mandatory Source Separation

(Formerly: Multi-unit Program)

City Operations | Waste Services

City of Edmonton

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Change History

Version #	Date	Author	Description
0.0	February 26, 2020	Alison Abbink	Creation of the document for drafting.
1.0	March 26, 2021	Alison Abbink	Major revisions based on team feedback.
2.0	April 16, 2021	Alison Abbink	Major revisions based on team feedback and addition of cost information.
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Document Approval

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1. Executive Summary

Currently, the communal collection program collects two streams: commingled garbage and recycling. The program uses front load bins (bins that are serviced with front load vehicles) that are shared by residents of multi-unit properties. This program is provided to apartment and condo properties that cannot be serviced by curbside collection. Participation in recycling collection is voluntary at the property level. The garbage and recycling collected is processed at the Edmonton Waste Management Center (EWMC), where streams can be mechanically sorted and a portion is diverted from landfill.

The current approach, which requires processing large amounts of unsorted waste, has limited the effectiveness and efficiency of the waste processing facilities. Although the City's waste processing infrastructure includes a Refuse Derived Fuel (RDF) Facility, which is able to divert residual waste, the production of RDF is not meant to replace actions that achieve diversion through more sustainable processes such as composting, anaerobic digestion and recycling. As outlined in Edmonton's 25-year Comprehensive Waste Management Strategy (Waste Strategy)[1], and in alignment with the internationally accepted solid waste management hierarchy, waste systems should prioritize waste reduction, reuse, and recycling and composting above materials recovery in order to operate efficiently.

Most recently, the diversion rate for the sector dropped from 14 percent (in 2019) to nine percent (in 2020), largely as a result of negative impacts resulting from the closure of the Edmonton Composting Facility and the COVID-19 pandemic. Without consideration for the additional diversion that can be achieved from the production of Refuse Derived Fuel, or the additional diversion that is expected to be achieved through the options contemplated in this business case, waste diversion from the sector is expected to increase over the coming years to a projected total of 41 percent (as a result of system improvements including processing facility enhancements and investments in additional processing capacity) but to then stagnate without changes to the collection program.

Continuing the status quo service will not achieve the City's strategic goals, particularly the goal of 90 percent diversion across all sectors set in Edmonton's 25-year Waste Strategy. Substantive program changes are required to align the communal collection program in support of this goal.

Program components that are critical to achieving a high diversion rate were identified through comprehensive research. These components address the many challenges unique to the communal collection program, such as anonymity, space constraints and less convenient access to disposal for specific waste streams. These components include source separation of waste streams; convenient, equal access to containers for all waste streams; and targeted, sustained

[1] CR_5829 Waste Strategy - Comprehensive Waste Management Strategy 2019

education. Communal collection customers have not historically received targeted educational support to overcome these challenges. Residents that receive curbside collection have benefited from enhanced education and outreach.

Transitioning to a three stream source separated collection program is a key starting point to addressing challenges, capitalizing on opportunities and making meaningful progress toward the goals of the Waste Strategy.

Table 1 highlights the recommendations being made by Waste Service:

Table 1: Recommended Alternative Summary

Recommended Program	
Source separation of three streams	Mandatory
Colocation of waste containers	Mandatory
Chute closures	Voluntary
Potential diversion increase	16%
Costs and Net Present Value (NPV)	$29.2M Capital $91.0M Operating & Maintenance $-67.6M NPV

With a capital cost of $29 million, and operating and maintenance cost of $91 million over the life span of the project, the recommended alternative is anticipated to add an additional 16 percent to the projected diversion rate, moving the communal collection program closer to the 90 percent diversion target and addressing a performance gap that would be difficult or impossible to close with processing improvements alone. The recommended alternative also received the highest level of support from both residents and property managers through two phases of public engagement.

In addition to the recommended alternative for the program, Waste Services is proposing that City Council endorse the implementation of enforceable developer standards for new buildings, and a regular program review. Waste Services is also requesting that City Council advocate for landfill disposal bans at a provincial level. While these items require endorsement from Council, additional funding is not requested as they can be accomplished within the current budget.

If approved, implementation for the program will be phased. Property evaluations will begin in

2022, with rollout commencing in 2023 in multiple phases that are expected to continue for approximately four years.

Once proposed program changes have been approved by City Council, work can commence on updating the Waste Services Bylaw 18590 to align with the program requirements. Bylaw recommendations are expected to follow at a later date for review by City Council.

2. Background

For more than 25 years, Waste Services has sought to continually evolve the City of Edmonton's waste management practices to reduce environmental impacts and achieve financial stability. This commitment to sustainability has been recently reaffirmed by the City of Edmonton's Strategic Plan: Connect Edmonton[2], which sets out four goals: Healthy City, Urban Places, Regional Prosperity, and Climate Resilience. It has also been reaffirmed by the City Plan[3] Outcome 1.4: Edmontonians demonstrate shared leadership as stewards of the environment.

By connecting to those key strategic documents the Waste Strategy sets the City on a path of significant change to the way that waste is perceived and managed. This path begins by reaffirming the goal of 90 percent waste diversion from landfill across all sectors and adopting a zero waste framework, and will continue as the City develops and implements programs to require source separation of recyclables, food scraps and yard waste, and takes on new initiatives to reduce waste generation.

The Waste Strategy outlines how consistent requirements for source separation, supported by comprehensive educational campaigns and regulatory measures, will help to achieve the diversion rate goal set by City Council. An updated timeline to implement source separation across all sectors, citywide, was developed in response to the impacts of the COVID-19 pandemic and is depicted in Figure 1.

[2] Connect(ed) Edmonton - Edmonton's Strategic Plan 2019 - 2028

[3] Charter Bylaw 20000 - Edmonton City Plan 2020

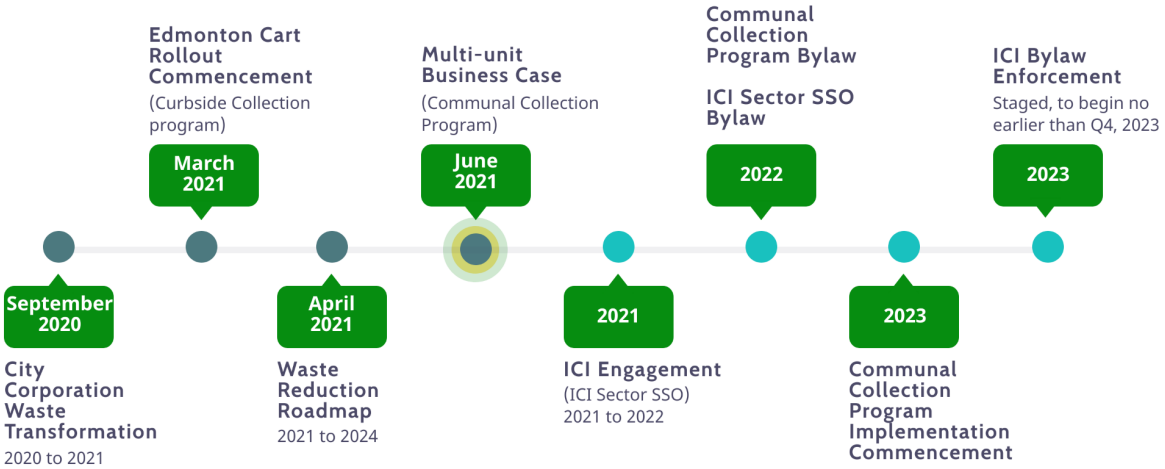

Figure 1: Waste Strategy Implementation Timeline

Following the launch of the cart-based system for the curbside collection program (the Edmonton Cart Rollout) and the approval of Edmonton's first Waste Reduction Roadmap (Roadmap'24) in May 2021, the City is ramping up the next steps for source separation in the communal collection program and Industrial, Commercial and Institutional (ICI) sector.

2.1. Current Situation

2.1.1. Sector Classification and Billing Structure

The City of Edmonton provides waste collection and processing services to multi-unit residents receiving communal collection under a municipal utility model. This means that all units receiving the service pay the same utility fee, receive service from the City, and do not have the ability to choose a different service provider or a different level of service. In addition to paying for the cost of waste collection and disposal, rate payers contribute to the costs of Eco Stations, Community Recycling Depots, waste education programs, management of the City's closed former landfills, and the operations of the Edmonton Waste Management Centre. The utility model also enables long-term investments in assets to support responsible waste management and aggressive waste diversion targets, along with the associated debt and amortization costs of advanced waste diversion facilities like the City's Materials Recovery Facility (MRF), High Solids Anaerobic Digestion Facility (HSADF) and Refuse Derived Fuel (RDF) Facility. This ensures all residents of Edmonton have access to the same services, pay for the shared responsibility of the closed landfills, and share in achieving the City's waste diversion objectives.

When City Council approved the Waste Strategy, it also approved changes to the Waste Services Bylaw 18590[4] which made changes to the utility rate structure. Previously, residents living in single unit properties were classified as "single unit residential" and those living in a multi-unit

[4] CR_6362 Waste Bylaw - Summary of Proposed Bylaw Changes 2019

property were classified as “multi-unit residential.” The rate paid by a resident was based on the type of dwelling they resided in, not the collection program they received. This meant that some multi-unit residents receiving curbside service (a higher cost service) paid the lower rate associated with communal collection. The updated bylaw aligns utility rates with the type of service received rather than the dwelling type. Now, residents pay either a cart collection rate (i.e. curbside collection program) or a bin collection rate (i.e. communal collection program), depending on the service they receive. Multi-unit properties that receive curbside collection have begun to transition to the new classification and are included in the Edmonton Cart Rollout.

An effort has been made to move away from using “single unit” and “multi-unit” terminology throughout this business case, where possible, since waste services and utility rates are no longer associated with dwelling type. Instead, the terminology is focused on the collection programs provided to residents: curbside collection and communal collection. Curbside collection refers to the collection of individual containers either at a front street or back alley location. Each household is responsible for setting out waste in containers that are allocated on an individual basis. Communal collection refers to the service that is provided through the use of shared containers located in an indoor waste room or outdoor location. Containers for communal collection are allocated at a building level rather than on an individual basis. This business case is focused on the communal collection program.

2.1.2. Collection Approach

Currently properties that receive communal collection (such as apartments and condos) can have waste collected in two streams: garbage and recycling. Front load bins are used for both streams in the majority of cases (a small number of properties have recycling collected in blue bags that are placed in a central location, without a bin). Participation in recycling is voluntary, and as a result, approximately 36 percent of properties (representing 16 percent of units) do not have a recycling bin. The estimated number of multi-unit properties receiving communal garbage and communal recycling collection is shown in Figure 2. Front load bins are shown in Figures 3 and 4.

Figure 2: Current Multi-unit Site Breakdown for Garbage and Recycling Collection

There is currently no limit on the quantity of waste that is collected from communal collection customers. While bins are collected on a regular schedule, additional collection is provided at no cost to a building if a bin becomes full between regular collection days.

Residents set out all household garbage, including compostable material such as food scraps, in the garbage bins. For properties with recycling bins, residents can place all recyclable materials in the recycling bin. Residents of properties without recycling bins may choose to drop off their recyclable materials at a Community Recycling Depot.

Due to the variation in building sizes and infrastructure, bins ranging in size from two to eight cubic yards are provided by the City. This allows the service to be tailored to best meet the needs of each property. Collection of garbage and recycling is done by the City or the City's contractors.

Figure 3: Collection of a Recycling Bin

Figure 4: Communal Bins - Recycling (left) and Garbage (right)

2.1.3. Processing of Communal Collection Program Waste

Currently garbage from the communal collection program is taken to the EWMC for processing. Residential garbage arriving at the EWMC is mechanically sorted at the Pre-Processing Facility (PPF) inside the Integrated Processing and Transfer Facility (IPTF) and sent to other facilities for further processing. Since the closure of the Edmonton Composting Facility (ECF) aeration hall in 2019, a limited quantity of organic waste has been sent for processing at the High Solids Anaerobic Digestion Facility (HSADF) and the Cure Site. Additional capacity to process organic waste is currently being provided by third party composters in the region. Similarly, another portion of the waste that has been pre-processed can be processed into Refuse Derived Fuel (RDF).

Recycling from both curbside and communal collection programs arrives at the EWMC at the MRF for sorting. After being sorted into streams, the material can then be sold to recycling markets. A facility renewal project to increase the processing capacity and performance of the MRF was approved in October 2020[5].

2.1.4. Diversion Rate

It is estimated that approximately nine percent of communal collection waste was diverted from landfill in 2020. This figure is based on the total volume of waste that was recovered out of the total volume of waste generated by residents and includes both the collection and processing aspects of the communal collection program as well as contributions from waste drop off programs such as Eco Stations and Community Recycling Depots. Based on recent analysis of multiple municipalities, as much as 40 percent of communal garbage is organic waste (i.e. food scraps) and an estimated further 32 percent is recyclable material. These numbers are in addition to the recycling that is already collected separately through the City's voluntary recycling program.

A Diversion Rate Calculation for the communal collection program is available as a separate document presented with this business case (Attachment 5).

2.1.5. Education and Outreach

Currently, Waste Services has limited educational resources specific to the communal collection program. Online resources include a web page with information about the service. Print resources include a brochure entitled *Your Guide to Waste and Recycling* (which was initially designed for English Language Learners).

Residents have also been invited to take advantage of other educational events and tools that are offered to all Edmontonians, such as the tours of the Edmonton Waste Management Centre, the *WasteWise* mobile app, and a printable *What Goes Where* poster. Currently, Waste Services does not have any in-person educational programs specifically targeting communal collection

[5] CO00057 Material Recovery Facility (MRF) Renewal Business Case Report 2020

and there are currently no dedicated education staff to support communal collection customers.

2.1.6. Regulatory Requirements

Waste Bylaw 18590 was revised in 2019 to align with leading municipal best practice to support a waste program designed to achieve high diversion targets. Two best practices are establishing mandatory source separation of waste streams and setting volume limits. The revision in 2019 did not introduce regulatory requirements related to volume limits or mandatory three stream source separation for residents receiving communal collection. Those best practices are reflected in the sections of the bylaw related to curbside collection.

The bylaw currently supports the proposed changes in this business case, but further revisions will be required to bring it into full alignment.

Currently, developer guidelines, which describe the size and location of waste management facilities as well as vehicle access requirements for new multi-unit properties, are presented by Waste Services during the permitting phase of a new development, and must be reflected in the Comprehensive Site Plan required by Clause 13.5 of Edmonton Zoning Bylaw 12800[6]. As the Zoning Bylaw is updated, ongoing alignment with the Waste Bylaw and updated Waste Design Standards, along with enhanced procedures to ensure standards are reflected in completed developments, will be required to provide clarity to developers and require best practices for waste management to be incorporated into all new buildings.

2.2. Planning and Growth

The City Plan[7] provides an outlook for the growth and evolution of the City. As the City continues to grow from one million to two million residents, a substantial increase in growth in medium to high density dwellings such as apartments and mixed use properties is anticipated. Steady growth in high density residential development is expected over the next ten years, followed by more intense increases in subsequent years. The City Plan anticipates that a total of 280,000 medium density and 220,000 high density dwellings will be required in order to accommodate two million residents.

The City Plan estimates that medium and high density dwellings will account for 59 percent of all dwellings city-wide with at least 50 percent of net new units added through infill. This growth will influence how programs and services will need to evolve to keep up with demands, and will play a large role in how waste is collected in the City. It will become increasingly important for design and development standards to become enforceable and consistently utilized for new developments while allowing for flexibility and innovation in response to emerging needs, to ensure that this growth is aligned with best practices and service standards.

[6] Edmonton Zoning Bylaw 12800 2017
[7] Charter Bylaw 20000 - Edmonton City Plan 2020

3. Challenges and Opportunities

3.1. Diversion

In 2020 the diversion rate for the portion of the residential sector that receives communal collection services dipped to nine percent. This rate includes collections and processing, as well as waste drop off programs. This decrease in diversion is largely a result of negative impacts resulting from the COVID-19 pandemic and the closure of the ECF aeration hall. Over the coming years this diversion rate is expected to increase as a result of processing facility enhancements and investments in additional processing capacity to reach a projected total of 41 percent, even without changes to collection.

This diversion forecast, and others presented throughout this business case, does not include the diversion that can be achieved by processing mixed waste into Refuse Derived Fuel (RDF), since the intended feedstock for the City's RDF process is municipal solid waste that cannot be recycled or composted. The diversion impact of RDF was removed from the calculations presented in order to clearly show the impact of source separation of waste for the communal collection program. The diversion potential of RDF should be seen as an adding value to both the curbside and communal collection programs, by achieving diversion of residual waste that has traditionally been sent to landfill. As recycling and composting are higher than recovery (including RDF) on the internationally accepted solid waste management hierarchy, the City's waste system emphasizes diversion anchored in source separation before relying on recovery solutions. Without changes to how waste is collected, the diversion rate will stagnate and continue to fall short of the target of 90 percent diversion from landfill, even when diversion from RDF processing is considered.

Calculations and analysis indicate that as much as 72 percent of the material that is currently collected as garbage through communal collection could be diverted through a source separation program. Furthermore, the current recycling stream has a contamination rate of about 22 percent, indicating that waste sorting behaviour can be improved[8]. These two challenges, in conjunction with the 90 percent diversion target across all sectors, present a significant opportunity to manage waste from communal collection customers in a more environmentally sustainable way.

As identified in the 2019 Single Unit Waste Set-out business case[9], the current method of collecting and processing a stream of commingled garbage that contains organic waste reduces the effectiveness of processing facilities and the value of the end products such as compost and RDF, contributing to a lower diversion rate.

Waste that enters the City's pre-processing facility is mechanically sorted by size, rather than

[8] City of Edmonton Four-Season Waste Composition Study 2016
[9] CR_7173 Single Unit Waste Set-out Business Case 2019

type. The waste that is less than three inches in size is classified as organic waste and is sent for processing. However, a significant amount of non-organic materials (such as plastic and glass) is small enough to be mixed in with this stream. This has historically resulted in a lower quality compost which is not suitable for landscaping and horticulture. This limits the uses for and marketability of the product.

A parallel challenge exists with sorting material to be used as feedstock for RDF. RDF relies on a dry waste feedstock for optimum efficiency in the waste to biofuels facility. The mechanical sorting for RDF targets larger waste materials, but there is no effective way to remove relatively wet organic material (such as food scraps). To date, approximately 18 to 20 percent of the waste used to produce RDF consists of wet organic material. As a result, Waste Services invested in additional processing and drying equipment to reduce the moisture content of this waste. Production can be improved if the moisture content of the incoming material is reduced (i.e. by reducing the amount of organic waste in the garbage stream).

City Council's decision to require source separation of food scraps and yard waste in the curbside collection program begins to address the issues described above for waste that originates from the curbside collection program. These improvements will result in an increased diversion rate and reduce the quantity of garbage that arrives at the IPTF, allowing the facility to operate more effectively. However, should the communal collection program continue to set out unseparated waste, the program will be unable to reach the established diversion target.

3.2. Commitment to Cross Sector Consistency

In addition to the opportunity to improve diversion, changes to the communal collection program will help to make requirements for waste sorting consistent across all sectors, as envisioned by the Waste Strategy. Consistency will reinforce changes and support enhanced performance system-wide. Consistent expectations for sorting food scraps, yard waste and recyclable materials at home (regardless of dwelling type), work, school and in the community help to reinforce concepts communicated through educational programs and encourage the formation of responsible waste habits. The growth expected in the number of properties serviced by communal collection presents an opportunity to focus on this sector. The City has an opportunity to leverage its position as the utility provider of residential waste collection service to ensure service consistency that ultimately supports the City's environmental objectives.

Changes to the communal collection service also provide an opportunity to improve educational programs that target communal collection customers. Historically, residents who receive communal collection were provided with fewer, more passive educational resources, compared to the targeted and more abundant educational offerings for residents receiving curbside collection. Significant changes to the communal collection program will require a corresponding level of educational support.

The current program, supported by the Waste Bylaw, only sets parameters for communal garbage collection and optional communal recycling collection, whereas the curbside collection program requires source separation of three streams. Once the program has been updated, revisions will be made to the bylaw to align with the new program requirements.

The City also has the opportunity to better leverage the development process for new properties to ensure that developer standards for waste are reflected in new developments as the city grows. These standards clearly outline minimum expectations for properties across the sector. Current Zoning Bylaw 12800 is undergoing a multi-year, comprehensive overhaul. Revising the Waste Bylaw and the Zoning Bylaw in tandem will allow for deeper integration and collaboration between internal stakeholders, and support the development of aligned regulations, standards and procedures to achieve the intended outcomes of the Waste Strategy, alongside those of the City Plan and other key strategic policies and initiatives.

3.3. Additional Challenges

Communal waste collection differs from curbside waste collection in many ways including a need for more flexible servicing due to space constraints and anonymity of the users. Compared with properties receiving curbside collection, resident turnover in properties with communal collection has a higher impact to service participation and compliance, as large numbers of people may move in a single month.

Properties receiving communal collection tend to have more variety in building size and type. This means there is a need for flexibility in terms of the types and sizes of containers used and service frequency. Where homes receiving curbside collection can be serviced by one type of container (with variations in size to incentivize waste reduction and proper waste sorting), one type does not fit most in the context of communal collection.

Communal waste areas can be located indoors (e.g. garbage rooms on the ground floor of buildings or in underground parking garages) or outdoors (e.g. in parking lots), and properties may also have chutes that allow residents to dispose of waste on the same floor as their dwelling. This variety in infrastructure requires staff to assist properties with allocating space for waste collection containers. The variety also compounds the challenge of providing equally convenient access to containers for all waste streams. Equal access is a fundamental component of successful waste sorting.

Residents who receive communal collection do not always have a direct relationship with the impacts of how they set out their waste. This is a result of two factors: a level of anonymity that is created by many residents sharing a container, and the fact that many residents do not pay the utility rate directly because it is incorporated into rent or monthly condo fees. This lack of a direct relationship can pose challenges to participation in diversion programs and can give rise to higher contamination rates.

In some properties, outdoor communal bins create an opportunity for illegal dumping. Illegal dumping can include disposing of items that don't belong in the waste stream in the bins (e.g. furniture, car batteries) or placing furniture and other prohibited materials next to the garbage and recycling bins, and can include opportunistic dumping by those who are not site residents. Although an illegal dumping strategy is outside the scope of this business case, changes to the service may provide ways to mitigate the impacts of illegal dumping. For example, container and lid size or shape may reduce disposal of bulky items that are problematic when received at processing facilities at the EWMC, and changes to the location may deter people from placing items next to bins.

Based on information gathered during research and Public Engagement, residents of communal collection properties typically move more often than residents in single unit dwellings, and tend to represent a wider variety of cultural backgrounds and languages. Educational programs must therefore address challenges associated with high turnover rates and diverse backgrounds. Ensuring residents have adequate information and support requires more resources and effort from educational staff. Having a robust educational program with resources dedicated to residents of communal collection properties can also impact the behaviour of residents in the curbside collection program in the long term, as people may transition between property types interchangeably over time. This is especially true if the behavioural expectations are similar in both programs.

Overall, the communal collection program presents a more complex situation than the curbside collection program and will require a unique approach to ensure the success of the Waste Strategy.

4. Initiative

4.1. Initiative Description

The alternatives presented in this business case would significantly change the way that residents that receive communal collection sort and set out their waste. These changes include moving from a program that provides garbage collection with voluntary recycling to a program that requires the separation of waste into three streams, and the creation of a targeted education and outreach program to support both residents receiving communal collection and property managers.

The streams proposed for collection are aligned with the three primary streams provided to curbside collection customers:

Garbage - Sorting waste into three streams will inevitably reduce the amount of residual waste, or garbage, set out. As a result, some properties will be able to use smaller containers for this stream. Appropriately sized containers will be provided to every property (with the exception of

compactors which are procured, maintained and replaced by the property owner to reduce the required collection frequency and/or building footprint required for waste collection from large scale multi-unit sites). Limits on the volume of garbage collected will also be introduced, to match expectations of customers receiving curbside collection service, and to incentivize residents to sort and reduce their waste.

Recycling - Recyclable materials make up a large volume of the waste that is generated by residents receiving communal collection service. The alternatives examined in this business case are based on mandatory collection of recycling to increase the recovery of recyclable materials. Suitable containers will be provided to every property.

Food Scraps - The separate collection of food scraps will also be mandatory. This stream will be new to all properties receiving communal collection, and suitable containers will be provided to every property. Containers may also be topped up with yard waste, as is permitted for residents who receive curbside collection service.

A targeted education and outreach program is proposed to ensure residents and property managers are informed of the changes and supported through both the initial program change and the pursuit of targets for program performance.

The impact of the selected alternative will be monitored and evaluated at regular intervals. Additional changes may be made to ensure the program continuously improves and adjusts.

4.2. Urgency of Need

The Waste Strategy and the Corporate Business Plan commit to implementing mandatory source separation in the multi-unit sector (communal collection program) by 2023. This timing is aligned with changes currently underway for curbside collection customers (the Edmonton Cart Rollout) and planned for the ICI sector. Implementation across sectors on similar timelines allows for consistent educational programs, provides equitable service, closes gaps and ensures resident habits are supported across sectors. The success of source separation programs in both residential programs will increase the success of source separation in the ICI sector.

If changes are not made to the communal collection program starting in 2023, the ongoing disparity of services between residential programs may have a negative impact on residents' willingness to participate in the source separated curbside collection program, which will negatively impact the diversion rate in the curbside program. There will also be less rationale for mandatory source separation for the ICI sector.

It will take time to realize the impact of changes to the communal service. By starting to make changes now, Waste Services will be better positioned to achieve the goals of the 25-year Waste Strategy.

4.3. Anticipated Outcomes

Waste Services anticipates the following outcomes as a result of the implementation of the proposed program:

- A decrease in the amount of garbage set out by residents, impacting container size and/or frequency of collection.
- More compliance with collection rules and increased participation in sorting as a result of clear and consistent expectations, enforcement, outreach and education.
- Harmonized expectations across residential sectors, which may lead to an increased diversion rate in both programs, as residents move fluidly between housing types.
- Equity for residents between the curbside and communal collection programs.
- Cleaner feedstock for organic processing facilities, resulting in an increase in processing efficiency and higher quality end product.
- Effective separation of recyclable materials from garbage to increase the amount of recyclables that can be processed and sold to end markets.
- Improved pre-processing at the IPTF due to a reduction in the volume of garbage.
- Improved production of RDF, as a result of reduced moisture content in the garbage stream.
- Effective up front planning with regards to serviceability and optimal impact on usable space in new developments as a result of enforceable Developer Standards.
- Improved responsiveness to the needs and constraints of complex developments, including mixed-use sites, where innovative design approaches are required to achieve serviceability and program outcomes without compromising city building outcomes.

An estimated increase in the projected diversion rate of approximately four to 16 percent, is expected as a result of these outcomes, depending on the approved alternative. This is based on assumptions that waste sorting and diversion facilities at the EWMC are fully functional and have sufficient capacity to process the incoming waste, end markets for all recyclable commodities are available, participation in waste drop off programs remains constant, and education programs are effective at changing residents' habits.

4.4. Scope

Table 2 describes the scope for this business case.

Table 2: In Scope Items

Component	In Scope
Customers	• All residential properties which are currently being serviced or will be serviced in the future by communal garbage collection. This includes the residential units in buildings that contain commercial units.

Method of Separating Food Scraps and Recyclables	• Collection and processing of three streams of source separated waste: garbage, food scraps and recycling. • Collection and processing of two streams of source separated waste: garbage and recycling.
Collection	• Identification of preferred containers for recycling. • Identification of preferred containers for garbage. • Identification of preferred containers for food scraps. • Impact of colocation of collection containers or disposal points (i.e. ensuring residents have access to all three streams in the same space) on capture and contamination rates.
Financial	• Capital and operating budgets to support the program changes. • Net Present Value (NPV) analysis. • Revenue Requirement (RR) analysis.
Implementation	• A high level implementation plan. • Introduction of regular waste characterization studies to support regular data collection and measurement.
Strategic	• Analysis of the impact of waste chute closures on capture and contamination rates. • The need for mandatory developer standards addressing the design of waste spaces in new multi-unit properties.
Education and Outreach	• Development and delivery of education and outreach programs and strategies specific to the communal collection program as part of the initial program launch, as well as ongoing support.

4.5. Out of Scope

Table 3 describes the items that are managed separately and that are out of scope for this business case.

Table 3: Out of Scope Items

Component	Out of Scope
Customers	• All residential units that are in scope of the Edmonton Cart Rollout project. • Non-residential customers, including commercial units in mixed use properties.
Collection	• Changes to waste drop off programs such as Eco Stations, Community Recycling Depots, the Reuse Centre, and the Residential Transfer Station.

	• Analysis of the cost of collection performed by City crews and contractors. • Analysis of the percentage of collection performed by City crews and contractors.
Implementation	A detailed implementation plan for the recommended options including: • Educational plan, tactics and materials for residents and property managers. • Staff training requirements. • Updates to the billing system, if needed. • Collection contract procurement. • The procurement process for any private processors or technology providers. • The details of the implementation phases (timing, number of dwelling units per phase, etc.).
Processing	• Changes to processing infrastructure including contracts, equipment and resources. • Organics processing facility business case or approval.
Utility Model	• Analysis for the deregulation of communal collection.
Strategic	• Solutions for on site management of organic waste for multi-unit properties. • Solutions for waste reduction for multi-unit properties. • Updates to the Waste Management Policy C527. • Diversion rate calculation methodology for communal collection and proposed methods for measuring the diversion (presented separately at the same time of this business case).
Regulatory	• Updates to the Waste Services Bylaw 18590 (to follow at a later date based on the alternative approved by City Council).

4.6. Critical Success Factors

The following critical success factors have been identified:

- Completion of comprehensive research and analysis during program development to support and identify best practices and evidence of mandatory three stream source separation being effective in other jurisdictions with similar goals, and application of lessons learned from those jurisdictions.
- Effective engagement with stakeholders and residents to learn about local conditions, potential barriers to program implementation, and associated solutions.
- Risk identification and management to mitigate the risks during program planning and implementation.
- Continued City Council endorsement of the Waste Strategy and its associated goals and

programs.
- City Council and corporate leadership endorsement of the proposed program changes.
- City Council approval of funding for the proposed program changes.
- Resident and property manager participation and adoption of program changes.
- Sufficient processing capacity, either at the EWMC or third party facilities, for the expected quantity of food scraps and recycling.
- The successful implementation of the Edmonton Cart Rollout program. The Edmonton Cart Rollout will create momentum that will aid in implementation of an equivalent program for communal collection.
- Sufficient time for educational program planning as well as adequate resourcing to implement.

5. Strategic Alignment

The transition of the communal collection program to mandatory three stream separation is rooted in the Waste Strategy, which was approved by City Council in September 2019. The goals in the Waste Strategy are aligned with City Council's Strategic Goal of Climate Resilience set out in ConnectEdmonton[10].

This business case is aligned with City Plan[11] Outcome 1.4: Edmontonians demonstrate shared leadership as stewards of the environment. Intention 1.4.1 of the City Plan is to support Edmontonians' transition to a low carbon future in their daily lives and Direction 1.41.4 is to avoid waste at its source, improve diversion rates, and reuse and recover resources. The implementation of mandatory waste sorting, and mechanisms to incentivize waste reduction among communal collection customers is clearly aligned with the directions of the City Plan.

The Waste Strategy also aligns directly with the Environmental Protection aspect of the Corporate Business Plan[12], supporting the commitment of minimizing the environmental impact of Edmontonians' daily living through sustainable waste management practices, including the implementation of the Source Separated Organics program. This allows for the collection of organic waste separately from residential garbage to then be processed into compost[13].

The proposed changes to the communal collection program are critical to the City's ability to achieve these goals and commitments. The program changes will allow Waste Services to contribute directly to the delivery of excellent services through more efficient and effective waste collection, and reduce the impact on the environment through source separation and waste processing.

[10] Connect(ed) Edmonton - Edmonton's Strategic Plan 2019 - 2028
[11] Charter Bylaw 20000 - Edmonton City Plan 2020
[12] City of Edmonton Corporate Business Plan 2019 - 2022
[13] City of Edmonton Corporate Business Plan 2019 - 2022

This business case also aligns with the goals of the Revised Community Energy Transition Strategy approved by City Council on April 19, 2021. The Revised Community Energy Transition Strategy includes interconnected pathways of transformative change to reach Edmonton's Climate Resilience goal of a low carbon city. Pathway 1 calls for a renewable and resilient energy transition, and one associated goal is for Edmonton to use waste as a resource. The collection of source separated streams of waste enables the potential expansion of processing methods that provide opportunities to maximize the production of zero emissions energy and resources from waste, such as anaerobic digestion. In addition, source separation of recycling and food scraps will reduce the City of Edmonton's carbon footprint; recycling uses less energy and fewer resources than production using virgin materials; and keeping food scraps out of landfills reduces methane production.

Finally, this business case is also strategically aligned with a number of other distinct but related initiatives that are currently under development as part of the implementation of the Waste Strategy such as the Waste Reduction Roadmap, the Edmonton Cart Rollout, and the ICI waste source separation strategy. Discussion is also underway with the provincial government regarding the introduction of an Extended Producer Responsibility (EPR) Framework for Alberta. If implemented, producers will be responsible for the end of life treatment of their products. The implementation of a mandatory recycling collection by the City is anticipated to align with these efforts. While these initiatives are outside the scope of this project, their outcomes will impact its overall success, and collectively contribute to achieving the ultimate goal of 90 percent diversion.

6. Context Analysis

6.1. Comprehensive Research

Comprehensive research was undertaken by Waste Services to seek out and validate potential program components that would meet the City's current and future needs. The findings also provided a basis for the public engagement activities.

The research examined the current practices of jurisdictions in Canada and internationally. An effort was made to discover learnings from those municipalities that have long-standing programs, uncover successful approaches, understand sector best practices, and explore innovation. In addition, the research identified future-facing strategic goals, considerations for the evolution of programs, and program maturation milestones.

The research pulled from five types of information:

- Jurisdictional scans: A scan of publicly available online data was conducted for 49 municipalities across Canada, the United States, Europe, Australia and Asia.
- Interviews with government representatives: 14 municipalities were directly engaged via phone interviews and email correspondence in Canada, the United States, and Europe. These municipalities were chosen because they represent a similar future-state

for Edmonton with three stream collection.
- Interviews with industry representatives: 10 industry groups such as waste associations, haulers, and processing companies were directly engaged via phone interviews and email correspondence.
- Literature review: A review of 73 publicly available documents such as municipal educational materials, policies, non-government organization (NGO) reports, case studies, strategic documents, peer reviewed and comparative studies, pilot reports, and regional and municipal reports.
- Behavioural science studies: A review of research focusing on the impact of program design on resident behaviours.

In addition, the project team undertook a high level feasibility study of centralized waste processing as an alternative to source separation, using existing Waste Services infrastructure.

The research results were organized into the following categories:
- Methods of collection,
- Resident supports such as educational and outreach tools,
- Supports for property managers,
- Regulatory mechanisms for a successful program, and
- Financial mechanisms for a successful program.

6.1.1. Key Findings

A number of key findings were distilled from the research. These findings inform the options analysis process of this business case. A full Summary of Findings is available as a separate document presented with this business case (Attachment 2).

Complexities of Communal Collection
Recurring challenges to communal collection were identified, including a high level of anonymity, a wide range of building types and infrastructure needs, high rates of resident turnover, illegal and opportunistic dumping, and access challenges for residents, especially in large properties.

Many municipalities find that communal collection requires a more dedicated and sustained effort to support successful behaviour change. This may result in the creation of dedicated customer service or multi-functional support teams.

Due to the more complex nature of this type of program, the diversion rate for communal collection programs among municipalities with the most mature programs is in the range of between 20 and 30 percent[14]. While establishing a new program can result in an immediate increase in diversion, program maturity takes time to achieve. Even municipalities with mature programs have a goal to increase their diversion rate. The most successful municipalities have

[14] Multi-unit specific, not combined residential.

had programs in place for the longest time, including sufficient time for generational turnover.

Common Approaches to Waste Separation in Communal Collection Programs
Most jurisdictions examined have determined that it is preferable to focus on source separation, rather than depend on processing of mixed waste to achieve diversion. Source separation is mandatory in an increasing number of jurisdictions that have high diversion goals. The impact of separation being mandatory is discussed further in the next subsection.

Not only is source separation of waste into three streams achievable, many jurisdictions examined during the research provide separate regular collection of up to five streams (e.g. glass, plastic and metal containers, paper and cardboard, food scraps and garbage).

There is a common perception that a lack of space prevents a large number of properties from being able to participate in multi-stream waste collection programs. Based on the municipalities examined, the vast majority of properties are able to participate in the program and do not encounter barriers related to space limitations.

Mandatory Programs and Clear Standards
Mandatory programs were both the most common and the most preferred approach among municipalities examined. Mandatory programs not only reinforce norms and standardize the requirements from building to building but also increase participation. These benefits were noted even in the municipalities that did not directly service the sector.

As an extension of this finding, the most successful programs in the municipalities examined have consistent sorting requirements enforced in all spheres of life such as home, work and school.

In addition to providing mandatory service, other elements of successful programs can be made mandatory. One example is providing equally convenient access to containers for all waste streams, and integrating this into building design. Many municipalities in North America consider colocating waste streams as a best practice. Colocation prioritizes equal convenience and access to all waste streams by siting container locations together, and can be achieved by establishing enforceable developer standards. Some North American municipalities have begun including colocation in their standards which in turn are enforceable with bylaws and ordinances. This emphasis on a user centric program design moves the focus of waste management from being an “out of sight, out of mind” issue to becoming embedded in building design and a recognized process that contributes to sustainability.

How Communal Waste is Collected
Owing to the diversity of building stock the research revealed that municipalities commonly used more than one, and sometimes up to five, distinct methods of collection to ensure that service can be provided to all building types and sizes.

Flexibility in container offerings was key to meeting the needs of the properties and residents. Many municipalities opt to utilize the smallest container size required while still ensuring adequate waste storage. This flexibility helps municipalities "right size" combinations of containers to suit the layout of each property. Smaller containers may also help decrease opportunities for illegal dumping and additional contamination.

Underground containers are becoming more common in Europe as a method of providing convenient access while working with above ground space constraints and aesthetics of the streetscape design. However, the styles of underground collection utilized in Europe are not commonly available in North America. So while this technology has been successful in the European jurisdictions researched, it requires further investigation and reviews of applications in North America to determine suitability for Edmonton.

The Role of Education and Outreach
All the sources examined emphasized the importance of supporting the establishment of new behaviours in both residents and property management. The research showed that education and a convenient, well planned program should work hand in hand to achieve success.

Education in the multi-unit sector requires a more sustained effort compared to the single unit sector, because of the challenges associated with higher resident turnover. Dedicated teams that provide logistical help to building managers (e.g. identifying optimal container types and locations) as well as educational information for managers and residents are critical to the success of a mandatory source separation program. Teams need to work consistently on developing relationships with property managers because strong relationships with property managers are considered as valuable to program success as having well-supported residents.

6.2. Regulated Utility Model

The regulated utility model presents an advantage that ensures all residents and property managers are provided with the same high standard of service and educational support regardless of dwelling type. The research has demonstrated that municipalities achieve the most success in increasing waste diversion through source separation when expectations are clear and consistently enforced across all sectors. Consistent expectations for sorting in all spheres of life help to solidify the formation of positive and responsible waste habits.

This consistency is more difficult to achieve and enforce where properties can enter into their own agreements with service providers. Municipalities interviewed during the research highlighted how non-regulated service introduces the possibility of disparity. The regulated model delivers specific benefits related to service equity, long-term planning and financing, and the design and implementation of consistent standards and incentives to support strategic policy objectives. These benefits are particularly relevant as the City implements the Waste Strategy, with new facilities and programs coming online and the diversion forecast expected to trend sharply upward as part of the ongoing transformation of the waste management system.

7. High Level Options

The research revealed a variety of components that can be used in a communal source separation program. The components were grouped into six categories, as described below. An explanation of the evaluation process is provided in Section 8, and the findings are discussed in Section 10.

7.1. Method of Separating Food Scraps and Recyclables

Two primary approaches were identified:

- **Source Separation:** The majority of the research pointed to a three (or more) stream source separated waste collection program, similar to the expectations in place for the curbside program.
- **Centralized Processing:** One jurisdiction researched uses an approach that is conceptually similar to Edmonton's current system. Waste is collected in two streams (garbage and recycling), with centralized processing facilities used to separate organics for further diversion.

7.2. Method of Collection

A wide variety of collection methods were identified for communal collection programs. These methods included mobile collection depots, waste drop off sites, a range of above ground containers such as carts and bins, as well as underground containers and pneumatic collection systems.

7.3. Resident Support

A number of resident focused support mechanisms were identified, such as the provision of in-unit containers (such as kitchen catchers or totes), ambassador programs and a range of educational and outreach campaign components.

7.4. Property Management Relationship

Supports for property management were catalogued separately from resident supports to account for the difference in needs. Property manager supports included a range of educational materials, toolkits and customer service approaches such as stakeholder working groups and dedicated customer service teams.

7.5. Financial Mechanisms

A small number of financial incentives were identified, including the possibility of rate reduction for streams with low contamination, variable rates based on volume of waste set out, and credits that could be used to encourage desired waste behaviour.

7.6. Regulatory Mechanisms

A range of regulatory mechanisms were also found. Regulations can be used to control how space for waste is designed in new properties (developer standards), ease of access to all three stream disposal points (colocation), the role of chutes (chute closure regulations), and to set volume limits.

8. Options Analysis Methodology

8.1. Overview of Analysis Approach

The approach that was taken to evaluate options for the communal collection program was iterative and integrated feedback from public engagement activities after each phase of analysis. As shown in Figure 5, public engagement was interwoven between rounds of analysis to ensure that the recommendations were well aligned from multiple perspectives.

Figure 5: Overall Options Analysis Methodology and Process

The options considered for the communal collection program were evaluated individually, to help give the program flexibility to address the variety of needs in communal collection.

A three step process (outlined in Figure 6) was used to narrow down potential options for this business case. The process ensured that the analysis was done in a consultative and structured environment. Notes and results were recorded transparently and in detail to allow the project team to provide critical feedback and make adjustments as necessary. Results from each phase of analysis are included as Appendices to this document.

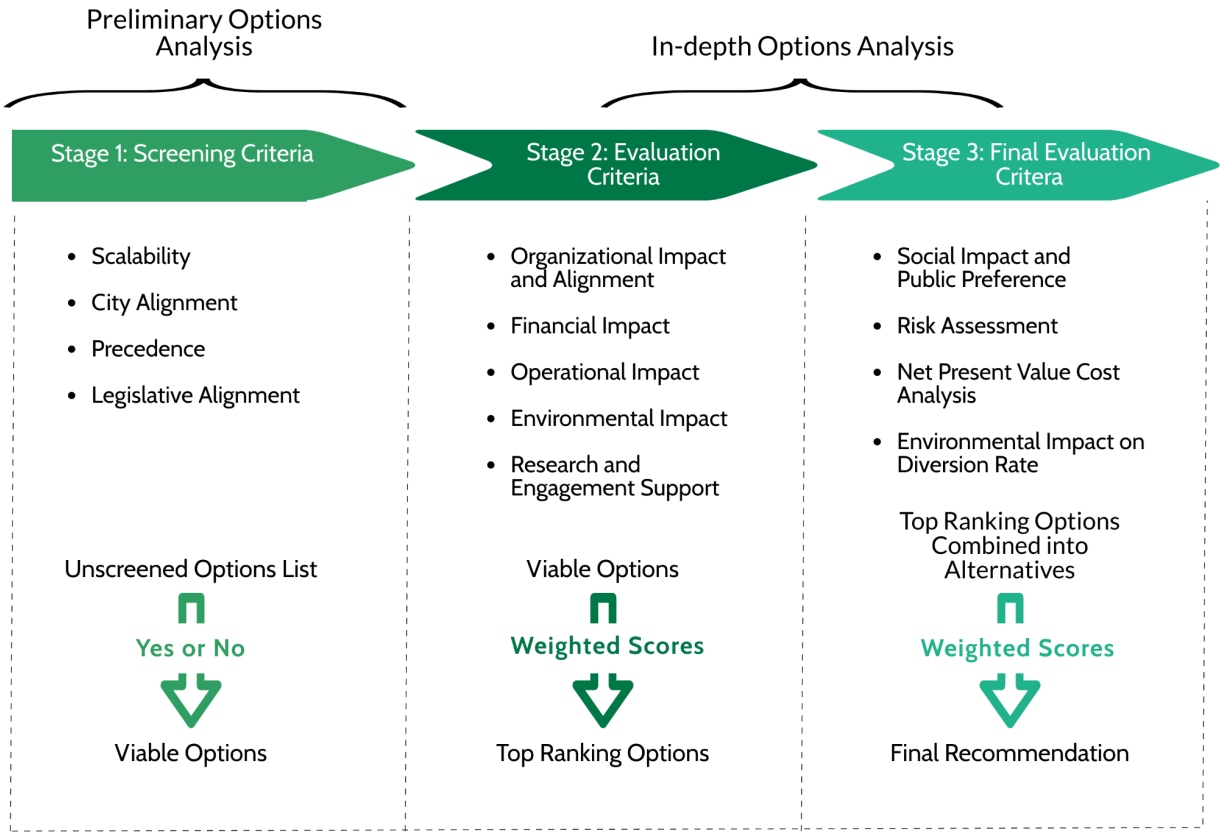

Figure 6: Business Case Option Analysis Steps and Evaluation Criteria

8.2. Options Analysis Stages

8.2.1. Stage One - Screening Criteria

The first stage of the evaluation addressed options identified from the research, and sought to eliminate options that would not work in Edmonton. High level criteria were applied, focusing on strategic/regulatory alignment and operational feasibility. An option which failed one or more of the Stage One criteria was considered non-viable. Eliminated options were not carried forward to public engagement or further stages of the options analysis process.

Criteria for Stage One evaluation were:

- **Scalability** - the ability for the option to adjust to meet population growth forecasts and adapt to program changes.
- **City Alignment** - alignment with corporate and branch goals and outcomes.
- **Precedence** - whether or not the waste industry has established the option for residential collection.
- **Legislative Alignment** - alignment with policy or legislation from higher levels of government.

After the non-viable options were screened out, Phase One of public engagement was conducted. Phase One was designed to learn about stakeholders' needs, barriers and potential solutions for source separation. Stakeholders were asked to participate in the engagement process in an *Advise* capacity along the City of Edmonton's Public Engagement Spectrum. Participants were invited to share feedback and perspectives considered for policies, programs, projects, or services. Stakeholders were organized into three primary groups: managers (property managers, condo board members, and developers), service providers (waste haulers and processors), and residents.

The focus of manager and service provider engagement was to gain feedback on the options that passed through the Stage One analysis; this feedback was then used in Stage Two evaluation. Managers and service providers participated in one of three identical online workshops and a unique Engaged Edmonton web page where they could learn about the topics of program rollout, collection containers, regulatory requirements and incentives, education and outreach, and program success measurements. The Engaged Edmonton site also allowed stakeholders to ask questions of the project team and contribute to peer-to-peer discussion. There were a total of 767 site visitors to the Engaged Edmonton page and 20 active participants who left a combined total of 61 comments and four questions for the project team. A total of 67 managers and service providers participated in the three online workshops.

A total of 52 residents were engaged through eight focus groups and ten one-on-one interviews in Phase One. The engagements were designed to learn about potential barriers to this program and solutions to those barriers.

Two stream waste collection and the utilization of processing-only options to separate food scraps were eliminated based on Stage One criteria. Still, additional evaluation was conducted in Stage One and Two to ensure these options were eliminated only after a complete and comprehensive review.

Results for Stage One of evaluation are available in more detail in Appendix A.

8.2.2. Stage Two - Evaluation Criteria

The second stage of evaluation utilized a more comprehensive criteria list to further analyze the benefit and impact of the remaining options. In contrast to the Stage One evaluation, which used yes/no answers, the Stage Two evaluation used a scoring scale to indicate the level of compliance with each criteria. The criteria used in Stage Two are presented in Table 4.

In addition to the criteria presented in Table 4, the impact on diversion was used as a criteria only to assess two stream versus three stream source separation. All other options fall under one of these two overarching options.

Table 4: Stage Two Evaluation Criteria

Organizational Impact and Alignment
Alignment with corporate/branch goals and outcomes Evaluates how well the option reflects the priorities outlined in Waste Services and City of Edmonton documents such as the Waste Strategy and City Plan.
Alignment of expectation of residents between curbside and communal collection programs Considers the option's ability to maintain consistency across programs with regards to sorting and waste behaviour.
Impact to the City's ability to deliver existing programs and services Scoring represents the option's effects on the City of Edmonton's ability to provide existing services (e.g. traffic safety, road services, etc.) but excluding Waste Services.
Financial Impact
Impact on capital cost Scores represent the high level estimate of an option's capital cost compared to the current state. This can best be described as the difference between current state and future state.
Impact on net operating cost Scores represent the high level estimate of an option's impact on operating expenses compared to the current state. Net operating costs include revenue other than rate revenue (i.e. program revenue such as revenue from compost sales).
Operational Impact
Impact on operational productivity, operating efficiency and capacity Scores an option's ability to increase collection effectiveness and efficiency, and on the operational capacity of Waste Services (i.e. how many dwelling units can be serviced in a day).
Impact on operational reliability and flexibility Refers to the option's ability to avoid downtime or time lost due to risks like equipment failure. Flexibility refers to the option's ability to adapt to problems regarding reliability.
Operational adaptability Grades an option's ability to be maintained in a period of time, and over time to adapt to the changing needs of the properties in the communal collection program, such as densification and development.
Occupational health and safety Scores an option's impact on incidents and lost-time injuries.
Impact on feedstock quality and illegal dumping Scores an option's impact on waste product quality (i.e. the perceived quality/contamination of recycling and organics before it is processed), or reduction to illegal dumping. For the "Processing" options category: Scores an option's impact on the quality of waste

exiting the equipment after being treated. This is applicable to the stream of waste that the option is designed to process.
Research and Engagement Support
Resident engagement support Scores an option's support among residents from engagement sessions occurring during Phase One of Public Engagement (focus groups and interviews).
Property managers and service provider engagement support Scores an option's support among stakeholders from engagement sessions during Phase One of Public Engagement (workshops, Engaged Edmonton website, one-on-one interviews).
Research support Scores an option's support among sources from the research (jurisdictional scan, interviews with government and industry representatives, literature reviews, behavioural science studies).

After each option was scored using the criteria listed above, sensitivity analysis was conducted to determine how the ranking of each option might shift as a result of the level of emphasis placed on each category. This tested potential bias and ensured that the options selected for detailed analysis in Stage Three were based on a robust score. Each option was ranked according to its score under each sensitivity scenario. The rankings across all sensitivity scenarios were averaged to calculate the overall ranking of each option. Options with the highest average ranking in Stage Two were deemed as the most suitable options to help build the program alternatives and move forward to Stage Three.

Once the second stage of evaluation was completed, a final phase of public engagement was conducted to gather additional information to further refine and narrow down program options. Stakeholders participated in the engagement process in a *Refine* capacity along the City of Edmonton's Public Engagement Spectrum, which includes inviting stakeholders to adapt and adjust approaches to policies, programs, projects, or services. Participants were provided with more information about potential options and were asked to provide feedback on how those options would work for properties with communal collection in Edmonton. Property managers and condo board members were asked to complete a survey; a total of 239 stakeholders completed this survey. An Engaged Edmonton page was used to provide property managers, condo board members, developers and service providers with more information about the program and gather input through a forum as well as a question and answer tool that allowed these stakeholder groups to ask questions of the project team.

A separate survey was developed to reach residents living in properties with communal waste collection. The survey was promoted to residents through social media and was distributed to the Edmonton Insight Community, which is an online citizen panel of Edmontonians who provide feedback on a variety of programs and policies. A total of 2,896 residents completed

this survey.

Results for Stage Two of evaluation and sensitivity analysis are available in more detail in Appendix B.

8.2.3. Stage Three - Final Evaluation Criteria

In the final stage of evaluation, four complete packages of options were created and evaluated as the program alternatives. These alternatives were evaluated using a triple bottom line approach, plus a risk assessment. The package with the highest weighted score is the recommended alternative in this business case.

The following criteria were used for the Stage Three evaluation:

- **Social Impact and Public Preference -** This criteria category evaluated the preferences of both residents and property managers based on the Phase Two Public Engagement results. Feedback from residents and managers was considered independently and scored on a scale of one to five; a score of one meant that there was no support for an item and a score of five meant that there was very high support. The scores were then added together to provide the raw social score for the package.
- **Environmental Impact on Diversion Rate -** This criteria category considered the estimated increase in the diversion rate that each alternative was expected to achieve. Increases in diversion due to Refused Drive Fuel production were not included in this assessment, reflecting the City's commitment to the zero waste framework that prioritizes recycling and organics processing over energy recovery. Alternatives with higher estimated diversion rates scored higher.
- **Net Present Value (NPV) and Cost Analysis -** Scoring in this category was calculated based on a 24 year financial model that considered the forecasted operating and capital expenses related to implementation of the alternative. The period selected for the NPV analysis was based on the shortest common period of the expected life cycle of the assets. Once scored, options with lower NPV values received higher scores relative to options with higher NPV values.
- **Risk Assessment -** This criteria category evaluated the risks unique to each alternative. Unique risks were identified and scored based on likelihood and impact. The "total possible risk" for each package was calculated by assigning the maximum likelihood and maximum impact to each risk and taking the sum of risk scores. The "actual total risk" for each package was calculated by taking the sum of individual risks. The risk score of each alternative was then determined by calculating the risk avoided, which is the difference between the actual total risk and the total possible risk. Common risks between all alternatives were scored separately in the same manner but excluded from the overall risk score as the impact would be equal for each package of alternatives.

The scoring for Stage Three packages was based on equal weighting of all criteria. Results for Stage Three of evaluation are available in more detail in Appendix C.

9. Summary of Public Engagement Results

As described in the previous section, two public engagement phases were interwoven between rounds of options analysis. This ensured that the feedback received was integrated into the analysis, and that stakeholders were provided with the latest analysis. The What We Heard Reports for both Phase One and Phase Two of Public Engagement are available in separate documents presented with this business case (Attachments 3 and 4).

9.1. Phase One

Feedback gathered during Phase One of public engagement was used to determine the engagement scores in the Stage One options analysis. Phase One of public engagement found that residents want supports to increase their participation; these supports could include being provided with food scraps pails and ongoing education that teaches them how to sort their waste, why it is important, and the impact their efforts have. Convenience and access to all streams of containers were identified as paramount when it came to overcoming barriers, including easily accessible collection containers and colocation of waste streams. Property managers similarly want focused supports, and identified that the customer service relationship between themselves and the City is a critical component of a successful program. Specifically, collaborative support from the City will be important to overcome challenges with space, infrastructure challenges and site logistics. Developers and property managers also identified the need for developer standards for new properties to be established and enforced to ensure that waste is incorporated into building designs and to make colocation of collection containers possible.

9.2. Phase Two

Phase Two of public engagement focused on residents and managers. For the purpose of this phase of engagement, managers refers to property managers, condo board members and those in equivalent roles.

Based on the final public engagement results, residents communicated that a variety of tactics would be necessary to support the diverse needs of the sector, and that it was particularly important to have step by step guides demonstrating how to sort food scraps properly and a food scraps pail to use in their kitchens. Residents also felt that clean and well lit communal waste areas, and waste containers being located next to each other in the same common area, were both very important factors to help with proper sorting. Managers agreed that colocation of communal containers is important for resident convenience and compliance, however many were concerned that limited space in communal waste areas may limit their ability to place communal containers beside each other.

The majority of managers felt that one or more of the collection container options presented (e.g. front load bins or carts) would work for their properties. However, many managers were

still quite concerned about lack of space for more collection containers onsite and requested one-on-one discussions with the City to find a solution that does not require expensive infrastructure changes. Some managers also expressed hope for grants or rebates to help with the cost of infrastructure changes, and some would like to participate in working groups to help shape the evolution of the program.

Both residents and managers had a strong preference for keeping chutes open. Rather than closing chutes, they preferred to find ways to work with chutes to achieve three stream collection at properties. Two options that received support were 1) prioritizing convenient disposal of food scraps by modifying chutes to accept food scraps only and adding containers for recycling and garbage in communal waste areas, or 2) adding recycling and food scraps containers near garbage chutes on each floor.

Both residents and managers shared concerns about tenants not sorting their waste properly and felt that there would be challenges with enforcing waste sorting in multi-unit properties. Residents and managers also shared concerns about potential increased costs and new fees. Many survey respondents from both the manager and resident groups were also concerned with mess, smell, insects and animals.

In addition, residents stated that regularly receiving information about the results of waste sorting efforts would help motivate them to sort their waste properly; managers similarly felt that regularly receiving information about the percentage of waste not sent to landfill, or the contamination rate in different waste streams would help them monitor the impacts of the program.

10. Viable Alternatives

The methodology presented in Section 8 was used to identify preferred options and generate the alternatives presented in this business case. The results of the analysis are described in detail below.

10.1. Method of Separating Food Scraps and Recyclables

The current method of collecting garbage and recycling as two streams of waste was evaluated as an alternative to a three stream source separated collection program. This method was ruled out as an option in Stage Two. Although it is generally accepted that making enhancements to the processing facilities at the EWMC may result in increased diversion, it was clear from the research that the most effective way to achieve cleaner streams (with higher value end uses) is through source separation. It was determined that maintaining a two stream approach would prevent the City from further progressing towards the strategic goal of 90 percent diversion from landfill. Furthermore, since both the Corporate Business Plan and the Waste Strategy commit to a source separation program, continuing the status quo would be a departure from the approved direction.

Three stream source separated collection is, therefore, recommended for inclusion in all alternatives and forms the basis upon which the alternative packages are proposed.

10.2. Method of Collection

Based on the Stage Two analysis, a range of collection containers were included in the final consideration for each waste stream. A range of container types and sizes will need to be used to ensure diversion programs can meet infrastructure, space and access limitations presented by the diverse building stock. The following subsections provide details about the container types and sizes that were included in the alternatives.

10.2.1. Front Load Bins

Front load bins are the primary type of container currently used to provide communal collection service. These bins range in size from two to eight cubic yards and are currently used for both recycling and garbage. These containers scored favourably in Stage Two and were included in the recommended alternatives.

10.2.2. Carts

Carts are currently being distributed to residents receiving curbside collection service. Carts are available in a smaller range of sizes than front load bins, typically 120 litres, 240 litres and 360 litres.

Carts scored well when considered for the collection of garbage and food scraps. There is an opportunity to operate efficiently by integrating curbside and communal collection services where possible. If carts can be used for communal collection of garbage and food scraps, then trucks that are collecting carts from a given neighbourhood can service both curbside and communal collection customers. This will result in efficiencies, which in turn will result in a more stable rate for the utility rate payer, reduced collection vehicle traffic, decreased impact to neighbourhoods, infrastructure and the environment. Carts for garbage and food scraps collection have been included in all alternatives.

Despite their high score when used to collect garbage and organics, carts did not score high for the collection of recycling, and were not considered for the recycling stream in the final alternatives. As noted earlier, recyclable materials are bulky in nature and make up a large portion of communal collection waste. Given the relatively small size of carts (up to 360 litres), they would fill quickly and may not be large enough to fit multiple bulky items such as large cardboard boxes. It was determined that other methods of collection such as front load bins would be more appropriate; larger containers means that the size of the container does not become a barrier or deterrent to recycling. In addition, front load bins are available in a range of sizes, meaning that it is still possible to ensure right-sizing for each property.

Furthermore, as recycling carts are not currently offered as part of the curbside collection

program, there is no opportunity for integrated collection services. Offering recycling carts to communal collection customers would require a dedicated fleet. This specialized service would be very costly with no notable benefits.

Carts for the recycling stream are, therefore, not recommended at this time for inclusion in the alternatives. If carts are used for curbside recycling collection in the future, they may become a viable alternative for smaller communal collection sites.

10.2.3. Roll-off Compactors and Manual Collection

Despite their lower score in the Stage Two options analysis, roll-off compactors for garbage and recycling, and manual (bag) collection of recycling were not eliminated from further consideration. These methods will continue to be used to address specific building situations. It should be noted that bag collection is not preferred and efforts will be made to limit its application. Waste Services currently uses roll-off compactors for certain properties with 250 or more units; manual collection of recycling is used in circumstances where space is a limiting factor for front load bins. As these methods of collection are already accounted for in the current operating budget and resource availability, the impact of these methods on the business case was considered negligible.

Both roll-off compactors and manual collection of recycling will continue to be available, but will not be included in the alternatives presented in this business case.

10.2.4. Underground Collection

Underground containers are available in multiple styles. For the Stage Two analysis, two categories of underground containers were assessed separately: those that require specialized equipment, and those that can be serviced with standard front load vehicles. Although underground containers that require specialized equipment did not score favourably in Stage Two, underground containers that can be serviced with front load vehicles did. However, further analysis of the cost and logistics determined that this method of collection offers few benefits compared to front load bins.

Underground containers offer the same or less capacity as front load bins, while occupying a similar footprint and with significantly higher capital costs. The containers pose additional risks and are less adaptable to change as underground infrastructure is more permanent and less forgiving should containers need to be adjusted to meet future building needs or program changes. Furthermore, the ownership model would be very complex and would require significant study to find a solution.

The advantages of underground containers appear to be limited to improved aesthetics. This means that these containers typically do not require enclosures or screens to improve aesthetics, saving money and space on private property.

Waste Services acknowledges that the future may bring new styles of underground containers that have the potential to provide better value for money and will continue to review and evaluate technologies as part of the regularly scheduled program review to determine their suitability for Edmonton.

Based on these findings, underground collection was not included in the alternatives for this business case.

10.3. Volume Allocation and Container Sizes

Extensive analysis was completed to determine a volume allocation per unit receiving communal collection. The analysis used waste composition data from multi-unit sites in Edmonton, data from the curbside program, as well as waste composition data and allocation formulas from other municipalities. The result is volume and tonnage allocations for each stream.

It was determined that the recycling stream would require the highest volume allocation per unit and would therefore require larger containers, while garbage and food scraps would require smaller containers.

For the food scraps stream, carts and smaller front load bins were preferred as food scraps are dense, resulting in heavier weights for a given volume. Based on the density, bins measuring two cubic yards are the largest container that will be used for food scraps collection. As a result, multiple front load bins measuring two cubic yards may be required to meet the volume allocation for a specific property.

For the garbage stream both carts and bins can be used, based on the size of the property. In general once source separation is implemented, removing both recycling and food scraps from the garbage stream may result in smaller garbage containers being suitable.

The number and size of containers for each stream will be calculated based on the volume allocation per unit per stream and the number of units per building. Waste Services will utilize a range of container sizes to ensure “right-sizing” occurs for each building. Right-sizing will aid with concerns regarding smell or pests in food scraps containers as well as providing flexibility to fit space concerns of a particular site.

While capacity allocated for the food scraps and recycling streams are based on the expected volume through the allocation formula, the total capacity for the garbage stream includes an allowance of some additional capacity to assist with adaptation to the program.

While there is a preference to use the smallest container size possible to provide location flexibility, there is also a threshold at which a large number of carts would be inefficient for collection and require more space for storage than a front load bin of equivalent volume. At

that threshold, a front load bin would be preferred.

Table 5 shows the container types and sizes that have been included in all alternatives:

Table 5: Recommended Containers and Sizes for Each Collection Stream

Waste Stream	Container Style and Size
Garbage	240L Cart 360L Cart 2, 3, 4, 6, 8 yd^3 Front load bins
Recycling	2, 3, 4, 6, 8 yd^3 Front load bins
Food Scraps	240L Cart 360L Cart 2 yd^3 Front load bins

10.4. Resident and Property Manager Supports

Research and engagement have both shown that education and other supports should be top of mind when a mandatory source separation program is designed and implemented. Without effective and ongoing education, programs are less likely to reach their full potential. This section discusses the resident and property manager supports for the proposed communal collection program.

10.4.1. Resident Supports

Annual marketing and communications campaigns, ongoing education, and in-unit containers were the resident support components that scored favourably in the Stage Two analysis, and were further analyzed in Stage Three.

Throughout the research and analysis it became clear that a targeted and sustained effort would be required to overcome challenges such as resident turnover and anonymity. Without ongoing education it is expected that adoption and participation rates will peak a few months after rollout and decline over the following years, resulting in an increase in contamination and a further stagnation of the diversion rate.

There was particularly strong support in all phases of public engagement for ongoing education programs, indicating that both residents and property managers felt like this dedicated and targeted education approach is critical to ensuring residents are informed and engaged.

A high level of awareness and education will be achieved by delivering ongoing and targeted campaigns. This includes a comprehensive mix of digital and traditional marketing tactics such as outdoor advertising, digital communications, multimedia assets, print resources, a strong

web presence with downloadable resources and in-person interactions through outreach activities. Targeted campaigns will allow more face to face interactions with residents to further educate, answer questions and attempt to overcome any accessibility and/or language barriers.

To compliment the above, the provision of food scraps pails will be an important tool to encourage positive behaviors and participation. A desire to receive food scraps pails was heard through Phase One of Public Engagement. Food scraps pails were provided to all curbside collection customers as well.

While there was some interest expressed during public engagement in having an ambassador program, residents did not communicate a corresponding interest in becoming an ambassador themselves. The research showed that some municipalities use these programs to aid with shifting waste behaviours at a building level, but at this time there is a lack of supporting data to show the efficacy of such programs. Further work is required to determine how effective this type of program would be. An ambassador program is not recommended at this time.

Based on this analysis, ongoing education, annual targeted campaigns, and the provision of food scraps pails have been included as resident supports in all alternatives.

10.4.2. Property Management Supports

Effective and ongoing support for property managers also scored very high in Stage Two analysis. In particular, managers requested ongoing communications and updates, City-developed resources, and materials that they could share with residents. Providing these supports to property managers would help to facilitate a positive relationship between property managers and the City.

Property managers are a vital link to ensuring that residents have the necessary information to be able to participate. Resources such as a toolkit (consisting of brochures, posters, door hangers, newsletters, etc.), access to dedicated customer support, and ongoing education will build their capacity to support waste programs. Building resources similarly would include materials that property managers could distribute to their residents, display in properties or request on their residents' behalf.

Another component which scored favourably in Stage Two was the creation of a stakeholder working group. Working groups can be used to help prepare for and implement mandatory waste sorting programs. These groups provide a way for stakeholders to give ongoing input into a project and can help build a constructive relationship between the City and stakeholders. The establishment of a stakeholder working group could be facilitated over the next few years and, while recommended, would not require any additional funding and is therefore not included in the evaluation of the alternatives at this time.

Based on this analysis, sustained and effective support for property managers via educational

resources, printed materials, and staff resources are very important and have been included in the alternatives.

10.5. Regulatory Mechanisms

The research shows that a successful mandatory source separation program for communal collection must be accompanied by a variety of regulatory tools to support program success.

10.5.1. Enforceable Developer Standards

Ensuring the enforceability of developer standards was the highest scoring regulatory mechanism. Developer design standards will be needed to set out criteria for new buildings related to the design of indoor and outdoor waste sorting and storage areas, acceptable applications of chutes, access criteria for collection vehicles, and may also address the mandatory separation of commercial and residential waste in mixed-use properties.

Mandatory separation of commercial and residential waste in mixed-use properties became standard practice for Waste Services when Waste Services stopped providing collection services to the commercial sector. As commercial tenants and residents are not serviced by the same collector, it is not recommended at this time to allow waste to be stored or collected together. This practice can lead to one building user group being responsible for the management of the other building users' waste. If commercial tenants use residential containers, the residential containers will not have sufficient capacity for the residential waste.

Research also reflects the beneficial impact of separate storage and collection of waste from different sectors on the overall participation, compliance and diversion from both sectors. As such, and with consideration for the challenges that shared containers present to the City's policy not to provide commercial waste collection services, it was determined that Waste Services should continue to require separate waste storage areas for each building user group. Understanding the potential impacts of this separation requirement, Waste Services will continue to work with internal stakeholders and the development sector to ensure that design guidelines clearly outline best practices for the separate collection and storage of residential and commercial waste in a manner that does not compromise city building outcomes.

From the analysis it is clear that for developer standards to be successful, they must be enforceable through bylaw. This ensures that residents have equivalent service across different building styles. Enforceable developer standards were also supported by stakeholders in Phase One of Public Engagement.

This business case recommends that no changes be made to the current requirement for mandatory separation of residential and ICI waste in mixed-use buildings. Mandatory separation along with other enforceable developer standards such as the design of waste areas and access criteria are recommended for all alternatives.

It is recognized that work with both internal and external stakeholders in developing design standards is required. The effectiveness of the developer standards and its role in making the mandatory three stream source separation program successful will be realized if the City works with designers, builders, developers and property managers to create mutually beneficial solutions that can be flexible and adaptable to support a well designed City as well as a successful source separation program.

10.5.2. Colocation of Waste Streams

The research and engagement show how important it is for residents to have equally convenient access to all waste streams to encourage participation in sorting and decrease contamination. Equal access to all streams, referred to in this business case as colocation, means that residents would have the same access to dispose of all three streams. In most cases, this means that containers for garbage, recycling and food scraps need to be placed next to each other in the same area or room. In other cases, this may mean that properties with garbage chutes require a mechanism to allow for the disposal of the other streams near the chute location on every floor. Colocation is in contrast to placing a garbage container or having garbage chute access in one location, with food scraps and recycling containers elsewhere.

Due to the operational, financial and significant strategic impacts of colocation, both mandatory and voluntary colocation were included in the alternatives.

10.5.3. Chute Closures

Waste chutes are constructed in some multi-unit properties to make disposing of waste more convenient for residents. Most chutes are for garbage disposal only, forcing residents who wish to dispose of recyclables to go to the recycling container, typically on the main floor, parking lot, or underground parkade of a building. The remote location of the recycling containers is a barrier to recycling, in contrast to the on-floor facility for disposing of garbage, and the lack of convenience associated with disposing of recyclables often leads to poor waste sorting behaviour.

Based on the Stage Two options analysis, closing chutes scored high due to enhanced collector safety and reduced contamination of waste streams. Residents indicated in Phase One of Public Engagement that maintaining chutes would provide easy opportunities to avoid doing “the right thing”.

In light of this discussion and the impact chutes can have on resident behaviour, both mandatory and voluntary chute closures were included in the Stage Three analysis.

10.5.4. Volume Limits and an Excess Waste Program

Setting volume limits and providing an excess waste program scored well in Stage Two. Volume limits would be based on the allocation formula that determines the container volume needed

for each waste stream at every property. Volume limits provide motivation to residents and property managers to participate in source separated waste programs and work towards reducing waste. As the curbside program has also adopted volume limits based on cart size, it would be equitable to have similar expectations for the communal collection program.

While volume limits are seen as an important success factor for source separation, it was determined that some properties may require additional service. An excess waste program could be developed to provide additional service. An excess waste program for communal collection is more complex than for the curbside program as it impacts all residents of a building. The cost and details of the program need to be equitable while still encouraging residents to comply with source separation.

The alternatives in this business case are based on the premise that volume limits will be enforced. Waste Services will continue working on details and logistics of an excess waste program, which will be presented at a later date. Details on volume allocations can be found in Tables D1 and D2 in Appendix D.

10.6. Financial Mechanisms

Financial mechanisms are often used as an incentive to encourage good waste sorting behaviour. A variety of financial mechanisms were considered, including rate reductions (applied on a regular basis and awarded based on waste sorting behaviour), one time credits (fixed discounts or incentives for displaying ideal waste behaviour), and variable pricing (the rate paid is dependent on the amount of waste discarded or size of container used). The variable pricing option scored favourably in Stage Two and was selected for further consideration. Variable pricing is equivalent to the pricing model used in the curbside collection program.

10.6.1. Variable Pricing

A variable rate structure would be based on the quantity of garbage set out for collection, taking into consideration the size of the garbage container and the frequency of collection. It is proposed that properties receiving communal collection would have the opportunity to reduce the amount of their utility bill based on a demonstrated ability to reduce garbage.

Variable pricing could apply to any of the alternatives in this business case. The details and exact cost structure of a variable pricing model is not included in this business case but would be determined as part of a utility rate approval in the future once the program implementation is underway.

11. Program Alternatives

Based on the information detailed above, packages of components were developed and analyzed as the Stage Three analysis. Each package is an alternative. As described previously, two stream

collection was eliminated in Stage Two, and it is for this reason that none of the alternatives include the status quo.

There were two primary drivers influencing the final scoring of the alternatives: whether colocation was mandatory or voluntary, and whether chute closure was mandatory or voluntary. The effect of these drivers on the presentation of the alternatives is explained below.

All alternatives were based on a 24 year life cycle. The total resources required for all alternatives have been included in the financial analysis and are a mix of permanent and temporary FTEs. In all alternatives the requirement for inspectors, education and outreach, GIS mapping, and customer support staff are the same.

A detailed list of assumptions for all alternatives can be found in Appendix D.

11.1. Colocation

Mandatory colocation prioritizes equal convenience and access to all waste streams. Alternatives featuring mandatory colocation garnered a higher social score as residents prefer the convenience and colocation is projected to result in a higher diversion potential, lower contamination and more significant behaviour change.

While both mandatory and voluntary colocation alternatives will use the same types of containers, it is expected that for the alternatives that feature mandatory colocation there will be a higher number of containers overall, and more smaller containers. As a result, more collection staff are required to service the program, resulting in a slightly higher cost than voluntary colocation.

If colocation is voluntary, properties will receive the same total allocation of waste container volume. However, since there is no requirement for containers for different streams to be located next to each other, fewer larger containers would be required per property. As a result, fewer collection staff are required to service the sector. While fewer containers results in a slightly lower overall cost, it is anticipated that since residents may not have equal access to all three streams, participation rates will be lower, contamination rates will be higher, and the diversion potential will be lower. These factors increase the risk that the City may not be able to achieve its diversion goal. This also carries an additional risk that residents and property managers would perceive the distribution of fewer containers as a lower level of service from the City. While voluntary colocation was slightly preferred by property managers (compared to mandatory colocation), it was considerably less preferred by residents, resulting in a lower social score for alternatives without mandatory colocation.

11.2. Chute Closure

Mandatory chute closure would mean that all buildings in the City of Edmonton that currently have garbage chutes would be required to close them. During public engagement, residents

identified that the convenience offered by chutes could tempt residents to sidestep program requirements, resulting in higher contamination and lower participation. Although mandating chute closure is therefore expected to result in a marginally higher diversion rate, it would also be difficult to enforce and could create accessibility challenges for some residents.

Currently, only about seven percent of properties and 17 percent of units have access to chutes in Edmonton. This means that the incremental increase in diversion resulting from mandatory chute closure is limited. Mandating chute closure would require significant effort and would result in frustration for residents of those buildings. This approach received very low support from residents and property managers, and also had a less favourable risk score.

Voluntary chute closure is a collaborative approach that involves assisting properties to close chutes where there is desire. This approach therefore carries less risk. Based on research findings, ongoing operation of chutes does not preclude colocation.

Chute closure was assumed to not have a financial impact on the City and therefore the approach to chute closure did not change the cost of the alternatives. There is also no difference in staff requirement.

The alternatives presented in Table 6 represent combinations of these primary drivers.

Table 6: Comparison of Alternatives

Parameter	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Chute Closures	Mandatory	Voluntary	Mandatory	Voluntary
Colocation	Mandatory	Mandatory	Voluntary	Voluntary
Potential Diversion Increase	16%	16%	5%	4%
Costs and NPV	$29.2M Capital $91.0M Operating & Maintenance $-67.6M NPV	$29.2M Capital $91.0M Operating & Maintenance $-67.6M NPV	$25.8M Capital $81.9M Operating & Maintenance $-60.4M NPV	$25.8M Capital $81.9M Operating & Maintenance $-60.4M NPV
Total Score	**69**	**78**	**62**	**71**

As described in Section 8, the total score for each alternative in Table 6 is calculated based on four equally weighted criteria. A higher score is desirable for all the criteria:

- A **social score** reflecting resident and property manager preferences elicited during Public Engagement.

- An **environmental score** based on the potential of each alternative to increase the projected diversion rate.
- A **net present value score** based on the combined capital, and operating and maintenance costs over a period of 24 years.
- A **risk score** that reflects risk avoided in each alternative.

The breakdown of the total score for each alternative (showing the contributions of each criteria) is presented in Figure 7.

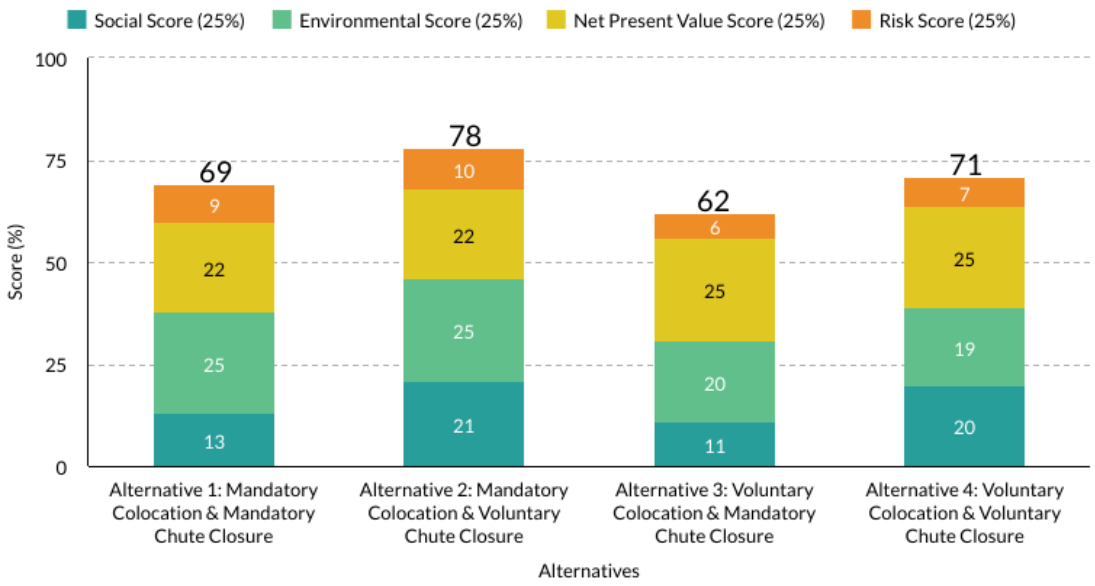

Figure 7: Stage Three Analysis Alternative Scoring Breakdown by Criteria

11.3. Summary of Alternatives

11.3.1. Alternative 1

As a result of mandatory colocation, the diversion potential for this alternative was higher than those without mandatory colocation. Colocation is anticipated to increase the projected diversion rate by as much as 16 percent. The cost of Alternative 1 is slightly higher than alternatives without mandatory colocation, at $29.2 million in capital costs and $91.0 million in operating and maintenance costs, with a negative NPV of $67.6 million. This alternative is anticipated to incur the most significant resistance from residents and property managers, as infrastructure changes may be required to close chutes and to find ways to colocate waste streams elsewhere on the property. This challenge lowered both the social preference score and created a less favourable risk score.

Alternative 1 is not recommended due to a low social score and less favourable risk score

when compared to Alternative 2.

11.3.2. Alternative 2

Alternative 2 differs from Alternative 1 by making chute closures voluntary. Alternative 2 received the highest social score as a result of having the most support from both residents and property managers. As with Alternative 1, mandatory colocation is anticipated to increase the projected diversion rate by as much as 16 percent, and results in $29.2 million in capital costs and $91.0 million in operating and maintenance costs, with a negative NPV of $67.6 million. The combined effect of mandatory colocation and voluntary chute closures results in Alternative 2 having the most favourable risk score, which contributes to Alternative 2 having the highest overall score.

Alternative 2 is the recommended alternative.

11.3.3. Alternative 3

Alternative 3 represents a combination of voluntary colocation and mandatory chute closure. Voluntary colocation results in a lower diversion potential than mandatory colocation and the anticipated increase to the projected diversion rate is only five percent. The impact of voluntary colocation is slightly mitigated by mandatory chute closure, which puts all streams in properties with chutes on equal ground in terms of convenience and access. This means that residents in properties with chutes will need to bring all three streams of their waste to the central waste sorting area(s). As colocation is not mandated, waste set out areas will not necessarily have containers for all the three streams. One stream may be easier to access than others due to the container locations. This would be particularly difficult for residents with physical limitations.

Due to the fact that colocation is voluntary, fewer containers will be required, so the cost is lower at $25.8 million in capital costs, $81.9 million in operating and maintenance costs, and a negative NPV of $60.4 million.

Mandatory chute closures resulted in the lowest social preference score of all alternatives, as well as the least favourable risk score. Alternative 3 has the lowest overall score of all the alternatives.

Alternative 3 is not recommended due to the low scoring in multiple criteria categories.

11.3.4. Alternative 4

Alternative 4 is a combination of voluntary colocation and voluntary chute closure. This alternative has the lowest diversion potential of all alternatives, offering only a four percent increase to the projected diversion rate. As residents and property managers prefer to maintain chutes, Alternative 4 received a relatively high social score. While voluntary colocation poses

risks to the achievement of the diversion target, voluntary chute closure mitigates other risks, giving Alternative 4 a more favourable risk score than Alternative 3. Voluntary colocation has a lower cost of $25.8 million in capital costs, $81.9 million in operating and maintenance costs with a negative NPV of $60.4 million.

Alternative 4 is the second highest scoring alternative overall, with a similar score to Alternative 1.

Alternative 4 is not recommended due to the low diversion potential.

11.4. Diversion Comparison

In 2020, the diversion rate was nine percent including collections and processing as well as waste drop off programs. Table 7 below provides a comparison of the projected diversion rates for each alternative once the program has reached maturity, as well as the projected rate without the proposed program changes. As noted in Section 6, while some increase in diversion can be realized immediately after full implementation of the program, it takes time for a program to mature and for residents to form lasting waste habits. Achievement of program maturity will depend on a number of factors such as the City's ability to provide processing capacity, educational programs, and time, which together will result in a shift in resident waste behaviours, increased capture rates, decreased contamination and ultimately higher diversion.

As noted earlier, the projected diversion rates in this business case exclude potential diversion from Refuse Derived Fuel (RDF).

Table 7: Comparison of Diversion Rate Contribution of Alternatives to the Total Diversion Rate

Program Alternative	Projected Diversion Rate at Maturity
Without proposed program changes	41%
Alternative 1	57%
Alternative 2	57%
Alternative 3	46%
Alternative 4	45%

11.5. Staff and Fleet Impacts

Table 8 below shows the number of staff and the fleet requirements for all four alternatives. The total numbers include collection staff and fleet required to support collection of waste from the

areas serviced by City crews (but not to contractor serviced areas) as well as education and outreach, GIS mapping, and customer support staff required to support all areas of the City (regardless of collection crews). The numbers below reflect needs that are in addition to what is already included in the status quo program, but do not reflect how existing resources may be shifted to prioritize the delivery of a new program. Costs for both City and contractor resources are identified later in this business case. The rate impact of a new program, which is expected to be mitigated or entirely addressed within the utility rate increases forecast in the Waste Services 2021 Utility Rate Filing, will be presented in the 2022 Utility Rate Filing pending a program decision by City Council. A summary of the net staffing impact, reflecting an effort to realign existing resources based on an assessment of the systems impact of an approved program change, would be presented at the same time.

Voluntary colocation requires fewer collection staff to service properties, reducing the total permanent and seasonal staff for those alternatives. However, the shorter implementation period means additional education staff are required to target more properties in a short period of time. Further information about the implementation plan is provided later in this business case.

Table 8: Comparison of Resourcing and Fleet

Category	Mandatory Colocation (Alternative 1 and Alternative 2)	Voluntary Colocation (Alternative 3 and Alternative 4)
Permanent and Seasonal FTEs	30	24
Temporary FTEs for implementation	14	25
Additional fleet requirements including spare ratio	12	8

12. Organizational Change Impact

12.1. Stakeholder Requirement, Business and Operational Impacts

The impacts to stakeholders, both internal and external, were evaluated for the initiative. Tables 9 and 10 identify the stakeholders, their requirements and the business and operational impacts associated with them. Primary stakeholders are more directly impacted by the initiative, whereas secondary stakeholders are more indirectly impacted. The stakeholders, their requirements and the impacts on them were determined to be equivalent for all four alternatives.

Table 9: Primary Stakeholders

Stakeholder Name	Stakeholder Requirement	Business and Operational Impact
Waste Services Branch (internal)	• To implement a communal waste collection program that separates food scraps and recycling from garbage in order to meet strategic goals on a corporate and branch level. • To develop and implement sector-specific educational and outreach programming to support implementation and ongoing program progress. • To develop regulatory requirements to support program requirements.	• Fulfillment of key strategic goals such as diversion from landfill through successful implementation of the new program. • Increased resource demands to meet the service level and program objectives. • Increased capital and operating costs. • Development of new enforcement strategies for the implementation of the program changes.
Fleet and Facility Services Branch (internal)	• Collaboration and consultation regarding project scheduling, purchase and maintenance of collection vehicles and equipment to meet the program requirements for all streams of collection.	• Potential increase in resource demand to support acquisition and maintenance of current and any new vehicles and equipment.
Communications and Engagement Department (internal)	• Effective collaboration with Waste Services and other key stakeholders to develop effective, high quality communication and outreach plans including briefing any internal stakeholders such as 311. • Support the implementation of said plans with resources.	• Increased resource and schedule demands to accommodate phased implementation.
Executive Leadership Team (internal)	• To receive timely, high quality information to support well-informed decisions that support and align with key corporate and strategic goals and	• Project outcome and business case review and approval.

	outcomes.	
City Council (internal)	• To receive transparent and comprehensive information from administration to support decision-making.	• Review and approval of business case including any supporting documentation and attachments. • Provision of any additional direction to Administration (Waste Services). • Receive and discuss any public feedback directly.
City of Edmonton unions (external)	• To ensure transparent communication and collaboration with Waste Services in accordance with 'Working Relationship Agreement' principles.	• Ongoing fulfillment and support of working relationships and principles.
Multi-unit residents (external)	• To be consulted and informed throughout the project life cycle. • To know that the proposed program considers resident needs and barriers. • To receive clear and effective communication regarding program changes and how to participate. • To receive support before, during and after implementation on an ongoing basis. • To be able to provide feedback.	• Changes to behaviour and routine required to transition to a new program. • Increased need for targeted and sustained education. • Ongoing support.
Multi-unit building management including: management companies, building owners, property site management, and	• To be consulted and informed throughout the project life cycle. • To know that the proposed program considers resident and manager needs and takes barriers to successful participation into consideration.	• Potential increase to resourcing and time to communicate with City staff regarding program changes. • Potential increase to resourcing and time to communicate with residents regarding

condo boards (external)	• To know that the proposed program was designed with an awareness of the need to limit stressors such as illegal dumping and cleanliness. • To be confident that the proposed program reflects their needs and was designed to limit additional costs that could impact their business model. • To receive clear and effective communication regarding program changes and how to participate. • To receive supports before, during and after implementation on an ongoing basis. • To collaborate with Waste Services to make any required changes to collection locations and containers to support implementation.	program changes. • Potential additional cost should infrastructure changes be required.
Multi-unit developers	• That proposed requirements be clearly explained. • To be informed and consulted throughout the project life cycle. • Consistency in application of standards from the City.	• Potential new costs, resources or time needed to adapt new building designs to meet new expectations. • Additional consultation regarding new standards.
Collection Services contractors (external)	• To be informed of the project requirements in order to be able to effectively bid on any upcoming contracts (which may include acquiring equipment to deliver new services). • To have clarity regarding scope of work and program expectations.	• Opportunity to bid and work for the City. • Resource and equipment needs for providing the service to the City.
Waste container vendors (external)	• To be informed of changes to contracts and/or have	• Opportunity to bid on any container supply and

	adequate notice to bid on new contracts as required.	potential distribution.
EPCOR (external)	• Consultation, information and collaboration to ensure any changes required in the billing system and waste account setup are communicated adequately to EPCOR and all relevant staff are trained.	• To update the billing system and waste account setup system as required. • Ensure all relevant staff are trained.

Table 10: Secondary Stakeholders

Stakeholder Name	Stakeholder Requirement	Business and Operational Impact
Financial Services Branch (internal)	• To ensure financial transparency in the allocation of the proposed budget and to ensure Waste Services meets its obligations under the Waste Management Utility Fiscal Policy.	• Review and consult on financial impact to program changes. • Make recommendations as required.
Corporate Procurement and Supply Services Branch (internal)	• Consultation and information from Waste Services regarding procurement needs to support proposed program changes.	• Provide resources to meet the project procurement needs.
Legal Services (internal)	• To be consulted regarding legal impacts of any or all components of the proposed program to manage risk.	• Provision of expert legal review of program, tender and contract aspects.
Community Standards and Neighbourhood Branch (internal)	• To be consulted on all regulatory changes to communal collection programs to ensure enforceability of proposed changes.	• To work collaboratively with Waste Services to recommend changes to Waste Bylaw 18590.
Urban Planning	• To be involved in setting	• Potential impact to Zoning

and Economy (internal)	developer standards and site requirements for new properties and incorporating them into bylaws. • To work jointly with Waste Services on the issue of container aesthetics and screening requirements.	Bylaw to ensure compliance with waste developer standards including enforcement staff capacity and resourcing. • Representation needed for discussion on container aesthetics and screening requirements.
Employee Services (internal)	• To be kept up to date on human resource management needs such as recruiting.	• To provide resources on human resource management needs.
Open City and Technologies (internal)	• To be communicated adequately with about IT needs.	• To provide IT resources.
Waste Services OHS (internal)	• To ensure the project aligns with all OHS Acts, Codes, Regulations and the COE OHS Policies, Procedures and Directives.	• To provide resources to review and finalize the project OHS program.
Alberta Environment and Parks (external)	• To ensure the program change meets all requirements under Alberta Environmental Protection and Enhancement Act.	• To review and approve any approval or amendment to existing approvals.
Media	• To be informed of the project decisions and progress and be provided with information as required.	• To provide resources on reporting the project decisions and progress.
Corporate Enviso	• To ensure the project aligns with the Corporate Enviso requirements.	• To provide resources to review and finalize the project Enviso documents.
Current Waste Services collection contractors	• To be communicated adequately on the needs for vehicle modifications/purchasing.	• To provide resources to ensure all garbage truck modifications/purchasing meets the City timeline and requirements.

Local waste management organizations	• To be informed of the project decisions and progress.	• To provide input and assist the City in ensuring a successful program.
Greater Edmonton region municipalities	• To be informed of project decisions and outcomes. • To be consulted or informed of changes that may impact regional waste management programs or market conditions.	• The proposed program changes will create precedence that may impact sector expectations and market conditions for surrounding municipalities and potentially affect program changes proposed by municipalities in the future.

13. Summary of Cost and Benefits

This section identifies overall benefits and costs incurred to realize the recommended alternative.

13.1. Expected Benefits

The benefits described in Table 11 are expected to result from the recommended alternative.

Table 11: Expected Benefits

Tangible Benefits	Intangible Benefits
Increase of 16 percent to projected diversion rate.	Equity for residents between services.
Higher quality end products for market.	Program is more aligned with best practices found in other jurisdictions.
Reduction of GHG from reduced landfilling of organics and increased recycling.	Collateral benefit of improved results in other programs (such as curbside collection) as a result of harmonized expectations.
Improved relationship with residents and property managers as a result of the support and resources provided by the City.	

13.2. Costs

13.2.1. Capital Costs

This financial requirement includes the purchase of collection vehicles, containers (both carts

and bins), as well as their corresponding replacement parts, contingency, and inflation.

The capital costs are summarized for the life of the project for the recommended alternative in Table 12 below.

Table 12: Capital Cost Summary for Alternative 2

Item	Alternative 2
Fleet Related Capital Costs	$10,170,000
Container Related Capital Costs	$10,739,537
Contingency	$4,181,907
Inflation	$4,106,682
Total	**$29,198,126**

The capital costs for the recommended alternative are presented in Figure 8. These costs are presented by category by business cycle.

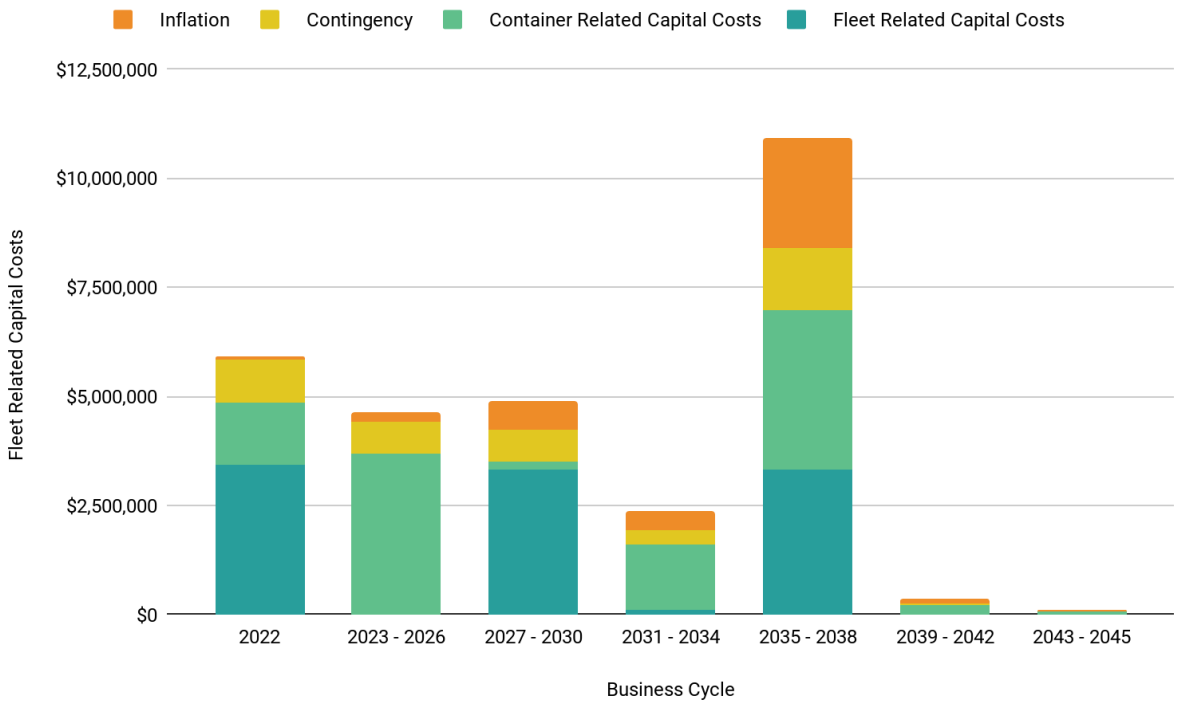

Figure 8: Capital Cost Breakdown by Category for a Four Year Business Cycle

13.2.2. Operating and Maintenance Costs

This financial requirement includes operational costs for the collection of all the streams

(including estimated contractor cost), routing, container maintenance, waste inspectors, costs for a comprehensive education and outreach program, costs for the initial rollout, costs for waste characterization studies every three years, costs for fleet maintenance, supply costs, inflation, and a contingency estimate.

The operating costs are summarized for the life of the project (24 years) for the recommended alternative in Table 13.

Table 13: Operating and Maintenance Cost Summary for Alternative 2

Item	Alternative 2
Operations	$31,970,814
Education and Outreach	$21,690,571
Fleet	$5,073,679
Rollout Materials	$694,314
Supplies	$1,288,755
Waste Characterization Studies	$1,600,000
Contingency	$12,463,627
Inflation	$16,184,392
Total	**$90,966,152**

The operating costs by category by year are presented in Figure 9.

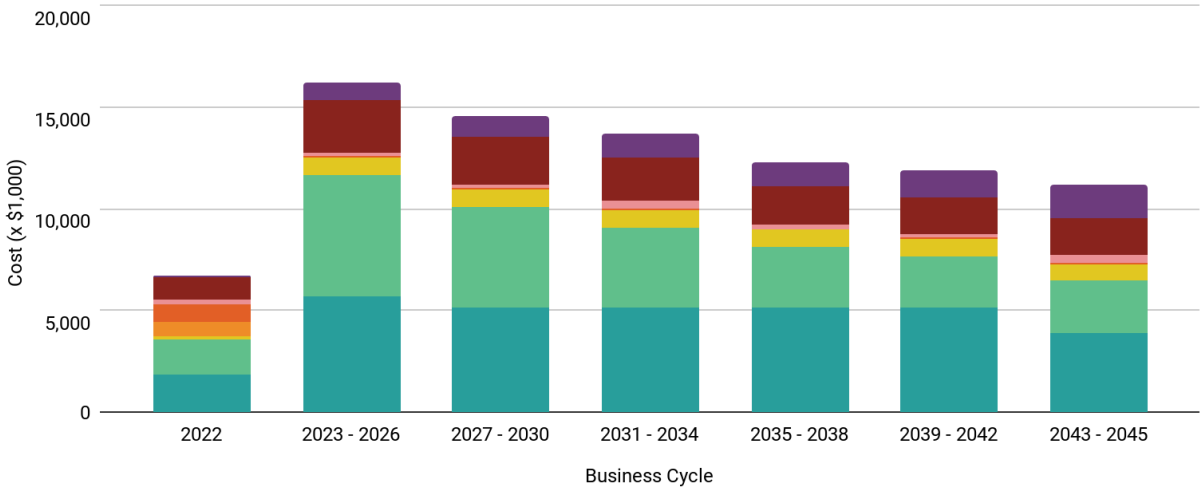

Figure 9: Operating Cost Breakdown by Category for a Four Year Business Cycle

Appendix E, F and G provide a detailed alternative cost comparison summary, a comparison of revenue requirements for the alternatives, and the annual operating and maintenance costs of the recommended Alternative respectively.

14. Key Risks and Mitigating Strategies

A comprehensive risk register was developed for this initiative. High impact risks for the communal collection program are summarized in Table 14, together with associated mitigation strategies. The risk impacts outlined in the table below are based on risk scores before the mitigation strategies for the program are in place.

Table 14: High Impact Risks and Mitigation Strategies for the Recommended Alternative

Risks	Mitigation Strategy
Improvements to waste sorting and set out behaviours are less than anticipated.	• Set achievable expectations and assumptions from the beginning. • Monitor behaviour and review the program regularly to ensure program expectations are aligned with communication and education tools. • Implement diverse and targeted educational tactics during implementation and on an ongoing basis to ensure residents have support they need to properly sort their waste, and in turn, help reduce contamination. • Work with customer support and bylaw teams to inform residents and property managers of issues with compliance. • Work with collections and bylaw teams regarding enforcement tactics. • Ensure the bylaw is updated with clear language.
Internal accounting platform (SAP Ariba) causes delays in the tendering process.	• Ensure CPSS is aware of project expectations and timelines. • Raise any concerns with leadership to ensure full support. • Give enough time to CPSS for the recruitment process.

Inadequate capacity to process separated waste streams (organics and recycling).	• Secure third party capacity for processing. • Regularly monitor tonnage and volume projections and compare with actual values to improve accuracy of predictive models.
Delays in administrative processes or difficulty in meeting needs of internal stakeholders due to the civic election. An unpredictable political climate resulting in the bylaw amendment not being approved on time.	• Begin working on bylaw amendments as soon as possible. • Include all stakeholders from the beginning to ensure everyone's concerns are captured. • Communicate early and often with City Council to ensure they are up to date and informed about the program.
Difficulty in enforcing the new developer standards in new properties if standards are not part of Zoning Bylaw.	• Work closely with the Zoning Bylaw renewal team to ensure they are informed of the necessity of enforceable developer standards.
Infrastructure changes may be required in some multi-unit properties to accommodate three streams.	• Provide as much time as reasonably possible to allow the site to make changes or find solutions to accommodate colocation of three streams. • Provide different styles and sizes of containers to help minimize the need for infrastructure changes.
Properties may expect the City to pay for (or contribute to) the cost of infrastructure changes required to accommodate three stream collection.	• Ensure expectations and program direction is clear from the beginning to remove any misconceptions. • Work with properties to try to find solutions to avoid infrastructure changes.

15. Gender Based Analysis Plus (GBA+) Considerations and Recommendations

GBA+ (Gender-Based Analysis Plus) is a process to examine and address how policies, programs and services impact diverse individuals and groups. Multiple identity factors, including age, race, ability, education, ethnicity, geography, health, language, class, sex, and gender need to be considered to improve planning and decision-making. By using a GBA+ lens, diverse perspectives, experiences, and needs are taken into account to create services that serve everyone.

Through all phases of work the project team looked at the nuanced approaches needed and already being taken in other municipalities to provide a successful program to service

multi-unit properties while considering the diverse needs of residents. Research examined other jurisdictions to find key program components influencing the experiences of residents in multi-unit properties. Two phases of engagement gathered feedback regarding anticipated barriers to participation and how to overcome them. The options analysis process sought to align approaches across the curbside and communal collection services, to ensure equity in experience and level of service, while utilizing feedback from the engagement to influence how options were scored and promoted for consideration.

The following considerations were included in the analysis:

- **Cultural and language considerations -** The use of icons, images and less text in educational materials was identified as a way to effectively offer education and outreach to program customers.
- **Socio-economic considerations -** Understanding that the actual or perceived cost of the program is a burden on residents and building management, a commitment was made to offer the same opportunities and service levels across the sector, regardless of socio-econonomic status.
- **Accessibility and convenience -** A user-centred program design addressing how residents access their waste collection areas resulted in consideration of distance travelled to collection areas and the influence of building infrastructure on program design.

Waste Services recognizes that after the major changes to the program have been established, the program will need to continue to be evaluated for enhancements to ensure that it continues to meet the changing needs of stakeholders in the multi-unit sector.

16. Conclusion and Recommendation

16.1. Conclusion

This business case and the supporting analysis demonstrate the need to transition the communal collection program to mandatory source separation of recycling and food scraps. Although introducing a mandatory source separation program in properties with communal collection is more challenging than an equivalent program for curbside collection, research and engagement have shown that it is possible. This change will favourably impact the diversion rate and will create equal expectations for residents in both sectors.

Waste Services recommends enforceable developer standards to ensure all new properties in Edmonton are designed and built to accommodate three stream separation and collection. Regular program review and advocating for landfill disposal bans are also recommended for endorsement by City Council.

Waste Services recognizes that change to the communal collection program will take time and require extensive communication and education to achieve high success rates. The changes

recommended herein are not expected to cause a steep increase to the diversion rate in a short period of time. Instead, this recommendation will help increase waste diversion over time as residents adapt and become comfortable with this new way of managing waste. The change to three stream collection is key to the overall success of the 25-year Waste Strategy.

16.2. Recommendation

Alternative 2 (mandatory colocation and voluntary chute closure) provides the most favourable results and is recommended for implementation. The recommended alternative has a capital cost of $29 million and an operating and maintenance cost of $91.0 million.

While Alternative 1 and Alternative 4 received the next highest total scores, they represent two contrasting scenarios: all mandatory or all voluntary. Although Alternative 1 scored higher from an environmental perspective and carried slightly less risk overall, there is significantly less support from a social standpoint compared to Alternative 4. Alternative 4 has significantly more support from a social perspective, which is countered by a lower diversion rate potential and a less favourable score for risk.

16.3. Additional Recommendations

Waste Services recommends the following additional items be added to all alternatives to form a complete program. These items do not carry additional resource requirements beyond the status quo, and therefore were not included in the financial analysis of the alternatives, but are presented here for consideration and endorsement by City Council.

A. **Enforceable Developer Standards -** Waste Services' comprehensive developer standards will be completed and referenced to the Zoning and Waste bylaws to ensure all new properties comply.
B. **Regular Program Review -** Waste Services will introduce provisions to review the program every six to nine years to evaluate program success in achieving diversion and contamination rate targets. This timing would align with the regular waste characterization studies, which are planned for every three years. Among other aspects, this review will include a review of volume allocations, container types, and the effectiveness of the regulatory and enforcement measures in this business case to ensure that the solutions remain relevant and effective as Edmonton grows and changes.
C. **Landfill Disposal Bans -** Research has shown that landfill disposal bans prohibiting organics and recyclable material from entering landfills have been a successful tool in ensuring the success of source separation programs. These regulations are often introduced at the provincial or regional level to ensure that all disposal facilities within a region have the same rules. The City continues to engage with its neighbours to explore regional alignment, as defined by the Edmonton Metropolitan Regional Board's 2019 Metropolitan Region Servicing Plan. This work includes a review of the success of landfill bans on successful waste diversion, establishing common reporting protocols,

and regional advocacy to the Provincial government for extended producer responsibility legislation. Waste Services recommends that City Council advocate for disposal bans to be implemented on a provincial level.

17. Project Responsibility and Accountability

The Waste Services communal collection program is sponsored by the Branch Manager of Waste Services. The program oversight and implementation is provided by the Director of Waste Strategy and Director of Collection Services. Once implementation is complete, the ongoing oversight will be provided by the Director of Collection Services.

Information to complete the business case was gathered and analyzed by a dedicated team which included subject matter experts from Waste Services under the supervision of the Director of Waste Strategy and the Waste Services Leadership Team.

18. Implementation Approach

The implementation of the new communal collection program is dependent on public education and outreach efforts, the availability of sufficient processing capacity for organics and recycling, allowing sufficient time for properties to prepare their sites for three stream collection, an update of the Waste Bylaw, and securing the resources identified in this business case.

A high level implementation timeline for the communal collection program is outlined in Figure 10.

18.1. Recommended Timeline for Mandatory Colocation

Should City Council select the recommended alternative, it is anticipated that preparation for the new service will begin in 2022 so three stream collection can commence in 2023. Rollout will be phased over a period of four years. The sequence for operational implementation and education program implementation is described in more detail below.

The timeline allows sufficient time for properties to make infrastructure changes if desired and ensures the City is learning and adapting as the program is rolled out. It also provides the opportunity to build strong relationships with property managers and condo boards along the way. Implementing source separation for properties receiving communal collection requires more time and resources than the curbside program, as the City will need to work with property managers and/or condo boards at each site to make decisions regarding container type, size, placement and collection frequency.

18.1.1. Operational Implementation

Changes to communal collection will be implemented in phases. Each phase is expected to

include approximately 100 properties and will take approximately six weeks. During this period, the properties will be provided with new containers and education. Phases will be determined by geographic area, beginning with areas currently serviced by City crews. Property assessments will start in 2022 to prepare for the first phases of rollout, and will continue as a parallel process during the phased implementation.

Starting in 2022, the City will advise properties which containers have been determined to be optimal for their site. This approach to phased notification will provide properties with as much time as possible to plan for changes and correspond with the City about modifying the assigned containers. Providing a long notice period to properties was one of the requests made by property managers during the engagement activities. A deadline will be set for properties to approach the City regarding any requests for changes to their containers.

18.1.2. Education and Outreach Implementation

The implementation of the proposed communal collection program includes a comprehensive education and outreach strategy. This education strategy is focused on supporting residents and property managers through the transition and on an ongoing basis. This approach will build awareness, provide the tools and support necessary for residents to successfully participate in the program, and help residents adapt to the change in the long term.

Education and outreach tactics will include, but are not limited to:

- Awareness campaigns that will help residents anticipate, understand and prepare for the change. Campaigns will use a variety of approaches, including materials mailed directly to residents, campaign videos and ads on City media channels. This will help to initiate adoption of the new program.
- An educational "welcome" package, which provides residents with the tools they need to immediately begin participating in the program, including an in-unit food scraps pail, an educational brochure outlining the program, a *What Goes Where* poster for in-unit use, and signage and posters for the building to ensure clear and consistent messaging.
- Direct outreach to all residents to introduce the program. This will involve door-to-door canvassing that will use behaviour change tools typical of Community Based Social Marketing practices. These tools have been proven to positively impact behaviour change and include identifying barriers and highlighting benefits of the desired behaviour to residents, asking residents to make commitments (both private and public) to try the new system, and a gift (the food scraps pail), to increase feelings of reciprocity.
- Digital educational resources, including the *WasteWise* app, information on the City website, and educational videos designed to help residents adapt to the program.
- Virtual education sessions for both residents and property managers, to create awareness of the program, answer questions and point residents and property managers to other available resources.
- An annual newsletter sent to each home receiving the communal collection service to

provide information about the progress of the program as a whole, highlighting residents' successes and where performance could be improved, and to encourage continued participation in the program.

Since the implementation is planned to take place over a period of several years, tactics and methods will be evaluated and improved continuously throughout the implementation. As well, learnings from the education and outreach associated with the Edmonton Cart Rollout will be applied during the implementation of the new communal collection program.

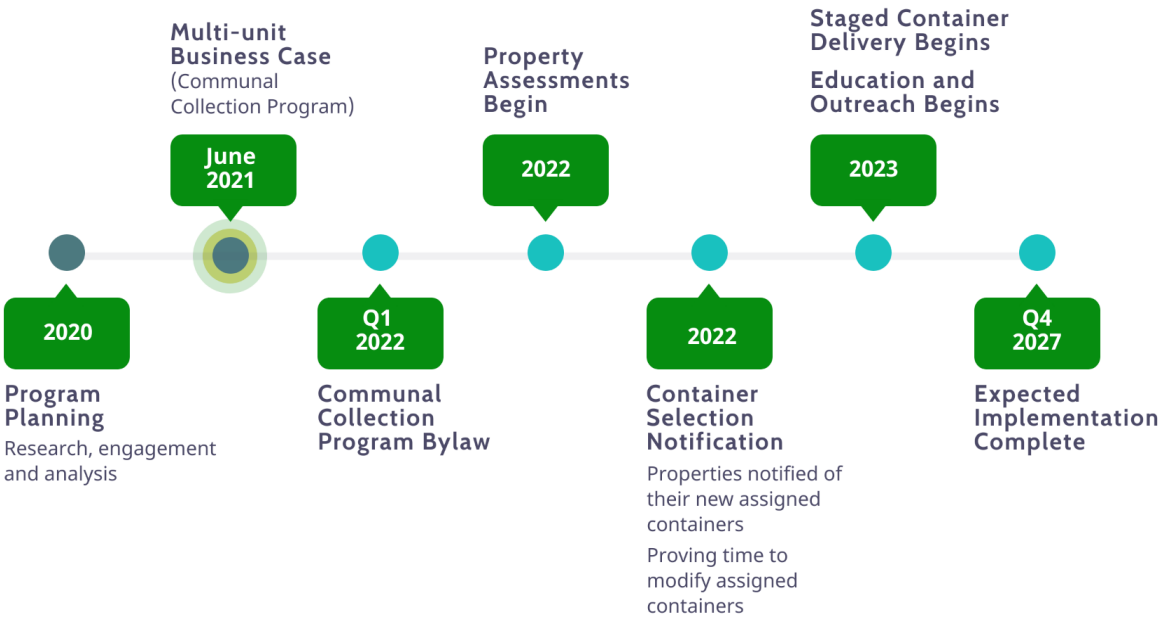

Figure 10: Implementation Timeline for the Recommended Waste Services Program

18.2. Alternative Timeline for Voluntary Colocation

Should Council select an alternative that is not recommended, the implementation timeline could vary. For Alternative 3 and Alternative 4, implementation is expected to take up to two-and-half years to complete. The sequence of steps would be the same, but as voluntary colocation requires distribution of fewer containers, it will not take as long. This expedited timeline means that additional educational staff are required; this difference has been reflected in the cost of the alternatives. Alternative 1 has the same implementation requirements as Alternative 2, the recommended alternative.

18.3. Bylaw Updates

Major changes to the Waste Services Bylaw were introduced together with the recommendations in the Single Unit Waste Set-out Business Case in 2019. These changes did not include updates related to the communal collection program.

Waste Services Bylaw 18590 will require further updates to ensure alignment with the recommendations presented in this business case. Waste Services will initiate an amendment to the current Waste Services Bylaw 18590 following approval of this business case. The bylaw amendment is planned to be presented for approval to Council in the first quarter of 2022. Bylaw changes will be a collaborative effort involving internal stakeholders such as the Community Standards Branch.

18.4. Performance Management

Waste Services will measure the effectiveness and efficiency of the program throughout implementation by assessing the results of performance measures such as:

- Overall communal program diversion rate.
- Stream-specific diversion from landfill.
- Gross tonnes of material collected from food scraps, garbage and recycling.
- Contamination rate in the waste streams.
- Total operating cost per tonne.
- Number of properties serviced.
- Number of properties transitioned per phase (until rollout complete).
- Overall residential customer satisfaction with the communal collection program.
- Overall property management satisfaction with the communal collection program.
- Number of properties using the excess waste program.
- Number of properties taking advantage of the variable rate program due to lower garbage generation.

The most appropriate measures for managing performance on an ongoing basis, once determined, will be embedded in the Enterprise Performance Management (EPM) scorecards of the Waste Services branch for regular review through the City's established EPM framework.

18.5. Critical Dependencies Impacting Timeline

Multiple factors and decisions could impact the timeline for the proposed program changes including, but not limited to, the following possibilities:

- Delay to Council approval of proposed program changes in June 2021 will impact the implementation timing.
- Delay to Council approval of forthcoming amendments to the Waste Services Bylaw.

18.6. Additional Implementation Steps

In addition to the rollout and the education and outreach programs that would be implemented, Waste Services will include the following in the implementation phase:

- **Variable Pricing Details -** Waste Services will continue working on the details of a variable pricing program and present it at a later date. Variable pricing is currently part

of the curbside collection program, allowing rates to be set based on the size of container at a property.

- **Excess Waste Program -** Waste Services will continue working on an excess waste program that would charge properties for additional service above and beyond the allocated amount of waste collected as part of the regular service standard.
- **Stakeholder Working Groups -** Waste Services will evaluate and consider the creation of a stakeholder working group consisting of property managers and condo board members during the implementation phase. Stakeholder working groups can contribute to better stakeholder relationships, collaboratively work towards informing further program iterations and overcoming implementation challenges.
- **Illegal Dumping -** Although planning and funding an illegal dumping strategy was not in scope for this business case, it was identified by many stakeholders as one of the primary concerns for properties with communal collection. As illegal dumping has a scope beyond the communal collection program, Waste Services will consider conducting further study of potential future programs to reduce illegal dumping, and make recommendations at a future date.
- **Bin Aesthetics -** Waste Services will investigate options to improve the aesthetics of front load bins, and work with the Development Services branch to determine if changes to current screening requirements would be possible, and under what conditions.
- **Regular Waste Characterization Studies -** Waste Services will conduct regular and frequent waste characterization studies and audits to ensure updated data is available to measure success against program success measures. These studies will look at contamination levels in all the streams and will help for benchmarking and education planning.
- **Communal versus Curbside Collection -** Where possible, depending on building layout and operational logistics, Waste Services will prioritize curbside collection over communal collection to achieve the policy objectives outlined in the Waste Strategy.

19. Review and Approval Process

Table 15 shows the review and approval process was followed for this business case:

Table 15: Business Case Review and Approval Process

Review Step	Reviewer
Review 1	• Project working team and Waste Strategy Director.
Review 2	• Branch Manager of Waste Services, • Branch Manager of Development Services, • Director of Business Integration (Waste Services), • Director of Collection Services (Waste Services), • Director of Sustainable Waste Processing (Waste Services), • Director of Technical Services (Waste Services), • General Supervisor Business Strategy, Planning & Performance

	(Waste Services), ● Operational Controller with Business Financial Analytics (Waste Services), ● Branch Strategic Coordinator (Waste Services), and ● Legal Services.
Review 3	● Deputy City Manager.
Review 4	● Utility Advisor and City Manager.
Review 5	● Utility Committee report presented.

19.1. Business Case Sign Off

The business case will be approved (signed and dated) by the Branch Managers of Waste Services and Development Services in addition to Directors of Waste Strategy, Collection Services, Technical Services, Sustainable Waste Processing Services, and Business Integration as well as the Operational Controller in Waste Services. The final approval will be received from the Deputy City Manager prior to submission to the Utility Committee and City Council.

Appendices

Appendix A - Stage One Options Analysis Results
Appendix B - Stage Two Options Analysis Results and Sensitivity Analysis Methodology
Appendix C - Stage Three Options Analysis Results and Scoring Methodology
Appendix D - Assumptions for Alternatives
Appendix E - Detailed Alternative Cost Comparison Summary
Appendix F - Comparison of Revenue Requirements for Alternatives
Appendix G - Annual Operating and Maintenance Costs

Appendix A - Stage One Options Analysis Results

Table A1: Stage One Options Analysis Results

Stage One Options Analysis Results			
Category and Option	Advance to Stage Two Options Analysis		
Containers	**Garbage**	**Recycle**	**Organics**
Carts	Yes	Yes	Yes
Front Load Bin	Yes	Yes	Yes
Underground Containers	Yes	Yes	Yes
Bags	No	Yes	No
Roll-off Compactors	Yes	Yes	No
Pneumatic Collection	No	No	No
Mobile Collection	No	No	No
Front Load Bin Compactor	Yes	Yes	No
Waste Drop Off (Exclusively)	No	No	No
Education Relationships		**Residents**	**Stakeholders**
No Education Program		No	No
Education Program		Yes	Yes
No Outreach Program		No	No
Outreach Program		Yes	Yes
Financial Mechanisms			
No Rate Reduction			Yes
Rate Reduction			Yes
No Bill Credits			Yes
Bill Credits			Yes
Variable Pricing Rate Structure			Yes

Fixed Pricing Rate Structure	Yes
Processing	
Pre-processing improvements to the IPTF	Yes
Organic Press	Yes
Waste to Energy Facility	No
No Improvements (Status Quo)	Yes
Developer Standards	
No Developer Standards and Requirements	No
Voluntary Developer Standards and Requirements	Yes
Mandatory Developer Standards and Requirements	Yes
Collections	
Two Stream Waste Collection (Garbage and Recycle)	Yes
Three Stream Waste Collection (Garbage, Recycle and Food Scraps)	Yes
Regulatory Programs	
No Chute Closure	Yes
Voluntary Chute Closure	Yes
Mandatory Chute Closure	Yes
No Colocation	Yes
Voluntary Colocation	Yes
Mandatory Colocation	Yes
Volume Limits Excluding an Excess Waste Program	Yes
Volume Limits Including an Excess Waste Program	Yes

Appendix B - Stage Two Options Analysis Results and Sensitivity Analysis Methodology

Table B1: Stage Two Options Analysis Results

Stage Two Options Analysis Results	
Option Category and Type	Sensitivity Rank Average
Collections	
Two Stream Collection (Garbage and Recycle)	1.80
Three Stream Collection (Garbage, Recycle, and Food Scraps)	1.20
Garbage Collection Containers	
Carts	3.40
Front Load Bins	2.40
Underground (Front Load Truck Unloaded)	1.60
Roll-off Compactor	6.00
Front Load Bin Compactor	4.60
Underground (Crane Unloaded)	6.00
Underground (European-Style)	4.00
Recycling Collection Containers	
Carts	4.80
Front Load Bins	2.00
Underground (Front Load Truck Unloaded)	2.20
Roll-off Compactor	6.20
Front Load Bin Compactor	4.20
Underground (Crane Unloaded)	5.60
Underground (European-Style)	3.60
Bags	7.40
Food Scraps Collection Containers	

Carts	1.00
Front Load Bins	2.40
Underground (Crane Unloaded)	3.80
Underground (European-Style)	2.80
Resident Relationships	
Make Operational Information Public	4.60
In-unit Food Scraps Containers	3.20
In-unit Recycle Containers	4.20
Ambassador Program	5.00
Annual Education Campaigns	1.80
Ongoing Education	2.20
Property Manager Relationships	
Property Manager Resources	3.80
Building Resources (Posters, etc.)	3.00
Voluntary New Tenant Orientation	4.00
Targeted Workshops	6.20
Dedicated Staff for Multi-unit Customer Service	1.80
System Feedback / Report Cards	6.40
Stakeholder Working Teams	2.80
Financial Mechanisms	
No Rate Reduction	3.80
Rate Reduction	2.80
No One-time Bill Credits	3.80
One-time Bill Credits	5.20
Variable Pricing Rate Structure	1.80
Fixed Pricing Rate Structure	3.40

Processing Improvements	
No Improvements (Maintain Status Quo)	2.80
Organic Press	2.00
IPTF Pre-processing Improvements	1.20
Developer Standards	
Developer Standards with Bylaw Enforcement	1.20
Developer Standards Not Enforceable by Bylaw	2.60
Mandatory Separation of ICI and Residential Waste in New Buildings	2.60
Voluntary Separation of ICI and Residential Waste in New Buildings	3.60
Regulatory Programs	
No Chute Closure	7.00
Voluntary Chute Closure	3.00
Mandatory Chute Closure	3.40
No Colocation	8.00
Voluntary Colocation	4.00
Mandatory Colocation	1.60
Volume Limits without an Excess Waste Program	5.00
Volume Limits with an Excess Waste Program	4.00

Table B2: Example of Sensitivity Analysis Methodology

Stage Two Sensitivity Analysis Example								
Criteria Being Analyzed (with % of bias)	Evaluation Criteria Weighting Percentages				Option Score and Rank			
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	3.454	-0.182	2.273	-0.727
Criteria 2: 0.00%	27.27%	**0.00%**	45.45%	27.27%	1	3	2	4
						↑	↓	
					3.842	3.501	3.500	1.922
Criteria 2: 71.07%	7.89%	**71.07%**	13.15%	7.89%	1	2	3	4
					↓	↑		
					3.882	3.883	3.628	2.196
Criteria 2: 78.44%	5.88%	**78.44%**	9.80%	5.88%	2	1	3	4

In the Sensitivity Analysis example above, four options are being evaluated against Criteria 2. The central columns show the weight assigned to each of the four criteria. The columns to the right are the corresponding rank of each option.

In the first row of the analysis, the weighting for Criteria 2 is set to zero percent, and the option ranks are recorded.

The percent weighting of Criteria 2 was then increased until a rank change occurred in the options. In the example above, a rank change occurred when Criteria 2 reached 71.07% (second row of the analysis above). When Criteria 2 was weighted at 71.07%, the option that had been ranked third moved up to rank second, and the option ranked second dropped to rank third.

The last row shows another rank change when Criteria 2 reached a weight of 78.44%. In this example, the ranking remains constant regardless of how much additional weight is added to Criteria 2 after 78.44%.

This methodology was followed for every option and every criteria in Stage Two analysis to reach the final average rank for each option. An option with a higher sensitivity rank average is preferred.

Appendix C - Stage Three Options Analysis Results and Scoring Methodology

The Total Weighted Score of the Stage Three analysis is summarized in Table C1 below. The Total Weighted Score is calculated by input from four equally weighted (25% each) criteria.

Table C1: Stage Three Options Analysis Results

Stage Three Options Analysis Results					
Alternative	**Social Impact / Public Preference Score**	**Environ-mental Score**	**Net Present Value Score**	**Risk Score**	**Total Weighted Score**
Weighting	**25%**	**25%**	**25%**	**25%**	**100%**
Alternative 1	50%	100%	88%	36%	**69%**
Alternative 2	85%	100%	88%	38%	**78%**
Alternative 3	45%	78%	100%	26%	**62%**
Alternative 4	80%	76%	100%	27%	**71%**

Social Impact / Public Preference Score

The Social Impact / Preference Score is the total resident score out of ten, plus the total property manager score out of ten, divided by a possible overall total of 20 points. For example, Alternative 2 has 17 points out of 20, equalling 85%. Table C2 provides a summary of the Social Impact / Public Preference Score.

Table C2: Social Impact / Public Preference Scoring Summary

Social Impact / Public Preference (25.00% Weighting)			
Alternative	Social Impact / Public Preference Scores		Criteria Score
Alternative 1: Mandatory Colocation & Mandatory Chute Closure	**Resident Score (Maximum 5 for Each)**		50%
	Mandatory Colocation 4	Mandatory Chute Closure 2	
	Property Manager Score (Maximum 5 for Each)		

	Mandatory Colocation 3	Mandatory Chute Closure 1	
Alternative 2: Mandatory Colocation & Voluntary Chute Closure	**Resident Score (Maximum 5 for Each)**		85%
	Mandatory Colocation 4	Voluntary Chute Closure 5	
	Property Manager Score (Maximum 5 for Each)		
	Mandatory Colocation 3	Voluntary Chute Closure 5	
Alternative 3: Voluntary Colocation & Mandatory Chute Closure	**Resident Score (Maximum 5 for Each)**		45%
	Voluntary Colocation 4	Mandatory Chute Closure 2	
	Property Manager Score (Maximum 5 for Each)		
	Voluntary Colocation 3	Mandatory Chute Closure 1	
Alternative 4: Voluntary Colocation & Voluntary Chute Closure	**Resident Score (Maximum 5 for Each)**		80%
	Voluntary Colocation 4	Voluntary Chute Closure 2	
	Property Manager Score (Maximum 5 for Each)		
	Voluntary Colocation 3	Voluntary Chute Closure 1	

Environmental Score

The Environmental Score is calculated with reference to the alternative with the highest projected diversion at program maturity. Program maturity refers to a period of time where ideal sorting behavior has been established and the program is fully implemented. Every alternative's score is a ratio of its own projected diversion compared to the highest projected diversion rate. For example, Alternative 1 and Alternative 2 have the same highest projected diversion rate (51%), so they score 100%. Alternative 3 has a projected diversion rate of 40%, which is 78% of the highest projected diversion rate (40% / 51% = 78%). The score for Alternative 4 is calculated the same way. Table C3 provides a summary of the environmental scores. All of the diversion rates are compared against the projected diversion rate if no alternatives were implemented. These diversion rates are estimated based on the proposed

changes to the collection aspect of the program and supporting educational programming. As this business case does not propose changes to other programs such as waste drop off, additional diversion from services such as Community Recycling Depots or Eco Stations is not included in the Alternative or Status Quo estimates, but are included in overall diversion rate totals (approximately 6%). Lastly, these diversion rates also exclude contributions from the RDF facility at the EWMC.

Table C3: Environmental Scoring Summary

Environmental (25.00% Weighting)		
Explanation of Diversion Rate	Predicted Diversion Rate (Collections and Processing Only, Excluding RDF)	Criteria Score
Alternative 1: Mandatory Colocation & Mandatory Chute Closure		
Alternative Diversion Rate at Maturity	**51%**	**100%**
Projected Status Quo Diversion Rate	35%	
Overall Increase in Diversion at Maturity	16%	
Alternative 2: Mandatory Colocation & Voluntary Chute Closure		
Alternative Diversion Rate at Maturity	**51%**	**100%**
Projected Status Quo Diversion Rate	35%	
Overall Increase in Diversion at Maturity	16%	
Alternative 3: Voluntary Colocation & Mandatory Chute Closure		
Alternative Diversion Rate at Maturity	**40%**	**78%**
Projected Status Quo Diversion Rate	35%	
Overall Increase in Diversion	5%	

at Maturity		
Alternative 4: Voluntary Colocation & Voluntary Chute Closure		
Alternative Diversion Rate at Maturity	**39%**	**76%**
Projected Status Quo Diversion Rate	35%	
Overall Increase in Diversion at Maturity	4%	

Net Present Value Score

Each alternative is scored for Net Present Value based on the percent difference compared to the highest NPV subtracted from a perfect score (100%). To demonstrate, Alternative 3 and Alternative 4 have the highest NPV (i.e. the least costly alternative), thus the score is 100%. Alternative 1 and Alternative 2 are $7.25M more expensive than Alternative 3 and Alternative 4. $7.25M / $60.38M = 12% summarizes the percent difference calculation, and 100% - 12% gives the NPV Score of 88%. A mathematical summary can be seen below. Table C4 provides a summary of the NPV scores.

$$\frac{\$60.38M}{\$60.38M} - \frac{\$67.63M - \$60.38M}{\$60.38M} = 0.87998 = 88\%$$

Table C4: Net Present Value Scoring Summary

Net Present Value (NPV) (25.00% Weighting)		
Alternative	Net Present Value	Criteria Score
Alternative 1: Mandatory Colocation & Mandatory Chute Closure	Net Present Value: -$67,630,915.92	88%
Alternative 2: Mandatory Colocation & Voluntary Chute Closure	Net Present Value: -$67,630,915.92	88%
Alternative 3: Voluntary Colocation & Mandatory Chute Closure	Net Present Value: -$60,383,543.18	100%
Alternative 4:		100%

Voluntary Colocation & Voluntary Chute Closure	Net Present Value: -$60,383,543.18	

Risk Score

The Risk Score reflects the risk avoided by an alternative. This approach was used to maintain consistency with the other scores where a higher percentage represents better performance. A risk analysis was completed to determine each alternative's risk potential and actual risk. The risk score is based on the difference between the risk potential and actual risk. For example, the risks associated with Alternative 1 had a potential score of 70 (if all risks had maximum likelihood and impact). The actual risk associated with Alternative 1 had a score of 45 (based on expected likelihood and impact). The avoided risk is therefore 25. The score is the ratio of the avoided risk to potential risk, where more risk being avoided results in a higher score. Table C5 provides a summary of the Risk Score.

Table C5: Risk Scoring Summary

Risk (25.00% Weighting)			
Alternative	Risk Score		Criteria Score
Alternative 1: Mandatory Colocation & Mandatory Chute Closure	Total Risk Avoided: Total Score Possible:	25 70	36%
Alternative 2: Mandatory Colocation & Voluntary Chute Closure	Total Risk Avoided: Total Score Possible:	23 60	38%
Alternative 3: Voluntary Colocation & Mandatory Chute Closure	Total Risk Avoided: Total Score Possible:	18 70	26%
Alternative 4: Voluntary Colocation & Voluntary Chute Closure	Total Risk Avoided: Total Score Possible:	12 45	27%

Appendix D - Assumptions for Alternatives

Table D1: Assumptions list for Alternatives 1 and 2 - Mandatory Colocation

Assumptions for Alternative 1 and Alternative 2 - Mandatory Colocation	
1	Cart lifespan is 12 years (less than the Single Unit Waste Set-out Business Case) due to the shared nature of multi-unit containers. FLB lifespan is set to 12 years for recycling and garbage containers. Food scraps FLB lifespan are set to 6 years to account for the corrosive nature of organic waste.
2	Food scraps carts are assumed to be coloured for cost purposes (similar to the curbside program).
3	An extra supply of 20% has been approximated to account for inaccuracies in unit count, site count, and properties with space restrictions and differing container needs. The 20% was taken from the ACEE guidelines for a Class 3 estimate.
4	Service frequency is assumed to be weekly for all streams, and hard volume limits are imposed (no extra lifts).
5	Volume allocation per unit, assuming no contamination, is calculated to be: Garbage = 0.09 yd^3 / week Recycling = 0.20 yd^3 / week Food Scraps = 0.03 yd^3 / week
6	Densities from EPA[15] (converted to metric) taken as: Mixed Multi-unit Solid Waste (Uncompacted) = 43.09 kg / yd^3 (aka Garbage) Mixed Single Stream Recycle (Uncompacted) = 23.13 kg / yd^3 (aka Recycling) Food Scraps = 210.01 kg / yd^3 Mixed Yard Waste = 113.40 kg / yd^3 (added to the Food Scraps stream)
7	Food scraps container size volume allocation is based on a 90% capture rate (by weight), resulting in a total allocation of 0.0276 yd^3 / week per unit.
8	Recycling container size volume allocation is based on a 90% capture rate (by weight), resulting in total allocation of 0.185 yd^3 / week per unit.
9	Garbage volume container size allocation is based on: • 52% of food scraps to be in the garbage stream by weight to account for improper sorting. • 15% of recycling to be in the garbage stream by weight to account for improper sorting and to not significantly increase the volume of the garbage allocation. This results in the garbage container size to be increased by 23% above the 0.09 yd^3 / week allocation, resulting in a total allocation of 0.125 yd^3 / week per unit.

[15] EPA Density Document 2016

10	Based on current in-field percentages, 20% of the bins require casters. Only medium duty casters are used, and no FLB over 4 yd^3 in size will have casters.
11	No FLB are refurbishable due to end of life wear and tear.
12	Every unit will be given 1 food scraps pail. After the first initial purchase of food scraps pails, new purchases will equate a 2% expected growth rate and a 5% surplus.
13	The requirements for garbage FLB can be met by existing inventory.
14	The largest container to be used for food scraps is a 2 yd^3 front load bin.
15	Cart and FLB replacement part quantity is set to match the surplus, a similar assumption to the Single Unit Waste Set-out Business Case.
16	None of the FLB are assumed to be "Cathedral Style.”
17	The number of 240L carts is assumed to be 25% of the 360L carts. The two different sizes will be used based on building space limitations.
18	No more than 4 food scraps carts can be placed in a single "collection area" at a property. If 5 or more carts are needed, a 2 yd^3 bin shall be allocated instead. It is assumed a property limit of 15 food scraps carts will satisfy all "collection areas" that a property requires.
19	No more than 7 garbage carts per property are allowed, which services up to a potential 7 "collection areas.” These are for special cases where a frequency reduction for current garbage bins would be too low, or space is a primary concern. This is to ensure that existing FLB are used as often as possible instead of replacing them with carts. This limit is separate from the food scraps cart limit of 15 outlined in Assumption 18.
20	Lifespan of new trucks has been averaged to 8 years instead of 10, to allot for reduced life expectancy due to dedicated organics collection.
21	Downtime for all collection vehicles is calculated at 15% based on historical data.
22	City contractor cost for servicing food scraps FLB is assumed to be higher than the cost of servicing recycling and garbage FLB. This is based on data from the existing curbside program.
23	The contractor food scraps cart 240L and 360L servicing cost follows the same cost progression as garbage carts.
24	Contractor collection costs are the current average cost multiplied by the new additional allocation.
25	Contractor collection costs are set to 100% of status quo for the first year of implementation, as city-side rollout will occur first. The costs are then adjusted as implementation is completed.

26	Implementation will take 4 years to complete.
27	For costing purposes, the growth rate has been set to 2% per year.
28	Chute closure will have no impact to capital or operating cost.
29	For diversion rate calculations, it is assumed that processing facilities have adequate capacity to process all incoming garbage, recycle and food scraps.
30	Is it assumed that contamination for Alternative 1 and Alternative 2 will be 10% for both food scraps and recycle collection, for diversion calculations. This is attributed to colocation.
31	Chute closure is assumed to have no impact on diversion in Alternative 1 and Alternative 2.
32	The Multi-unit Waste Bylaw will be updated in time for full program implementation. Costs and resources required for Bylaw updates have not been included in the analysis.
33	Staffing and resource additions will be adequate to maintain the program during and after implementation.
34	The annual compounded inflation rate is calculated and averaged to be 1.96% based on City Economist data over the project period from 2021 to 2046.
35	The diversion rates predicted in the Stage Three analysis are “mature” program predictions, and can be seen as an end state scenario for each alternative.

Table D2: Assumptions List for Alternatives 3 and 4 - Voluntary Colocation

Assumptions for Alternative 3 and Alternative 4 - Voluntary Colocation	
1	Cart lifespan is 12 years (less than the Single Unit Waste Set-out Business Case) due to the shared nature of multi-unit containers. FLB lifespan is set to 12 years for recycling and garbage containers. Food scraps FLB lifespan are set to 6 years to account for the corrosive, damaging nature of organic waste.
2	Food scraps carts are assumed to be coloured for cost purposes (similar to the curbside program).
3	An extra supply of 20% has been approximated to account for inaccuracies in unit count, site count, and properties with space restrictions and differing container needs. The 20% was taken from the ACEE guidelines for a Class 3 estimate.
4	Service frequency is assumed to be weekly for all streams, and hard volume limits are imposed (no extra lifts).

5	Volume allocation per unit, assuming no contamination, is calculated to be: Garbage = 0.09 yd^3 / week Recycling = 0.20 yd^3 / week Food Scraps = 0.03 yd^3 / week
6	Densities from EPA[16] (converted to metric) taken as: Mixed Multi-unit Solid Waste (Uncompacted) = 43.09 kg / yd^3 (aka Garbage) Mixed Single Stream Recycle (Uncompacted) = 23.13 kg / yd^3 (aka Recycling) Food Scraps = 210.01 kg / yd^3 Mixed Yard Waste = 113.40 kg / yd^3 (added to the Food Scraps stream)
7	Food scraps container size volume allocation is based on a 90% capture rate, resulting in a total allocation of 0.0276 yd^3 / week per unit.
8	Recycling container size volume allocation is based on a 90% capture rate, resulting in total allocation of 0.185 yd^3 / week per unit.
9	Garbage volume container size allocation is based on: ● 52% of food scraps to be in the garbage stream by weight to account for improper sorting. ● 15% of recycling to be in the garbage stream by weight to account for improper sorting and to not significantly increase the volume of the garbage allocation. This results in the garbage container size to be increased by 23% above the 0.09 yd^3 / week allocation, resulting in a total allocation of 0.125 yd^3 / week per unit.
10	Based on current in-field percentages, 20% of the bins require casters. Only medium duty casters are used, and no FLB over 4 yd^3 in size will have casters.
11	No FLB are refurbishable due to end of life wear and tear.
12	Every unit will be given 1 food scraps pail. After the first initial purchase of food scraps pails, new purchases will equate a 2% expected growth rate and a 5% surplus.
13	The requirements for garbage FLB can be met by existing inventory.
14	The largest container to be used for food scraps is a 2 yd^3 front load bin.
15	Cart and FLB replacement part quantity is set to match the surplus, a similar assumption to the Single Unit Waste Set-out Business Case.
16	None of the FLB are assumed to be "Cathedral Style."
17	The number of 240L carts is assumed to be 25% of the 360L carts. The two different sizes will be used based on building space limitations.
18	Recycling FLB are included for the properties that currently do not have recycling service.

[16] EPA Density Document 2016

19	No more than 4 carts can be placed in a single collection area at a site. If 5 or more carts are needed, a 2 yd^3 FLB is preferable due to the fact the footprint of 5 carts is more than one 2 yd^3 FLB.
20	Lifespan of new trucks has been averaged to 8 years instead of 10, to allot for reduced life expectancy due to dedicated organics collection.
21	Downtime for all collection vehicles is calculated at 15% based on historical data.
22	City contractor cost for servicing food scraps FLB is assumed to be higher than the cost of servicing recycling and garbage FLB. This is based on data from the existing curbside program.
23	Contractor collection costs are the current average cost multiplied by the new additional allocation.
24	The contractor food scraps cart 240L and 360L servicing cost follows the same cost progression as garbage carts.
25	Contractor collection costs are set to 100% of status quo for the first year of implementation, as city-side rollout will occur first. The costs are then adjusted as implementation is completed.
26	Implementation will take 2 years to complete.
27	For costing purposes, the growth rate has been set to 2% per year.
28	Chute closure will have no impact to capital or operating cost.
28	For diversion rate calculations, it is assumed that processing facilities have adequate capacity to process all incoming garbage, recycle and food scraps.
29	Is it assumed that contamination for: ● Alternative 3 will be 56.28% for recycle and 68.78% for food scraps collection assuming that with mandatory chute closure, properties with chutes will follow the same contamination as Alternative 1 and Alternative 2 (10%). Buildings without chutes will follow contamination outlined below for Alternative 4. ● Alternative 4 will be 71.50% for recycle and 84.00% for food scraps collection based on composition studies from other municipalities who also have voluntary colocation and voluntary chute closure.
30	Chute closure is assumed to have no impact on diversion in Alternative 1 and Alternative 2.
31	The Multi-unit Waste Bylaw will be updated in time for full program implementation. Costs and resources required for Bylaw updates have not been included in the analysis.

32	Staffing and resource additions will be adequate to maintain the program during and after implementation.
33	The annual compounded inflation rate is calculated and averaged to be 1.96% based on City Economist data over the project period from 2021 to 2046.
34	The diversion rates predicted in Stage 3 analysis are “mature” program predictions, and can be seen as an end state scenario for each alternative.

Appendix E - Detailed Alternative Cost Comparison Summary

Table E1: Cost Comparison and Revenue Requirements for Program Alternatives

Cost Comparison & Revenue Requirement		
	Alternatives	
Reference	**Voluntary Colocation**	**Mandatory Colocation**
Base Year	2021	2021
In-service Year	2022	2022
Cumulative Revenue Requirement (from base year)	**Voluntary Colocation**	**Mandatory Colocation**
CPV @ Year 5	$22,024,746	$24,555,811
CPV @ Year 10	$35,122,719	$39,529,164
CPV @ Year 15	$47,202,026	$51,721,468
CPV @ Year 20	$57,247,418	$63,000,595
CPV @ Year 25	$62,783,437	$69,957,002
CPV @ Year 30	$62,891,716	$70,086,105
CPV @ Year 35	$62,891,716	$70,087,362
Capital Cost Summary (Base Year Dollars)	**Voluntary Colocation**	**Mandatory Colocation**
Equipment	$16,252,147	$18,944,014
Building	$0	$0
Other (engineering/PM, etc.)	$2,133,904	$1,965,523
Total Base Costs	**$18,386,050**	**$20,909,537**
Contingency	$3,677,210	$4,181,907
Inflation	$3,721,430	$4,106,682
Total Capital	**$25,784,691**	**$29,198,126**

Economic Assumptions	
Inflation (compounded each year)	1.96%
Contingency	20.00%
Analysis is based on 35 years to capture the full life cycle costs of the assets.	
Assumes borrowing required at 84% (based on current Utility split) at 3.80%.	

Table E2: Alternative Cost Comparison Summary

Alternative Cost Comparison Summary			
Waste Services Vehicle & Equipment (2019 - 2022)	**Voluntary Colocation**	**Mandatory Colocation**	**Net Change**
Total Capital Cost	($25,784,691)	($29,198,126)	-$3,413,435
Total Revenues	$0	$0	$0
Total Operating and Maintenance Costs	($81,891,043)	($90,966,152)	-$9,075,109
Project Net Inflows (Outflows)	($107,675,733.72)	($120,164,277.71)	-$12,488,544
WACC Discount Rate	5.21%	5.21%	0.00%
Net Present Value	($60,383,543)	($67,630,916)	-$7,247,373

Appendix F - Comparison of Revenue Requirement for Alternatives

Table F1: Annual Cost Revenue Requirement Summary

Revenue Requirement Summary (Annual Costs)		
	Alternatives	
Calendar Year	**Voluntary Colocation**	**Mandatory Colocation**
2022	$8,109,713	$7,234,481
2023	$6,127,119	$4,974,144
2024	$3,494,209	$5,507,765
2025	$3,754,500	$5,725,237
2026	$3,502,270	$4,877,711
2027	$3,505,270	$4,145,149
2028	$4,777,900	$4,504,408
2029	$4,343,816	$4,263,001
2030	$3,260,417	$4,686,733
2031	$3,668,133	$4,907,894
2032	$3,410,498	$4,168,191
2033	$3,435,939	$4,025,467
2034	$6,023,450	$5,102,216
2035	$6,274,940	$5,052,044
2036	$4,426,515	$5,359,984
2037	$4,477,931	$5,971,653
2038	$4,312,260	$5,472,708
2039	$4,539,895	$5,503,118
2040	$6,103,546	$5,681,994

2041	$5,784,618	$5,387,215
2042	$4,320,093	$5,425,276
2043	$4,467,952	$5,680,789
2044	$4,155,226	$5,053,432
2045	$3,972,369	$4,882,541
2046	$431,766	$769,644
2047	$311,338	$348,463
2048	$99,102	$54,285
2049	$0	$45,665
2050	$0	$31,483
2051	$0	$18,596
2052	$0	$6,065

Table F2: Cumulative Present Value Revenue Requirement Summary

Revenue Requirement Summary (Cumulative Present Value)		
	Alternatives	
Calendar Year	**Voluntary Colocation**	**Mandatory Colocation**
2022	$7,708,120	$6,876,230
2023	$13,243,435	$11,369,932
2024	$16,243,825	$16,099,313
2025	$19,308,074	$20,771,986
2026	$22,024,746	$24,555,811
2027	$24,609,262	$27,612,125
2028	$27,957,667	$30,768,863
2029	$30,851,112	$33,608,476

2030	$32,915,351	$36,575,746
2031	$35,122,719	$39,529,164
2032	$37,073,420	$41,913,242
2033	$38,941,352	$44,101,669
2034	$42,053,814	$46,738,107
2035	$45,135,663	$49,219,347
2036	$47,202,026	$51,721,468
2037	$49,188,876	$54,371,079
2038	$51,007,469	$56,679,064
2039	$52,827,251	$58,884,947
2040	$55,152,658	$61,049,745
2041	$57,247,418	$63,000,595
2042	$58,734,365	$64,867,939
2043	$60,196,051	$66,726,404
2044	$61,488,113	$68,297,761
2045	$62,662,148	$69,740,798
2046	$62,783,437	$69,957,002
2047	$62,866,566	$70,050,043
2048	$62,891,716	$70,063,820
2049	$62,891,716	$70,074,835
2050	$62,891,716	$70,082,053
2051	$62,891,716	$70,086,105
2052	$62,891,716	$70,087,362

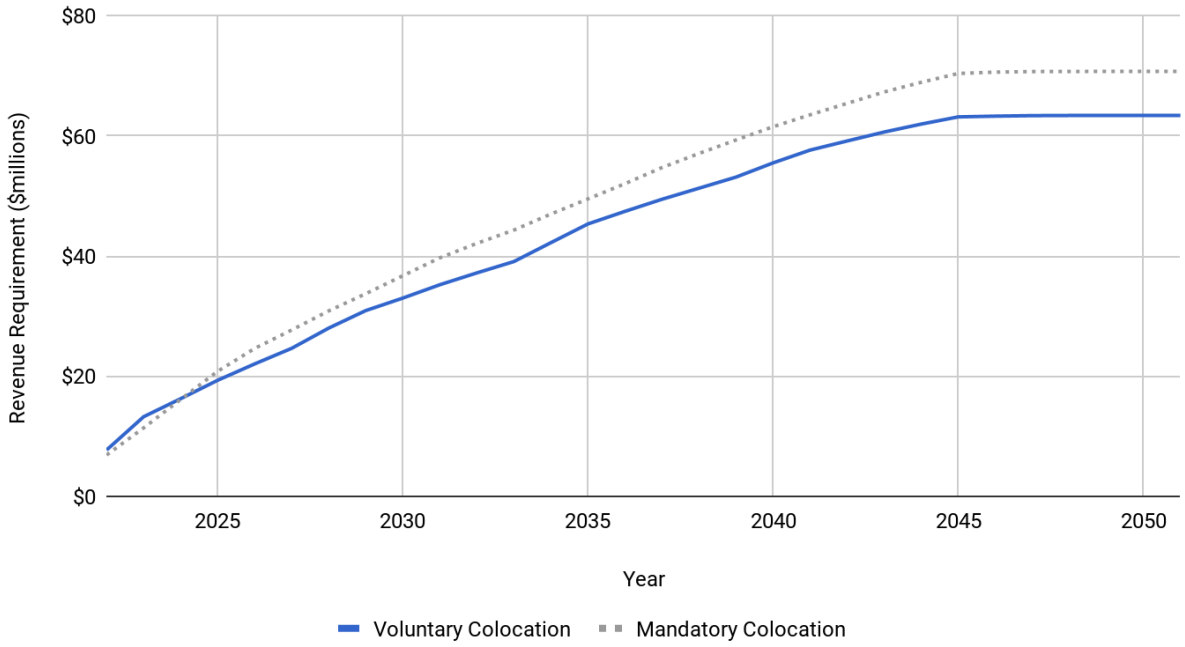

Figure F1: Cumulative Present Value of Revenue Requirement for Program Alternatives

Appendix G - Annual Operating and Maintenance Costs

Table G1 provides the annual operating and maintenance costs for the recommended Alternative.

Table G1: Annual Operating and Maintenance Costs for Alternative 2

Year	O&M Costs	Year	O&M Costs
2022	$6,723,767	2034	$4,174,480
2023	$4,020,672	2035	$3,947,372
2024	$4,358,771	2036	$4,019,204
2025	$4,382,952	2037	$4,403,103
2026	$3,481,905	2038	$3,397,170
2027	$2,784,152	2039	$3,460,630
2028	$3,170,684	2040	$3,937,468
2029	$2,953,683	2041	$3,676,041
2030	$3,006,885	2042	$3,745,342
2031	$3,343,041	2043	$4,161,456
2032	$3,044,538	2044	$3,800,071
2033	$3,100,119	2045	$3,872,649