



## **Single Unit Waste Set-out**

### **Business Case**

City Operations | Waste Services

City of Edmonton

Capital Profile: CPP# 20-81-2041

*page intentionally left blank*

## TABLE OF CONTENTS

<b>Executive Summary</b>	<b>6</b>
<b>Single Unit Waste Set-out Business Case Summary</b>	<b>6</b>
<b>Single Unit Waste Set-out Business Case Recommendation</b>	<b>7</b>
<b>Background</b>	<b>8</b>
<b>Setting the Stage for Sustainable Waste Management</b>	<b>8</b>
<b>Current Situation</b>	<b>9</b>
<b>Collections and Processing</b>	<b>9</b>
<b>Issues Identified with the Current Waste Collection and Processing</b>	<b>10</b>
<b>Collection</b>	<b>10</b>
<b>Processing</b>	<b>10</b>
<b>Opportunity</b>	<b>11</b>
<b>Context Analysis</b>	<b>12</b>
<b>Environmental Scan</b>	<b>12</b>
<b>Source Separated Organics</b>	<b>13</b>
<b>Leaf and Yard Waste</b>	<b>13</b>
<b>Method of Collection</b>	<b>13</b>
<b>Cart Size Offerings</b>	<b>13</b>
<b>Recycling Best Practices</b>	<b>13</b>
<b>Initiative Description</b>	<b>14</b>
<b>Initiative Description</b>	<b>14</b>
<b>Source Separated Organic (SSO) Stream</b>	<b>15</b>
<b>Seasonal Leaf &amp; Yard Waste (L&amp;YW) Stream</b>	<b>15</b>
<b>Garbage Stream</b>	<b>15</b>
<b>Recycling Stream</b>	<b>15</b>
<b>Anticipated Outcomes</b>	<b>16</b>
<b>Scope</b>	<b>16</b>
<b>Waste Collection</b>	<b>16</b>
<b>Residential Waste Drop off</b>	<b>16</b>
<b>Processing</b>	<b>16</b>
<b>Financial</b>	<b>16</b>
<b>Education, Outreach and Enforcement</b>	<b>16</b>
<b>Out of Scope</b>	<b>16</b>
<b>Critical Success Factors</b>	<b>17</b>

<b>Options Analysis Methodology</b>	<b>17</b>
<b>Strategic Alignment</b>	<b>18</b>
<b>Public Engagement</b>	<b>19</b>
<b>Analysis of Options</b>	<b>20</b>
<b>Operational Considerations</b>	<b>20</b>
<b>Methods of Collection</b>	<b>20</b>
<b>Frequency of Collection</b>	<b>21</b>
<b>Processing Feasibility</b>	<b>22</b>
<b>Social and Resident preference</b>	<b>23</b>
<b>Environmental</b>	<b>25</b>
<b>Financial</b>	<b>25</b>
<b>Recommendation Methodology</b>	<b>25</b>
<b>Alternative Analysis</b>	<b>26</b>
<b>Source Separated Organics (SSO) Stream</b>	<b>26</b>
<b>Shortlisted Alternatives SSO Program</b>	<b>26</b>
<b>Cost Benefit Analysis</b>	<b>27</b>
<b>Recommendation for SSO Program Change</b>	<b>28</b>
<b>Seasonal Leaf and Yard Waste (L&amp;YW) Stream</b>	<b>28</b>
<b>Shortlisted Alternatives for Seasonal L&amp;YW Program</b>	<b>29</b>
<b>Cost Benefit Analysis</b>	<b>29</b>
<b>Recommendation for Seasonal L&amp;YW Program</b>	<b>30</b>
<b>Additional L&amp;YW collection</b>	<b>30</b>
<b>Garbage Program</b>	<b>31</b>
<b>Shortlisted Alternatives for Garbage Program</b>	<b>31</b>
<b>Cost Benefit Analysis for Garbage Program</b>	<b>31</b>
<b>Recommendation for Garbage Program</b>	<b>32</b>
<b>Other Additional Add-On Programs</b>	<b>33</b>
<b>Additional Assisted Waste Program</b>	<b>33</b>
<b>Excess Waste Program</b>	<b>33</b>
<b>Recycling Program</b>	<b>34</b>
<b>Shortlisted Alternatives for Recycling Program</b>	<b>34</b>
<b>Cost Benefit Analysis for Recycling Program</b>	<b>35</b>
<b>Recommendation for Recycling Program</b>	<b>36</b>
<b>Single Unit Waste Set-out Business Case Recommendations</b>	<b>36</b>
<b>Waste Services Recommended Program Set-out and Costs</b>	<b>36</b>
<b>Resourcing, Fleet and 4-Year Financial Requirement</b>	<b>37</b>
<b>Organizational Change Impact for the Single Unit Waste Set-Out Business Case</b>	<b>39</b>

<b>Stakeholder Requirement, Operational and Business Impacts</b>	<b>39</b>
<b>Single Unit Waste Set-out Business Case Key Risk(s) and Mitigating Strategy</b>	<b>42</b>
<b>Conclusion and Recommendations</b>	<b>44</b>
<b>Conclusion</b>	<b>44</b>
<b>Single Unit Waste Set-out Business case Final Recommendations</b>	<b>44</b>
<b>Project Responsibility and Accountability</b>	<b>44</b>
<b>Implementation Approach</b>	<b>45</b>
<b>New Organics Processing Facility Planning and Implementation</b>	<b>45</b>
<b>Education and Outreach Implementation</b>	<b>46</b>
<b>Demonstration Phase Implementation</b>	<b>46</b>
<b>Single Unit Waste Set-out Program Changes Implementation</b>	<b>46</b>
<b>Bylaw, Enforcement Strategy and Compliance</b>	<b>46</b>
<b>Performance Indicators</b>	<b>47</b>
<b>Critical Dependencies Impacting Timeline</b>	<b>47</b>
<b>Review and Approval Process</b>	<b>47</b>
<b>Business Case Sign Off</b>	<b>48</b>
<b>Appendices</b>	<b>48</b>

## Executive Summary

### 1.1. Single Unit Waste Set-out Business Case Summary

The current residential waste collection program needs significant changes to support the City's current 90 percent single unit residential diversion goal. The two stream residential collection program currently offered by Waste Services allows for collecting unlimited comingled waste (organic and garbage) and recycling at the curbside. The materials are processed at the Edmonton Waste Management Centre (EWMC) where a portion is diverted from landfill.

Waste Services is committed to environmental responsibility by aiming to divert 90 percent of single unit residential waste from landfill. In the last few years, the diversion rate has been slowly decreasing, reaching a low of 36 percent in 2018. The reduction in single unit residential waste diversion is linked to current processing challenges at the EWMC, including the seasonal operation of the Edmonton Composting Facility, and the continued delay of the full operation of Enerkem Alberta Biofuels.

The Single Unit Residential Waste Diversion Rate was restated in 2018 based on the City Auditor's review. Specifically, it was noted in the 2018 Audit report that Waste Services cannot achieve its 90 percent diversion target through the existing waste management program. New waste diversion programs would need to be implemented in order to achieve this goal.

Waste Services recognized the current context as both a challenge and an opportunity to make the necessary changes and improvements to current waste management program. One of these initiatives identified is separating the organic waste in the garbage stream collected at the curbside.

At the March 20, 2018, City Council meeting, the following motions were passed:

2. That Administration continue with targeted engagement and provide a report on the removal of grass, leaf and yard waste from the waste stream, the availability of alternate disposal options for leaf and yard waste, and further details on the proposed program, to Utility Committee in June 2018, and that Administration:

- a. continue to collect grass clippings in 2018, pending results of the public engagement
- b. implement special collection on yard waste (eg. Christmas trees) in fall 2018.

6. That Administration provide a report in June 2018 on options for a pilot project on the source separated organics program prior to the planned fall 2020 program implementation.

This business case evaluates the transition of the single unit set-out at the curbside into the following four streams:

- **Source Separated Organics (SSO) Stream:** Residential kitchen organics will be separately collected at the curb in a green cart. Residents will also be permitted to fill up their green cart with compostable yard waste, including leaves and grass clippings. Green cart collection will occur weekly in the spring, summer and fall, and biweekly in the winter. Biweekly collection in the winter months is possible as colder temperatures reduce odours generated by the organic material and the volume is significantly reduced due to no leaf and yard waste.
- **Seasonal Leaf and Yard Waste (L&YW) Stream:** A separate, seasonal collection of residential yard waste, including items like garden waste, leaves and grass clippings, on predetermined days. Leaf and yard waste will be collected two times in the spring and two times in the fall in kraft paper bags.
- **Recycling Stream:** Recyclables will continue to be collected in blue bags at curbside on a weekly basis. Residents may set out unlimited blue bags for recycling.
- **Garbage Stream:** Remaining garbage will be collected in black carts on a biweekly basis. Residents will have the choice of a 120 litre or 240 litre black cart.

Waste Services evaluated each of the above streams, with variations on cart composition, size and collection schedules in detail for this business case. High-level cost estimates for potential alternatives have been prepared and analyzed through a detailed financial model considering both operating and capital costs and Net Present Value (NPV). The alternatives were also evaluated based on long-term and short-term overall risks as well as social and environmental impacts. The most favorable alternatives from each stream with the highest recommendation score were bundled together as a curbside collection set-out.

## 1.2. Single Unit Waste Set-out Business Case Recommendation

Based on the results of this process, Waste Services is recommending the following curbside set-out for collection of residential waste as outlined in Figure 1. This business case requests approval for the recommended single-unit waste set-out program.

The single-unit waste set-out program will require approximately \$145-million in capital funding to roll-out and manage the setout programs for the next thirty years. The recommended set-out anticipates approximately \$51.5-million in capital and \$15-million in operating expenses in the next three years to successfully roll-out the program to the residents. These funds will be used for purchasing carts and associated accessories, automated collection and crew maintenance vehicles, including automated fleet as well as and maintenance storage yard and processing equipment and managing other program related expenses.

The cost of add-on services, such as assisted waste collection, excess waste program, additional leaf & yard waste collection, and additional Big Bin Event, has also been included in this business case for Council review and consideration.

The overall impact to the diversion rate through the recommended program change will be approximately eight to 12 percent, thus improving the gap between the current diversion rate and the 90 percent goal.



Figure 1: Recommended Curbside Collection Set-out for Single Unit Residences

## 2. Background

### 2.1. Setting the Stage for Sustainable Waste Management

For more than 25 years, Waste Services has sought to continually evolve the City of Edmonton's waste management practices to achieve environmental and financial sustainability by diverting waste from landfill. Residents are encouraged to reduce, reuse and recycle waste. The City's Waste Management Strategic Plan<sup>1</sup> was last updated in 2008. This strategic plan provided the framework for an integrated system that blends strong community engagement programs with effective collection systems and innovative waste processing technologies.

The themes of waste diversion from landfill and sustainability were also affirmed in the City of Edmonton's Strategic Plan: *Connect Edmonton*<sup>2</sup>. This plan sets the path through strategic actions for the City to use incentives, education and partnerships to increase Edmontonians' participation in waste reduction, and achieves a landfill diversion rate of 90 percent for residential waste with focus on recycling, composting and recovery.

<sup>1</sup> Waste Management Strategic Plan 1993

<sup>2</sup> Connect Edmonton- Edmonton's Strategic Plan (2019-2028)



This is further reiterated in *The City of Edmonton's Waste Management Policy*<sup>3</sup>, which commits the City to provide sustainable waste management services, with due regard to evolving needs, preservation of natural resources, protection of the environment and the financial capabilities of the City. This is achieved with a waste system that meets the environmental, economic and social requirements to divert waste from landfill and provides sustainable waste solutions to Edmontonians.

## 2.2. Current Situation

### 2.2.1. Collections and Processing

Waste Services currently provides the following two-stream manual collection services to both single unit and a small number of multi-unit residents.

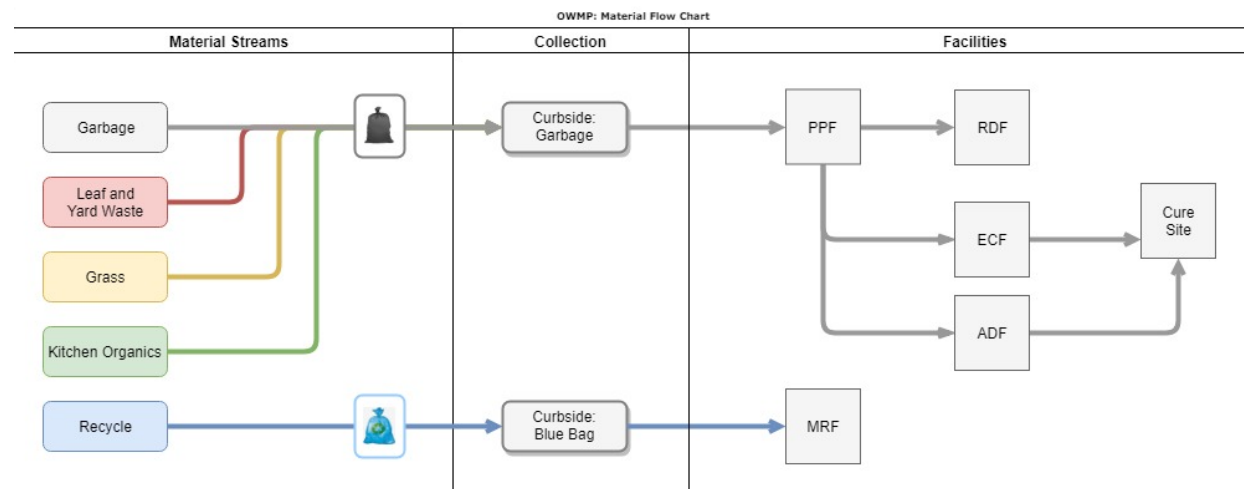
1. **Garbage stream:** allows residents to set out mixed garbage waste in black bags. There is currently no imposed limit on the number of black bags collected manually every week.
2. **Recycling stream:** allows the residents to set out recyclable materials in blue bags. There is no limit on the number of blue bags collected manually every week. This program is voluntary and has over 90 percent participation.

The garbage stream allows the residents to set out mixed garbage containing organic and compostable waste (including food scraps, grass, leaf and yard waste) along with other household waste. This mixed waste is taken to the Edmonton Waste Management Centre (EWMC) for processing. When the garbage stream arrives at the EWMC, it is mechanically sorted at the Pre-Processing Facility (PPF) inside the Integrated Processing and Transfer Facility (IPTF) and is then further processed at the Edmonton Composting Facility (ECF), Refuse Derived Fuel (RDF) facility or sent to landfill. In the past, the waste material was then sent to ECF and then the Cure Site for curing before it becomes compost that generates revenues through its sale, for Waste Services.

Figure 2 shows the current flow of waste collected and processed at the EWMC.

---

<sup>3</sup> [https://www.edmonton.ca/city\\_government/documents/PoliciesDirectives/C527.pdf](https://www.edmonton.ca/city_government/documents/PoliciesDirectives/C527.pdf)



**Figure 2: Current Waste Flow**

The recycling stream (blue bags) is collected separately and processed at the Material Recovery Facility (MRF). Material is sorted by equipment and people into different commodity types and sold to various recycling processors for beneficial reuse.

## 2.2.2. Issues Identified with the Current Waste Collection and Processing

### 2.2.2.1. Collection

The current method of collection for single unit residents is manual collection using garbage bags. Comingled garbage collected in bags can be heavy and sometimes contains materials such as broken glass or needles that can cause injury to collectors during pickup. Also, manual collection is not the most current method of collection.

### 2.2.2.2. Processing

The current method of sorting mixed waste was based on convenient customer service approach, however, due to the mechanical sorting/separation at IPTF, materials are unable to be sorted by type resulting in a significant amount of non-organic materials such as diapers, rubber balls, K-cups etc. make it into the compost. Similarly, as there is no effective way to remove organics in this mechanical sorting, organic materials such as grass and food scraps enter the process to create contamination in the feedstock or Refuse derived Fuel (RDF) for the waste to biofuels facility.

In 2016, the material processed at the ECF contained about 72 percent organics and 28 percent non organic material (high contamination). During the winter, the contamination percentage frequently ranges higher, towards 50 percent of non-organic material. Although pre-screening and post-screening are in place, contaminants such as glass shards are present in the compost. Because of this, the compost is given the rating of a Category B by the Compost Quality Alliance and has restricted end uses. These contaminants make the compost unsuitable for common residential uses such as landscaping and gardening, thus limiting its potential sales and impeding diversion. Figure 3 illustrates the mixed material entering the ECF and its low quality derived compost.



**Figure 3:** The photo depicts the inbound contaminated waste stream to the ECF, sorted out from the residential garbage stream (left) and the processed compost (right). The lower quality of the end product is visible in the photo on the right.

According to Waste Characterization Study<sup>4</sup> conducted in 2016, approximately 58 percent of the single unit residential garbage is organic waste with 21 percent kitchen organic waste and 36 percent grass, leaf and yard waste. During the spring, summer and fall, larger volumes of grass, leaf and yard waste are collected with residential curbside collection. Although residents are encouraged through educational campaigns to grasscycle, approximately 50,000 tonnes of grass, leaf and yard waste<sup>5</sup> is collected and processed, and some is sent to landfill.

Diversion of grass and yard waste would boost Edmonton's diversion rate significantly, and ensure the overall garbage stream has less moisture which allows for more effective processing.

The waste to biofuels process is another significant component of the goal to achieve 90 percent residential diversion from landfill. The wet organic waste is not ideal for the waste-to-biofuels process, given that this process relies on a dry waste feedstock for optimum efficiency. In 2016, approximately 18 to 20 percent of the feed directed to the RDF consisted of the wet organic material due to which Waste Services invested in additional processing and drying equipment.

### **2.2.3. Opportunity**

Edmonton's single unit residential diversion rate as of 2018 was 36 percent<sup>6</sup>. Edmonton is currently faced with a large gap between this current residential diversion rate and the 90 percent goal. Getting to 90 percent requires focus on the entire waste stream, starting with how households are asked to manage their waste in the home. Waste Services' Strategy Update (CR\_5124) outlines the path and program changes that will be required to achieve this goal.

---

<sup>4</sup> COE 4-Seasons Waste Characterization Study Final Report

<sup>5</sup> CR\_5826 Alternate Collection and Diversion Options for Grass, Leaf and Yard Waste

<sup>6</sup> CR\_6862 Waste Services 2018 Annual report

The gap between the projected diversion rate and the 90 percent goal could be best addressed by aligning Edmonton's waste management practices with current best practices for municipal waste. It requires focus on the entire waste stream, including diversion, sorting activities, as well as reduction and reuse initiatives undertaken at the household level, and allows for more effective processing of waste feedstocks, with reduced moisture and contamination challenges.

The Aeration Hall Building of the ECF was operated seasonally from late 2017 until it closed in May 2019, following proactive investigations into ongoing structural issues<sup>7</sup>. The structural issues that the ECF experienced allow for the opportunity to re-envision how waste is collected and processed in the City of Edmonton. Administration provided recommendations in February 2019 on the long-term composter strategy, as outlined in report CR\_6669 Organics Management<sup>8</sup>. Council approved that Administration proceed with Public Private Partnership (P3) planning of a digester and present the business case outlining the set-out and collection of organic stream, and its correlation with the composter business case in June 2019. An update on the P3 evaluation will be provided to the Utility Committee in the fall of 2019, and the business case for Gate 2 will be advanced in the spring of 2020. This business case impact adds to the digester strategy and will help the Administration initiate the development of the long-term strategy for the Organics Processing Facilities (replacement of the ECF facility and technology). Waste Services' existing Anaerobic Digestion Facility (ADF) is currently undergoing commissioning. Once operational, the facility will provide further organic waste processing capacity.

This unique opportunity allows Waste Services to design a waste collection program at the same time as developing an organics processing facility using current technology. By making this combined decision and improving on a number of other processes, Waste Services is able to further advance towards its goal of diverting up to 90 percent of residential waste from landfill.

### 3. Context Analysis

#### 3.1. Environmental Scan

Between 2016 and 2017, Waste Services conducted an extensive environmental scan<sup>9</sup> to identify best practices in waste management across Canada. Approximately 23 Canadian municipalities were examined in terms of efficiencies and effectiveness in their waste program and service delivery. Nineteen of these municipalities were also examined for their waste collection streams, method (manual vs automated), frequency, cart sizes and volume limits<sup>10</sup>. A list of these municipalities and their programs and diversion rates is shown in Appendix A.

The municipal scan below showed that City of Edmonton lags behind many Canadian municipalities, namely in two areas; the employment of some of the current collection best practices such as automation, which is shown to increase collector safety and efficiency of collection; and using different carts sizes to fit the needs of the residents. Also, SSO collection at the curb has been proven to increase the diversion rate of other municipalities that offer this

---

<sup>7</sup> CR\_5306 Composter Detailed Plan and Plan of Action, April 23, 2018

<sup>8</sup> CR\_6669 Organics Management

<sup>9</sup> CR\_5184 Waste Management Strategy Update

<sup>10</sup> Automated Collection Summary Report

program to their residents. Separating organics from garbage stream through SSO and leaf and yard waste programs reduces the contamination of these materials entering organics processing facilities thus increasing both the quality and quantity of the resulting useful end products. This in-turn decreases the amount of these materials in the landfill, improving the overall diversion rate.

The municipal scan results are described in details below:

### **3.1.1. Source Separated Organics**

Twenty-one out of the 23 municipalities have implemented an SSO program. Nationally, this includes municipalities such as Toronto, Ottawa, and Vancouver. Regionally it includes Calgary, St. Albert, Fort Saskatchewan, Leduc, Spruce Grove and Strathcona County. Some municipalities also placed limits on the volume of garbage set-out through a cart system or bag limit thus limiting the garbage tonnage while increasing participation in recycling, SSO programs and other available programs (such as reuse programs).

### **3.1.2. Leaf and Yard Waste**

Many municipalities have developed and implemented grass, leaf and yard waste diversion programs. All of the 23 municipalities researched have a grasscycling education program in place encouraging residents to leave the grass clippings on the lawn. Fifteen of the 23 Canadian municipalities/regions profiled have a separate yard waste program, which includes either seasonal curbside collection or drop-off locations that accept the material as a self-haul option.

### **3.1.3. Method of Collection**

Twenty-one of the 23 municipalities have chosen to use automated collection for garbage, SSO, or both. Automated waste collection is the standard industry practice in North America because it is safer, cleaner and more efficient than manual collection. Larger Canadian cities such as Toronto, Calgary, Vancouver, Richmond, Winnipeg and Regina all use automated collection for residential and commercial waste. Nearby Capital region municipalities of Strathcona County, Fort Saskatchewan, Leduc, St. Albert and Spruce Grove use automated collection for their garbage.

### **3.1.4. Cart Size Offerings**

Approximately, seven of the 15 municipalities that have automated garbage stream production, offer their residents the choice of more than one cart size. Additionally, 10 of these 15 municipalities with automated garbage including St. Albert, Regina, Guelph and Winnipeg also allow for tagging an additional garbage bag or getting an additional black cart for a fee.

### **3.1.5. Recycling Best Practices**

A municipal scan for the best practices within the recycling industry in Canada shows that separation of recyclables at the curb using either a dual stream or three stream separation is

an effective method to reduce contamination of the recycling bales.

Recycling stream municipal scan of 36 municipalities showed that approximately 15 of the 36 had either a dual-stream or a three-stream collection for recycling including municipalities like Waterloo, City of North Vancouver, Metro Vancouver, Richmond, Region of Durham, Halifax and Barrie. These municipalities separate their recyclables based on plastic, paper and/or glass material. Remaining 21 municipalities had a single stream co-mingled recycling program, similar to Edmonton's program, and includes Calgary, Surrey, City of Toronto, City of Saskatoon, St. Albert and Guelph. Separating by streams allows for cleaner recyclable bales with lesser contamination in them.

Recent developments in the Recycling commodities market, namely the implementation of the Green Wall in China has resulted in challenges in finding final end products for many commodities. With this in mind, we will continue to evaluate changes in municipal best practices over the next few years to determine how best to deal with these influences and make the necessary changes at that time.

## 4. Initiative Description

### 4.1. Initiative Description

This business case proposes significant changes to the current waste collection program and the way single unit residents set out their waste for collection in the City of Edmonton. These changes will include a four stream collection and processing instead of the current two streams.

In June 2017, the first steps were taken on the path towards the future of waste services when Administration presented the 2018-2020 Waste Services Business Plan<sup>11</sup> to Utility Committee which identified increasing residential diversion activities as an essential focus area for Waste Services. This update, along with the findings from an extensive research study between the summer of 2017 and January 2018, set the stage for the recommended activities in CR\_5184 Waste Management Strategy Update<sup>12</sup> presented to the Council in March 2018. Council approved seven motions for Waste Services during this Strategy Update, which included: planning a source-separated organics program for organic waste processing and collection, with planned implementation starting in fall 2020; providing a report on alternate collection methods for grass, leaf and yard waste; and continuing engagement with residents on the implementation of potential waste diversion programs.

In August 2018, Administration submitted reports on the Source Separated Organics (SSO) Pilot (CR\_5832)<sup>13</sup> and Alternate Collection and Diversion Options for Grass, Leaf and Yard Waste (CR\_5826)<sup>14</sup>. These reports outlined the options that would be included in the public engagement activities along with a demonstration phase for the program changes outlined in CR\_5184 Waste Management Strategy Update. Council approved the demonstration phase<sup>15</sup>

---

<sup>11</sup> CR\_5520 Waste Services Business Plan

<sup>12</sup> CR\_5184 Waste Management Strategy Update Report

<sup>13</sup> CR\_5832 Source Separated Organics Pilot

<sup>14</sup> CR\_5826 Alternate Collection and Diversion Options for grass, leaf and yard waste

<sup>15</sup> CR\_5832 Source Separated Organics Pilot



with the 120L green organic cart and alternate collection of leaf and yard waste pilot programs in August 2018, thus giving approval for administration to proceed with planning for the implementation of an organics program citywide.

The proposed waste collection and processing streams are:

- Source Separated Organics (SSO) Stream
- Seasonal Leaf & Yard Waste Stream
- Garbage Waste Stream
- Recycling Waste Stream

#### **4.1.1. Source Separated Organic (SSO) Stream**

Organics separation at the source is an effective method of reducing the environmental impact of solid waste. In the SSO program, households will segregate compostable kitchen organic waste materials, such as food waste. This organic waste will be set out for collection separately from their garbage.

Once the organic waste is collected by the City, it can be processed directly at organics processing facilities (ADF) without being pre-processed at the IPTF with other household garbage.

#### **4.1.2. Seasonal Leaf & Yard Waste (L&YW) Stream**

The seasonal L&YW stream includes a separate L&YW collection program and a free drop-off service. Residents will be encouraged to set out their leaf and yard waste, separately from their garbage and SSO on predetermined dates from spring to fall. The L&YW will be collected by Waste Services. Residents will also be provided with the opportunities to drop off L&YW at the Eco Stations, Big Bin Events, and the Edmonton Waste Management Centre for free. Such materials can then be processed directly at the cure site without going through a processing facility.

#### **4.1.3. Garbage Stream**

Removal of the organic waste from the garbage will decrease the total tonnage of materials in this stream. In addition, residents will be limited to the space available in their black carts for their garbage materials. This increases the incentive to maximize recycling and organic separation. Waste Services will continue to provide collection of garbage to the residents. This stream will capture all remaining materials that do not enter the organic or the recycling stream.

#### **4.1.4. Recycling Stream**

Waste Services will continue to collect recyclable materials at the curb. Residents will be able to continue to separate recyclable materials such as plastic, paper, and metal cans etc. in their blue bags and set it out for collection at the curb.

## 4.2. Anticipated Outcomes

The following anticipated outcomes will be achieved through these updated program changes:

- An estimated increase in the current diversion rate by approximately seven to 11 percent to contribute towards the 90 percent single unit residential diversion target. This forecasted diversion rate impact is predicated on the assumptions that waste sorting and diversion facilities fully function at the EWMC, end product markets for all recyclable commodities are available, and that residents fully participate in the proposed program change.
- An expected decrease in the amount of garbage set-out by single unit residents.
- A cleaner organics stream as an input to OPF and ADF processes, resulting in an increase in comparative efficiency of organics processing and higher quality compost.
- Behavior changes in single unit residents, which includes how residents sort and set out their household waste.
- Reduction in the expected moisture content in Refuse Derived Fuel.

## 4.3. Scope

The following options are considered in scope for this business case:

### **Waste Collection**

- Addition of automated collection of source separated organic stream.
- Addition of seasonal leaf and yard waste curbside collection stream.
- Changing the current method of garbage collection from manual to automated.
- Potential change in collection method and/or frequency of the recycling stream.

### **Residential Waste Drop off**

- Impact on Big Bin events, Eco-station programs and the Residential Transfer Station

### **Processing**

- Change in processing requirements related to the new Organics Processing Facility (OPF), Curesite, IPTF Pre-Processing facility, MRF and landfilling.

### **Financial**

- Capital and operating budgets to support the program changes.
- Net Present Value (NPV) analysis.
- Revenue Requirement (RR) analysis
- Utility rate change for different black cart sizes.

### **Education, Outreach and Enforcement**

- Development and delivery of education and outreach materials, programs, and strategies.

## 4.4. Out of Scope

The following services, although aligned, are managed separately and considered out of scope in this business case:



- Multi-unit residential sector receiving waste container collection service.
- Non-residential waste programs.
- Waste Bylaw update and related resourcing requirements.
- Waste Management Policy update.
- External Curesite Project: capital and operational expenses.
- OPF Business Case and financial approval.
- MRF retrofit.

#### **4.5. Critical Success Factors**

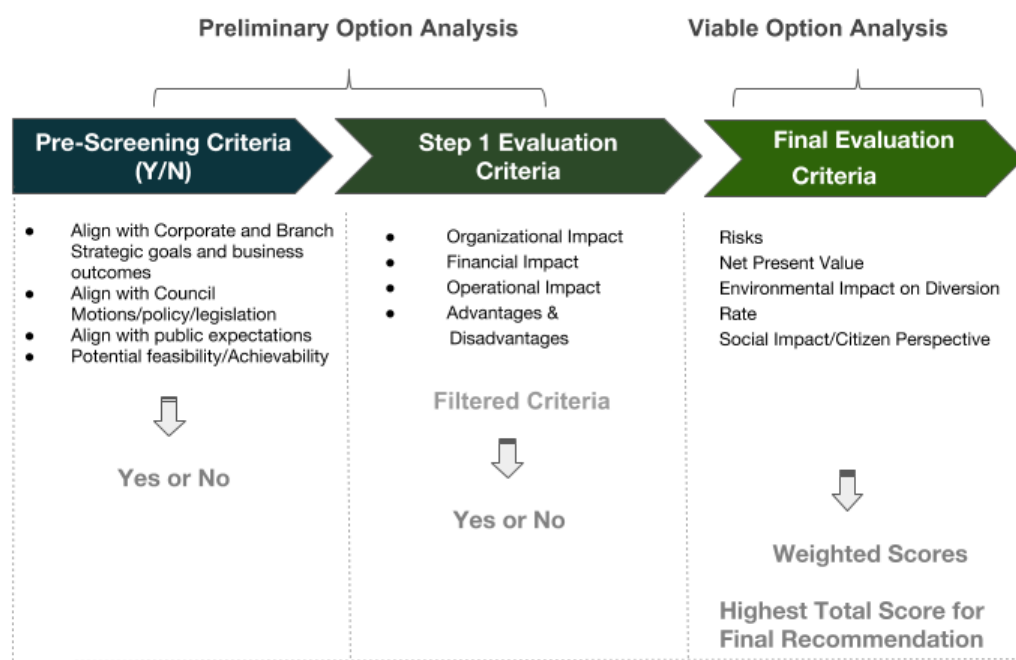
The following critical success factors have been identified:

- Enhanced project planning during the single unit waste set-out program development process to identify a clear and complete scope.
- Risk identification and management to minimize the risks during program planning and implementation.
- Council and corporate leadership endorse the proposed program changes.
- Council's approval of funding for the proposed program changes.
- Residents' acceptance of, support of, participation in, and compliance with the proposed program changes.
- Decision on the OPF long term strategy by Council in 2020 and completion of the External Curesite project on time will impact the scope, planning and delivery of both the SSO and L&YW seasonal collection programs.
- Interim solutions to process received SSO volume between 2021-2025 need to be developed, due to the operational disruptions in demolishing current ECF and construction of the new OPF between 2021 to 2025.

### **5. Options Analysis Methodology**

A three step elimination process (outlined in Figure 4) was used to shortlist the potential options for this business case. Pre-screening was the same for all the options considered for the four streams in this business case and included:

- Alignment with Corporate goals and Waste Services' 25-year business strategy
- Potential feasibility/achievability of the viable options
- Maintaining Waste's service level to the City's single unit residences participating in the current waste collection program



**Figure 4: Business Case Option Elimination Steps and Final Evaluation Criteria:** All the options for this business case went through a rigorous option analysis as shown above.

## 5.1. Strategic Alignment

The Corporate Business Plan<sup>16</sup> organizes the City of Edmonton's work into three objectives:

- **Our strategic objective** is to make transformational impacts in our community
- **Our service objective** is to deliver excellent services to our community
- **Our supporting objective** is to manage the corporation for our community

Waste Services is highly integrated and aligned to this plan and supports the City's success in advancing these objectives. Waste Services' 25-year Strategic Outlook<sup>17</sup> has been identified as a major initiative that will support advancement of the strategic goal of Climate Resilience. As a key component of that strategy, the Single Unit Waste Set-out Business Case is critical in advancing progress towards that goal.

This business case allows Waste Services to contribute to the delivery of excellent services through more efficient and effective waste collection and support the corporation through better processing of that waste. This will help ensure Edmontonians receive maximum economic and environmental benefits while minimizing the cost increases of managing solid waste.

<sup>16</sup> Corporate Business Plan (2019-2022)

<sup>17</sup> CR\_6216 Waste Services: 25 year Strategic Outlook, Project Overview

In addition, this business case supports the City's Environmental Protection and Stewardship programs by reducing Edmonton's carbon footprint and protecting the natural environment through diversion of waste from landfill. The project aligns to the City of Edmonton's Waste Management Policy C527<sup>18</sup> which commits to delivering sustainable waste management service exceeding provincial waste diversion and processing standards.

Finally, the Single Unit Waste Set-out Business Case is also strategically aligned with a number of other distinct but related initiatives that are currently underway. While these initiatives are outside the scope of this project, their outcomes will impact its overall success, and all will be important components of achieving the ultimate goal of 90 percent diversion.

- The OPF Business Case and Project Plan are being developed concurrently, which will provide direction towards developing long term strategies for the OPF to meet the City's existing and future organic processing needs.
- The Remote Cure Site Expansion Project, currently underway, that will provide the necessary physical expansion to the current external cure site to reduce bottlenecks under both current and future ECF capacity scenarios.

## 5.2. Public Engagement

Consideration of public engagement has also been a major factor in the business case. The business case option analysis and alternative section are based on two phases of public engagement conducted between October 2018 and April 2019, gathering close to 30,000 points of input. Input was gathered through surveys, drop-in sessions and facilitated conversations among four sectors: residents, multi-unit stakeholders, non-residential or ICI (Industrial, Commercial and Institutional) stakeholders and internal City of Edmonton stakeholders. These perspectives helped inform and refine the proposed strategy and program recommendations. Summary highlights from phase 1 include:

- 62 percent<sup>19</sup> of residents responded strongly that they would "gladly take the necessary steps to adopt these changes".
- Approximately 70 percent of survey respondents preferred options for setting out their garbage in a cart, rather than a bag.
- Participants were generally supportive of sorting more at home.
- At least 55 percent of residents wanted to be able to top up their green cart with grass clippings if this was permitted.
- Residents in general believed two yard waste collections per year (once in spring and once in fall) wasn't sufficient, but 52 percent indicated that they would be satisfied with two collections each season.

A key takeaway that was highlighted during this phase of public engagement was the desire of residents to have incentives to participate in the proposed program changes. This desire was highlighted by approximately 50 percent of respondents, and could be achieved by offering multiple garbage cart size options, with associated utility rates.

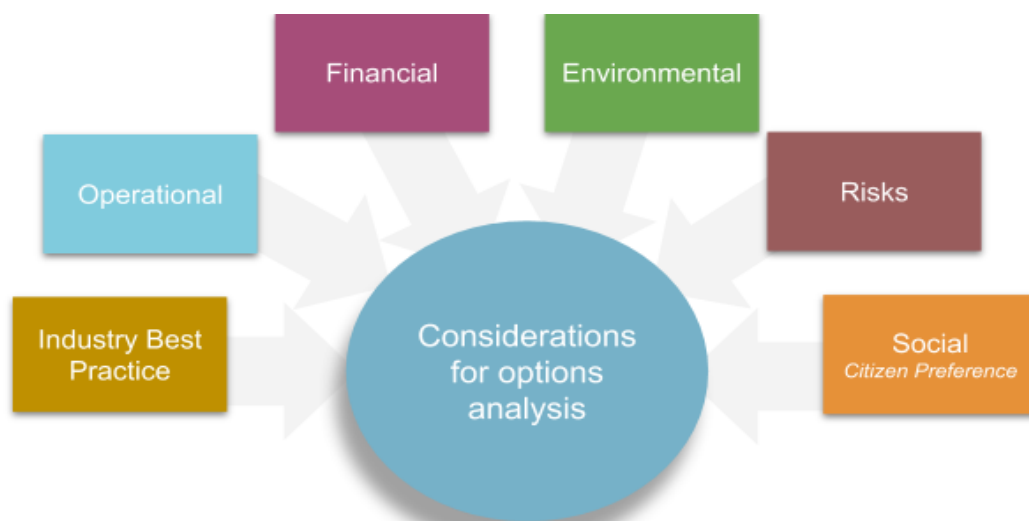
---

<sup>18</sup> [https://www.edmonton.ca/city\\_government/documents/PoliciesDirectives/C527.pdf](https://www.edmonton.ca/city_government/documents/PoliciesDirectives/C527.pdf)

<sup>19</sup> CR\_5829 Waste Strategy- Comprehensive Waste Management Strategy

### 5.3. Analysis of Options

In this step, all shortlisted alternatives were further analyzed by reviewing the potential advantages and disadvantages, risks and financial costs. Administration also considered the Phase 1 and 2 public engagement results while evaluating these options. Figure 5 below depicts the methodology used to shortlist and analyze the alternatives to reach the final recommendation. The process and metrics used to arrive to the shortlisted alternatives for the program considered various factors. A two step elimination process was used to shortlist the potential options for this business case to two major alternatives which were further analyzed to form the final recommendation. The second elimination step involved looking at previous Council decisions from 2018 to plan for the SSO program using the 120L green carts.



**Figure 5: Business Case Alternative Methodology:** All the options for this business case went through a rigorous option analysis as shown above.

#### 5.3.1. Operational Considerations

The process and metrics used to arrive to the shortlisted alternatives for each stream's curbside collection program considered various factors such as the method and frequency of collection.

##### 5.3.1.1. Methods of Collection

Both manual and automated methods for collection were evaluated for this business case. The term 'automated collection' generally refers to the use of garbage trucks equipped with hydraulically operated jointed arms with cart grasping mechanisms mounted to them. The operator does not need to leave the cab of the truck, but uses in-cab controls to manipulate the arm to grasp a cart set out along the curb or alley, tip it into the truck's hopper, then place it back. Automated waste collection is an industry standard. Automated waste collection trucks are standard manufacturing, while manual collection trucks are a more customized product.

This customization limits the number of vendors who can supply the trucks.

Automation allows for multiple benefits to the City and residents such as:

- a. Placing waste in carts reduces the probability of ripped or torn bags, resulting in reduced litter and improved aesthetics
- b. Increased prevention of rodents and animals gaining access to waste
- c. Ease of moving the carts for residents due to wheels
- d. Decreased work related injuries due to picking up of heavy and bulky garbage bags containing sharp objects.
- e. The expense to purchase the cart is partially offset over the life of the carts due to the residents having to purchase less garbage bags
- f. Reduction in the utilization of single use plastics
- g. Increased collection efficiency, when extra bags outside the carts are not collected.

Because of these reasons, the Administration went forward with analyzing the automation for all the four streams. Due to major advantages of automation for both garbage and SSO streams, this was the method of preference for them.

### **Seasonal Leaf and Yard Waste Stream**

Waste Services evaluated the collection in 240L carts, clear bags, kraft paper bags or black bag as methods of collection for the seasonal L&YW program for this stream. Both black bags and clear bags scored low due to the need of bag breaking equipment and possible contamination and were eliminated. Both the carts and kraft paper bags were evaluated for automated and manual collection methods for this program.

### **Recycling Stream**

Waste Services evaluated both the manual and automated collection using blue bags and 240L carts based on surrounding municipalities such as Calgary, Sherwood Park and St.-Albert. Because of similar recycling material tonnage collection trend between the municipalities, 240L cart was considered sufficient for collecting recycling material for the Edmonton residents hence no other cart size was analyzed for this program.

#### **5.3.1.2. Frequency of Collection**

### **Source Separated Organics Stream**

Kitchen organics contain higher odour and decomposing material which can attract insects and bugs if left unattended for a long time. This can be one of the major concerns with residents. In winter, the odor is not a major concern due to decrease in the insect activity and decomposition in cold weather. Thus, weekly collection frequency in summer and biweekly collection frequency in winter were considered for this business case.

## Seasonal Leaf and Yard Waste Stream

Waste Services evaluated four, eight and 15-times collection frequencies in a year. The cost analysis showed that eight times collection had a similar cost as 15 times collection while providing less service, hence this option was eliminated.

## Garbage Stream

Administration evaluated both weekly and biweekly options for collecting the garbage stream. With the removal of odor-causing organic material from garbage, collecting the garbage biweekly a feasible option for this business case.

## Recycling Stream

Waste Services currently offers weekly collection of comingled recycling material in unlimited number of blue bags, which forms the status quo for this stream. Biweekly collection frequency was evaluated and compared to the current status quo. Biweekly collection frequency reduces the requirement of fleet and resources required for this stream, which can then be used to compensate for the resource demands in the organic stream. However, reducing the collection frequency may be perceived as a reduction in the service level by the residents, and it runs counter to efforts to encourage residents to maximize recycling efforts. Blue bag recycling currently contributes over six percent to the single unit residential waste diversion rate. A reduction in service from weekly to biweekly with associated volume limits could reduce this diversion rate impact. With the new recycling strategy being developed for MRF, Waste Services decided to continue with the weekly co-mingled recycling frequency. We may revisit the recycling frequency in the future as we further consider the strategic direction for the MRF.

### 5.3.1.3. Processing Feasibility

## Source Separated Organics Stream

Waste Services evaluated the current processing capacity at EWMC for SSO stream processing. The current AD facility is under commissioning and is expected to be fully operational in 2019. This facility will process approximately 40,000 tonnes of organic material from the green cart. The current ECF will be demolished and a new facility will be constructed as outlined in the Organic Management Report.<sup>20</sup> The new facility will be sufficient to process the organic tonnage for the next 30 years. However, high level cost estimates from the Edmonton Composting Facility Long Term Strategy business case show that the top-up option results in an additional \$45 million capital investment versus the no-top-up option. However, based on a review of both operating and capital costs of this program, the total cost per tonne is actually lower if residents are permitted to top-up their green bin. This lower cost results from the differential in providing the additional collection.

## Seasonal Leaf and Yard Waste Stream

---

<sup>20</sup> CR\_6669 Organic Management

Waste Services evaluated both the cure site and AD facilities for receiving and processing the additional L&YW. The AD process of anaerobically digesting organics produces methane and compost. Compost produced is then transferred to the cure site for final processing. The benefit of this process is that it produces methane as a bi-product, which is captured and combusted to produce carbon-di-oxide (CO<sub>2</sub>) to generate heat and power. However, introduction of L&YW to the AD facility reduces the quality of the produced methane. Also, the existing AD size is not sufficient to handle all the L&YW collected under this program. A much larger AD facility will need to be built to process this material with additional capital and operating expenses, on top of the expenses mentioned in the Edmonton Composting Facility Long Term Strategy Business Case. Composting at a cure site is a more cost effective option to handle the additional L&YW and also saves on the material transfer costs from AD to curesite for the final composting step, compared to processing the material at AD. Due to these reasons, processing of L&YW at a cure site was chosen as the processing site for the seasonal L&YW collected in this Stream.

### **Garbage Stream**

Currently, garbage is sorted at the Pre-Processing Facility (PPF) at the Integrated Processing and Transfer Facility (IPTF). The introduction of the SSO stream will result in the removal of the organic fraction from the garbage stream, resulting in a reduction in tonnage of material entering the facility. The material that does get processed through PPF will be transferred to RDF or landfilled.

### **Recycling Stream**

The comingled recycling material collected will continue to be processed at MRF in the future. The current capacity of MRF is 58,000 tonnes and is sufficient to process the material received in the next four years as per CR\_6866 Materials Recovery Facility report to Council in February 2019.<sup>21</sup> Waste Services will revisit MRF requirements in the future and will address any infrastructure and recycling collection related changes at that time.

#### **5.3.2. Social and Resident preference**

### **Source Separated Organics (SSO) Stream**

Phase 1 public engagement results indicate that the largest percentage of residents (55 percent) of survey respondents would be likely or very likely to use the option to top-up their green cart with L&YW.

### **Seasonal Leaf and Yard Waste Stream**

Phase 2 public engagement results indicate that approximately 52 percent of the residents felt that 2 collections in spring and 2 collections in fall would be sufficient to meet their needs.

### **Garbage Stream**

---

<sup>21</sup> CR\_6866 Material Recovery Facility Report



Public engagement phase 1 results indicated that 68 percent of the residents preferred the automated carts over the 23 percent preferring the black bags. Further analysis was based on the need for the residents for the size of the black garbage carts. Two major cart sizes were evaluated, 120L and 240L black carts. Public engagement phase 1 and 2 results with the residents for deciding the appropriate black cart size gave mixed results. Results showed that residents were torn between paying more and getting a bigger cart size. Forty-one percent felt that their households did not generate enough garbage to fill the entire 240L cart, while 48 percent felt that 120L cart was too small. Fifty-two percent of the residents agreed that utility rates should be impacted by the cart size chosen at the curb. 54 percent of the residents agreed to pay extra for receiving the bigger carts. Because of such diversity in residents responses, Waste Services evaluated two scenarios of providing either the bigger cart size of 240 L or optionality of using 120L and 240L cart based on resident needs.

Waste Services partnered with Grant Thornton LLP to develop a rate design model to provide a cost range to differentiate pricing for each size of garbage cart. Results from the rate design model show that the expected differential in rates for a customer choosing a 120L cart would be between \$5 - \$6 less than the rate charged to a customer choosing a 240L cart.<sup>22</sup>

Public engagement phase 2 results indicated that 44 percent of residents were interested in receiving the 240L black cart and 41 percent wanted the 120L cart. Due to such a close percentage response, Administration decided to offer the residents a choice between the two cart sizes in Alternative 2 and 4. Hence for Alternatives 2 and 4 residents will be allowed to choose the size of their black cart based on their needs. The public engagement phase 2 results also showed that 54 percent of the residents agreed to having a different utility rate based on their cart choice.

Through recent public engagement, residents were asked about whether rates should be impacted by the cart size that residents choose.

- 54 percent of respondents agreed that a change in the utility rate would be reasonable if different cart sizes were used.
- 40 percent agreed that residents should all pay the same amount regardless of cart size.

When asked to consider a hypothetical pricing change, respondents weighed in on the scope of price incentive that should be provided, at the following levels:

Price difference suggested (per month)	Percentage of respondents who agreed
At least \$1	58%
Between \$2 to \$5	20%
Between \$6 to \$10	18.4%
Between \$11 to \$20	10%

**Table 1: Percent of Responses favoring the variable cart prices**

<sup>22</sup> Single Unit Rate Design Study



As the cart size preference input was collected from residents who haven't used carts yet, Waste Services will verify the residential preference between 240L and 120L black carts through the demonstration project with 8,000 homes, who received the automated collection since mid-April 2019.

### 5.3.3. Environmental

As part of the analysis of the options for each stream, contribution to the rate of diversion from landfill was considered.

### 5.3.4. Financial

As part of the analysis of the options for each stream, the capital and operating costs, as well as the NPV and revenue requirement, were all considered. The financial analysis for each program is demonstrated in the Appendixes to this document.

## 5.4. Recommendation Methodology

In addition to the aforementioned criteria and perspectives, the final recommendation scoring for the business case programs under the respective streams is based on the following table:

Criteria	Percentage
	Weighting
Risks	20.0
Net Present Value (\$)	35.0
Environmental- Diversion rate	20.0
Social Impact/ resident preference	25.0
Total (%)	100

**Table 2: Recommendation Matrix Criteria and Weighted Scoring**

The four criteria listed in the table above (Risks, Net Present Value, Environmental and Social Impact) each play an important role in comparing each alternative through individual scoring and weighting. Scores were calculated for each category, by alternative, and weighted according to the percentages above. Scores for each category were then summarized to calculate a total score for each alternative, out of 100.

The Risk Score was calculated through analysis of identified risks for each alternative. The total risk score includes both common risks (that are the same between each alternative) and specific alternative risks that are associated with respective alternatives.

Net Present Value score was calculated based on a 30 year financial model that considered the forecasted operating and capital expenses related to implementation of the alternative. Once scored, lower NPV values lead to lower scores in the matrix whereas higher NPV values lead to higher scores.

Environmental Scores consisted of estimated waste diversion rates. Alternatives with higher estimated diversion rates scored higher in the matrix.

Social Impact scores are derived from research done through eight months of public engagement. Indicators considered include those which reflect overall support/rejection of the approach.

6. Alternative Analysis

The above methodology was used to narrow down the feasible options to the respective alternatives for the four streams within this business case. The alternatives analysis is described in detail below. More detailed alternative scoring is shown in Appendix O - Alternative Scoring Methodology.

6.1. Source Separated Organics (SSO) Stream

This stream contains the SSO program that allows for separation of kitchen organic waste from the current garbage stream. A detailed table of the viable options and shortlisting is listed in Appendix B

6.1.1. Shortlisted Alternatives SSO Program

The shortlisted alternatives for the SSO program are described in Figure 6.

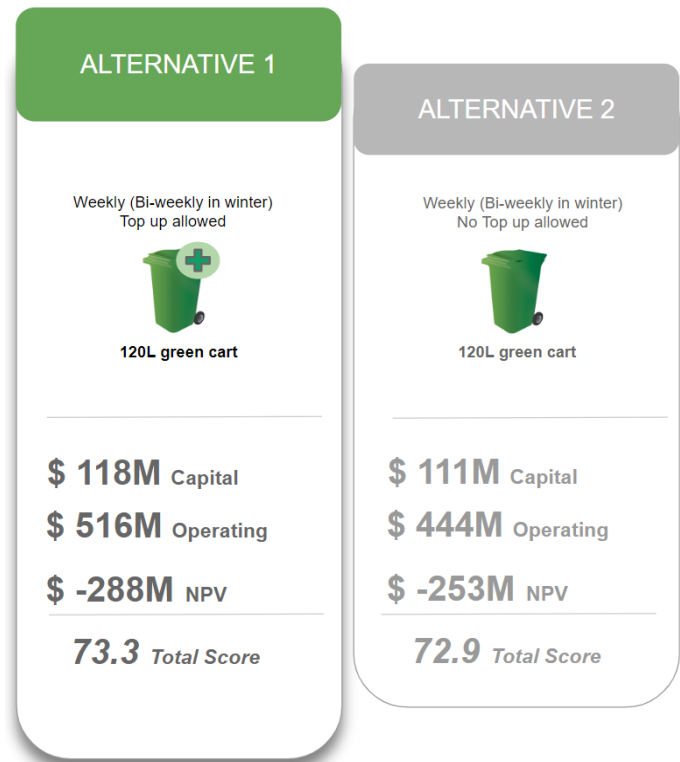


Figure 6: Shortlisted alternatives for SSO Program including Thirty Year (2020-2049) Cost Impact.

### 6.1.2. Cost Benefit Analysis

#### Assumptions for SSO Program:

The following assumptions are applied to all of the evaluated alternatives for the financial analysis:

- On an average, residents generate approximately five kilograms of kitchen waste per household per week.
- Waste Services will collect approximately 88,000 tonnes of organic waste, including yard waste, in green carts from single unit residential homes in 2024. This amount is projected to increase at an annual rate of 1.6 percent.
- Five percent contingency was used in 2021 and 2022 for operating costs and then 10 percent contingency was used from 2023-2049 to account for additional costs associated after program rollout.
- The Greenhouse Gas (GHG) credits received by Waste Services for the SSO program change has been accounted for in the Edmonton Composting Facility Renewal Business Case and will not be inputted in this business case to prevent double counting of these credits.
- The SSO program will be rolled out from summer/fall 2020 to 2022.

Detailed list of assumptions for financial analysis for the business case is listed in Appendix C.

#### COSTS for SSO Program:

Figure 6 above depicts the total capital and operating costs for the next thirty years (2020-2049). A detailed financial comparison of both the alternatives is outlined in Appendix D. Financial analysis for revenue generation comparison between the alternatives is outlined in Appendix E.

The cost impact analysis shown in Figure 6 above indicates that alternative 2 with 120L green cart and no top up has a lower net capital and operating cost of approximately \$111 and \$444 million in the next 30 years respectively. This alternative also has a lower net present value of negative \$253 million approximately. Comparatively, alternative 1 has a higher capital and operating expense of approximately \$118 and \$516 million respectively. It also has a higher negative NPV of \$288 million in the next 30 years due to higher number of fleet and associated operating and maintenance costs.

#### RESOURCING for SSO Program:

The total resources required for SSO stream alternatives were captured in the financial analysis and are a mix of permanent and temporary FTEs. Alternative 1 requires a higher resource demand of approximately 8 more FTEs compared to alternative 2. This is due to higher requirement of collectors required to cover the same route in the same time frame due to topping up of the green carts for alternative 1.

### 6.1.3. Recommendation for SSO Program Change

SSO program alternatives were further analyzed using the recommendation matrix shown in Table 2. Alternative 1, 120L green cart with the top up, scored higher in the total weighted score in the matrix, with a score of 73.3 percent because of higher environmental and social impact scores, compared to alternative 2, which had a score of 72.9 percent. Alternative 1, scored lower on the NPV compared to alternative 2 due to higher capital costs associated with the alternative.

Due to this reason, Administration is recommending to proceed with alternative 1, **120L green cart with the top up** for the SSO stream change.

## 6.2. Seasonal Leaf and Yard Waste (L&YW) Stream

This program contains the L&YW program that allows the residents to separate the L&YW from regular garbage. Any material that does not fit in the 120L SSO cart will be picked up in a separate seasonal collection in kraft paper bags.

Detailed table of the viable options and shortlisting is listed in Appendix F.

### 6.2.1. Shortlisted Alternatives for Seasonal L&YW Program

The shortlisted alternatives for the L&YW stream are described in Figure 7.

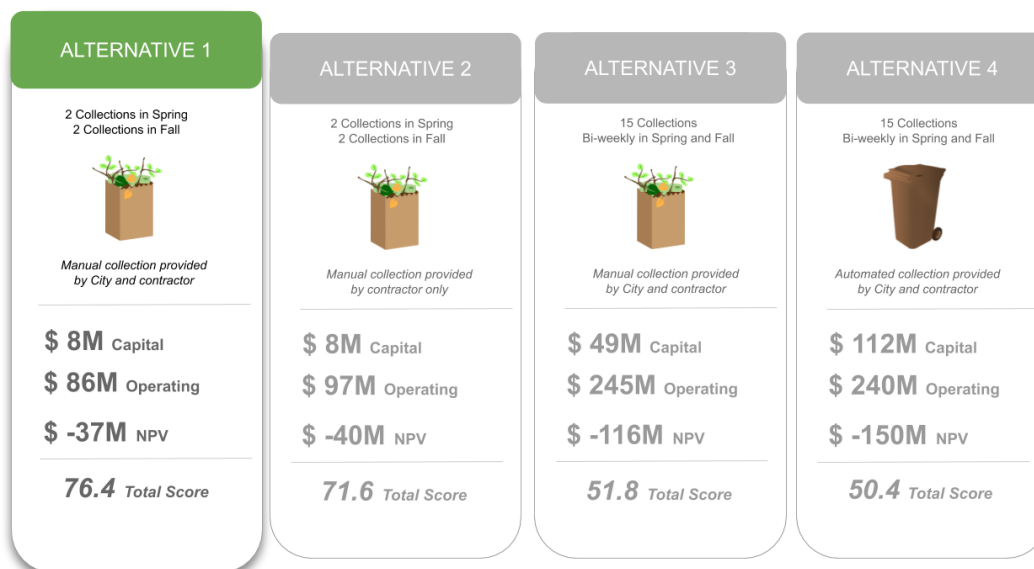


Figure 7: Shortlisted alternatives for L&YW Program including Thirty Year (2020-2049) Cost Impact.

### 6.2.2. Cost Benefit Analysis

#### **ASSUMPTIONS for L&YW Program:**

The following assumptions are applied to all of the evaluated alternatives for the financial analysis:

- Approximately 15,000 tonnes of L&YW material will be collected, twice in spring and fall through this program
- All L&YW FTEs are seasonal and are required approximately nine months of the year
- For Alternatives 1 and 2, L&YW seasonal collection will be conducted using employee overtime and vendor services for a total of four collections per household per year, thus eliminating the need for capital spending on collection trucks on this seasonal service
- For Alternatives 3 and 4, which are biweekly collection of L&YW, additional fleet and operators will be required to meet the service needs.
- No additional eco-station lifts or big bin events are planned.

Detailed list of assumptions for financial analysis for the business case is listed in Appendix C.

#### **COSTS for L&YW Program**

Figure 7 above depicts the total capital and operating costs for the next thirty years (2020-2049). A detailed financial comparison of all the alternatives is outlined in Appendix G. A financial analysis for revenue generation comparison between the alternatives is outlined in Appendix H.

The cost impact analysis shown in Figure 7 above indicates that alternative 1, has the lowest operating cost and negative NPV of approximately \$86 and \$37 million respectively, Alternative 2 has the second lowest operating cost and negative NPV of approximately \$97 and \$40 million respectively. Both alternative 1 and 2 have the same capital expense of approximately \$8 million. Both alternatives 3 and 4, with collections occurring 15 times biweekly, have higher capital and operating expenses than alternative 1.

#### **RESOURCING for L&YW Program**

The total resources required for L&YW program alternatives were captured in the financial analysis and are a mix of permanent and temporary FTEs. The resource requirement for alternative 1 and 2 is the lowest at approximately 1.5 FTEs. Alternative 3 and 4 with fifteen times manual and automated biweekly collection have a much higher resource impact of 22 and 24.25 FTEs respectively.

### 6.2.3. Recommendation for Seasonal L&YW Program

The L&YW alternatives were further analyzed based on the recommendation matrix shown in Table 2. Alternative 1 scored 76.4 percent, which is the highest total weighted score in the recommendation matrix based on its higher social impact, compared to alternative 2, which scored 71.6 percent. Alternative 1 also scored better in the risk and NPV compared to all the other alternatives. Both alternative 1 and 2 score slightly low in the environmental diversion category compared to alternatives 3 and 4 due to the less frequency of pickup. The remaining alternatives 3 and 4 scored much lower score of 51.8 and 50.4 percent respectively. Both these alternatives scored much lower in the NPV score due to higher capital costs associated with them. These alternatives also have a lower social preference score as majority of the residents felt that twice in the spring and twice in the fall collection was sufficient for their needs.

Based on the recommendation scores, Administration is recommending alternative 1, **four times manual collection of L&YW (twice in the spring and twice in the fall), with collection provided by City and contractor.**

### 6.2.4. Additional L&YW collection

Waste Services also reviewed the cost for an additional L&YW collection program to be provided on an ad-hoc basis. This could be accommodated through the provision of an additional curbside collection of L&YW material, separate Big Bin Event focused on the collection of L&YW material or a more focused collection of this material at Eco Stations. While the provision of additional Big Bin Events can be accommodated with existing resources, additional L&YW curbside collections requires the addition of waste collectors and waste collection vehicles. Estimated operating cost for these additional events are listed in Table 2 below.

Event	Estimated Operating Cost (2022)
One Additional Curbside Collection	\$566,000*
One Additional Big Bin Event	\$50,000

\* This cost applies when there is no more than two additional curbside collections of Leaf and Yard Waste.

**Table 3: Estimated operating cost for additional curbside collection and Big Bin Event.**

## 6.3. Garbage Program

The garbage program will continue to provide collection of garbage to the residents. This stream will capture all remaining materials that do not enter the organic or the recycling stream.

Detailed table of the viable options and shortlisting is listed in Appendix I.

### 6.3.1. Shortlisted Alternatives for Garbage Program

The shortlisted alternatives for the garbage program are described in Figure 8.

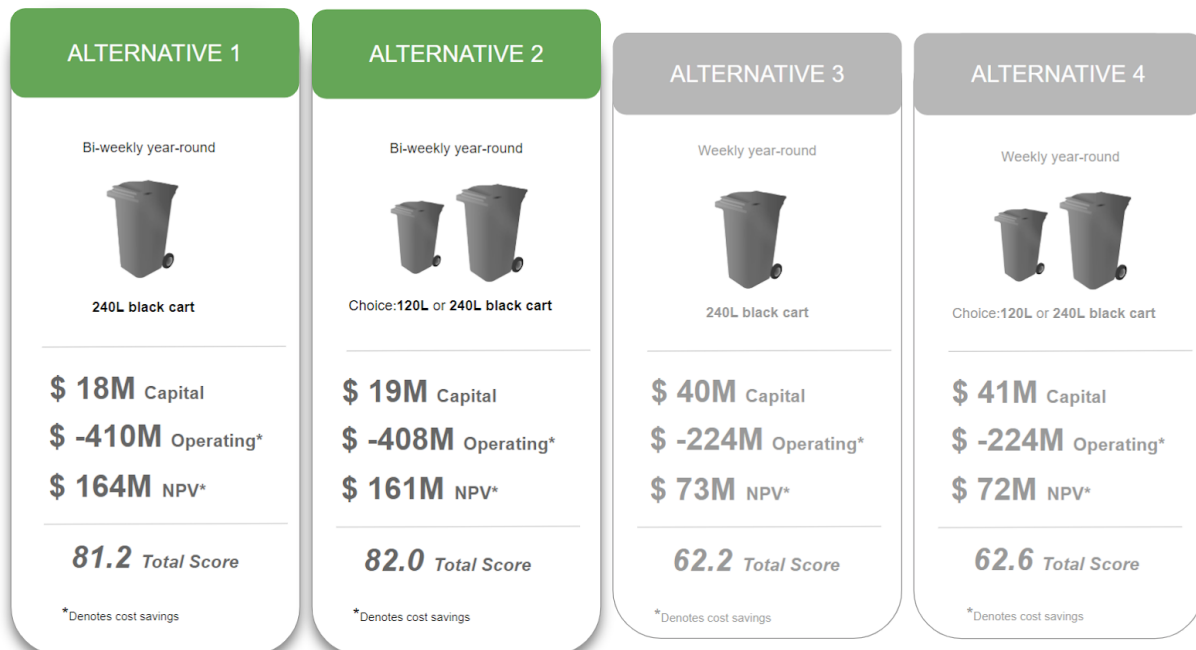


Figure 8: Shortlisted alternatives for Garbage Program including 30-Year (2020-2049) Cost Impact.

### 6.3.2. Cost Benefit Analysis for Garbage Program

#### ASSUMPTIONS for Garbage Program:

The following assumptions are applied to all of the evaluated alternatives for the financial analysis:

- Hotline staff required to maintain the resident enquiry for program change were counted under organic stream and hence have not been re-counted for the garbage alternatives.
- All costs are incremental to the status quo, the current weekly black bag collection which will have zero additional capital and operating expenses.
- Five percent contingency was used in 2021 and 2022 for operating costs and then 10 percent contingency was used from 2023-2049 to account for additional costs associated after program rollout.
- All financial costs assume that only one free black cart size exchange is allowed for the residents. The fee for additional cart exchange has not been factored in the total costs or revenues.

Detailed list of assumptions for financial analysis for the business case is listed in Appendix C.

## **COSTS for Garbage Program**

Figure 8 above depicts the total capital and operating cost for thirty years (2020-2049).

A detailed financial comparison of all the alternatives is outlined in Appendix J. Financial analysis for revenue generation comparison between the alternatives is outlined in Appendix K.

The cost impact analysis shown in Figure 8 above indicates that alternative 1 has a slightly higher operating cost savings of approximately \$410 million compared to alternative 2 that has an operating cost savings of approximately \$408 million. Alternative 1 also has a slightly higher positive NPV of \$164 million compared to alternative 2 that has a positive NPV of approximately \$161 million. Capital expense of alternative 1 and 2 are also very similar to approximately \$18 and \$19 million respectively, arising from similar investment to roll out the automation program. Both alternative 3 and 4 have the highest capital expenses of approximately \$40 and \$41 million respectively, and lower operating savings, thus making them the least favorable financially.

## **RESOURCING for Garbage Program**

The total resources required for garbage stream alternatives were captured in the financial analysis and are a mix of permanent and temporary FTEs. The resource requirements for both alternative 1 and 2, automating carts collected biweekly are the lowest with an approximate savings of 30 FTEs. On the other hand, alternative 3 and 4 have a cost saving of 14 FTEs only. The FTE saving from the garbage stream will be used to compensate for the FTE requirements for the SSO program. The net change in FTEs will be discussed in section 7.2 in detail.

### **6.3.3. Recommendation for Garbage Program**

The garbage stream alternatives were further analyzed based on the recommendation matrix shown in Table 2. Alternative 2, biweekly, automated collection, offering optionality to residents with either the 120L or the 240L black carts had the highest overall weighted score of 82 percent in the recommendation matrix score due to higher risk and environmental impact scores, followed closely by alternative 1, biweekly, automated collection using 240L black carts, which scored 81.2 percent. Alternative 3 and 4 both scored lower at 62.2 and 62.6 percent respectively, due to their lower NPV, environmental scores. All the four alternatives scored the same on the social impact score due to similar preference of the residents for these alternatives.

The social impact scores between alternate 1 and 2 are the same because there is no clear distinction in the percent of people preferring the 240L versus the 120L black carts. However, residents did prefer to have a choice between the two carts so that they could adjust the cart size based on their household demands.

Administration recommends alternative 2, **Biweekly, automated collection, offering optionality to residents with the use of either the 120L or the 240L black carts** for



further consideration by Council. An overall cost impact of the recommended and alternative program set-outs will be analyzed in section 8 for ease of differentiating the potential curbside programs to Council.

#### **6.3.4. Other Additional Add-On Programs**

##### **6.3.4.1. Additional Assisted Waste Program**

Waste Services will continue to provide service to the residents who are unable to place their organic, garbage and recycling waste at the curbside. As observed in municipalities with similar programs in place it is expected that the number of residents requiring assistance will increase with the new program rollout. An additional amount between \$350,000 and \$400,000 annually is estimated to adapt and maintain the level of service the City provides, and to support the transition to new program requirements.

##### **6.3.4.2. Excess Waste Program**

In addition, Waste Services will also implement an 'Excess Waste Program' for residual waste. This program will allow residents the ability to purchase specially branded clear bags for disposal of residual waste only. To support the City's goal of 90 percent diversion from landfill, use of these bags for recyclables and organic materials would not be permitted. The Excess Waste Program is meant to provide options that give some flexibility to households who may need occasional access to additional residual waste set-out capacity (ordinary household trash), yet provide a direct economic incentive to generate less waste and to increase recycling and source-separation of organics.

Some municipalities in Canada offer a similar extra garbage collection programs, including Airdrie, Vancouver, St. Albert, Toronto, and Guelph. In these municipalities extra garbage bag collection are typically offered within the price range of three to six dollars.

This excess waste program, if implemented, would be offered on a full cost recovery basis. The garbage bags would be priced to fully offset any additional capital and operating expenses incurred.

A preliminary analysis of the program cost estimates an approximate \$2 million in additional capital expense and an ongoing annual operating expense of \$3.5 million requirement to operate this program. An anticipated price per bag will be in the range of three to five dollars per bag. If approved by Council, the initial price per bag for the program will be included as part of the 2020 Utility Rate Filing.

#### **6.4. Recycling Program**

Besides the organic and garbage streams, Waste Services also evaluated the current recycling program. This stream will continue to provide co-mingled recycling collection services to the residents. Detailed table of the viable options and shortlisting is listed in Appendix L.

### 6.4.1. Shortlisted Alternatives for Recycling Program

Municipal benchmarking showed different industry best practices for recycling stream. These best practices were reviewed for frequency and method of collection. There are also new emerging trends in the recycling markets to reduce the contamination in the stream and dual stream collection and processing of recyclables. Waste Services proposed the rehabilitation strategy<sup>23</sup> for MRF to Council in 2019 because of the evolving markets and trends. Waste Services will continue to monitor and make the necessary changes as required in the future. The shortlisted alternatives for the recycling stream are described in Figure 9.

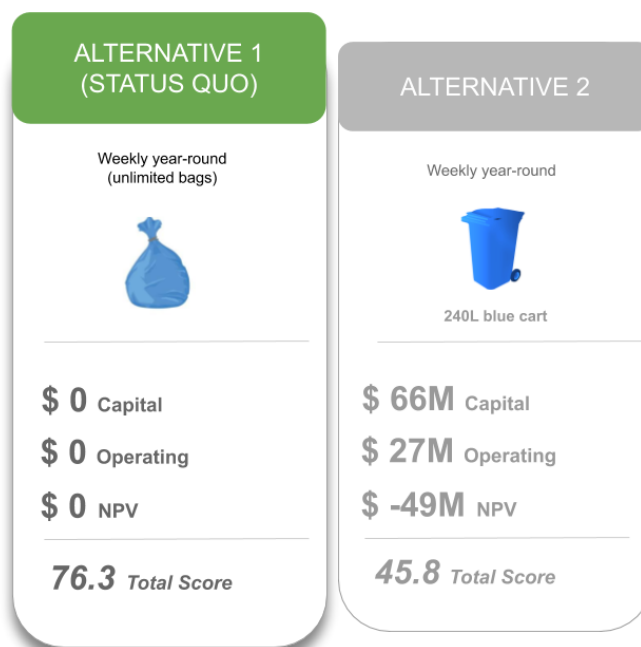


Figure 9: Shortlisted alternatives for Recycling Program including Thirty Year (2020-2049) Cost Impact.

### 6.4.2. Cost Benefit Analysis for Recycling Program

#### ASSUMPTIONS for Recycling Stream Program:

The following assumptions are applied to all of the evaluated alternatives for the financial analysis:

- Capital expenses required to update MRF facility and equipment have been put forward in the MRF business case<sup>24</sup> and hence have not been added for the

<sup>23</sup> CR\_6866 Material Recovery Facility Report

<sup>24</sup> CR\_6866 Material Recovery Facility Report

- alternatives in the set-out business case.
- All costs are incremental to the status quo, the current weekly unlimited blue bag collection which will have no additional capital and operating expenses.

Detailed list of assumptions for financial analysis for the business case is listed in Appendix C.

### **COSTS for Recycling Program**

Figure 9 above depicts the total capital and operating cost for thirty years (2020-2049).

A detailed financial comparison of all the alternatives is outlined in Appendix M. Financial analysis for revenue generation comparison between the alternatives is outlined in Appendix N.

The cost impact analysis shown in Figure 9 above, indicates that alternative 1, the status quo does not have any additional capital or operating expenses. Under this alternative Waste Services will continue to operate in the current manner with the same operating costs and resources. Comparatively, alternative 2, weekly collection of automated 240L blue carts requires an additional capital and operating budget of approximately \$66 million and \$27 million respectively. This alternative also has a negative NPV of approximately \$49 million, thus making it more expensive.

### **RESOURCING for Recycling Stream**

The total resources required for recycling stream alternatives were captured in the financial analysis and are a mix of permanent and temporary FTEs. There are no changes to the FTE requirement for status quo (alternative 1). The overall resource requirement for alternative 2 is a saving of two FTEs due to lower number of collector requirements in this scenario.

#### **6.4.3. Recommendation for Recycling Program**

Recycling stream alternatives were further analyzed using the recommendation matrix shown in Table 2. Alternative 1 scored the highest total weighted score of 76.3 percent in the recommendation matrix because of receiving the highest NPV value score due to no change in the capital and operating expenses for this alternative, indicating this is the most cost effective alternative. Alternative 2, scored a lower score of 45.8 percent, due to lower NPV scores. Alternative 2 scored higher in risks and social impact scores. Both alternative 1 and 2 has the same environmental score due to diverting the same tonnage of material from the landfill.

Based on the recommendation matrix score above, Administration is recommending continuing with the status quo recycling collection of **weekly manual collection of commingled recyclables in blue bags**.

## 7. Single Unit Waste Set-out Business Case Recommendations

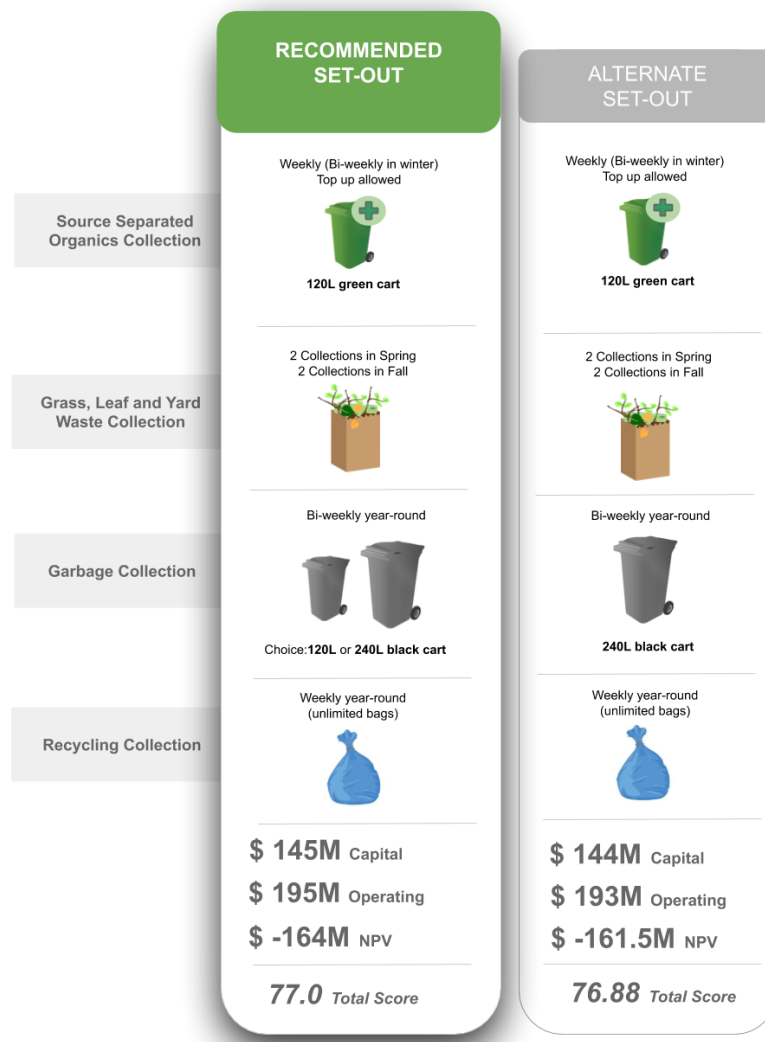
### 7.1. Waste Services Recommended Program Set-out and Costs

Administration is bringing forward the recommended set-out Waste Services curbside collection for Council's consideration. The program set-out and associated 30-year capital and operating costs are shown in Figure 10.

Recommended set-out has the highest overall score of 77 percent. This set-out has an overall capital and operating expenses of approximately \$145 and \$195 million respectively. It also has a negative NPV of approximately \$164 million.

Figure 10 also shows the alternate set-out, which differs from the recommended one in that it proposes the 240L black cart for garbage and has a slightly lower overall score of 76.9 percent. The alternate set-out has similar capital and operating expenses of approximately \$144 and \$193 million respectively. It also has a negative NPV of approximately \$161 million.

Even though both the recommended and alternate set-outs have very small differences in capital and operating expenses, NPV and overall scores, Waste services recommends the following set-out program due to its preference by the residents as observed in the public engagement phase 2 results.



**Figure 10: Two Possible Waste Services Curbside Program Set-outs and their associated capital and operating costs**

## 7.2. Resourcing, Fleet and 4-Year Financial Requirement

Both the recommended and alternate set-outs have the same resource demand of 16.5 additional permanent and seasonal FTEs required from 2022 onwards. On top of this, both set-outs also require additional 19 temporary FTEs to cover the cart roll-out program, public education and outreach, and GIS mapping between 2020 and 2023.

Net fleet and associated capital cost requirement for the recommended and alternate set-out is similar and is shown in Table 3. Net cost impacts to Waste Service as outlined in this business case have been forecast within the current business plan, and will primarily be offset with internal efficiencies as presented in the 2020 Business Plan.

<b>Fleet Number and Cost (2020)</b>	<b>Recommended Set-Out</b>	<b>Alternate Set-Out</b>
<b>Net Fleet Number</b>	4	4
<b>Total Capital Cost (2020)</b>	\$1,455,132	\$1,455,132

Table 4: Net Fleet Requirement for Recommendation set-outs 1 and 2.

Total three year (2020-2022) capital and operating costs for the recommended and alternate set-outs are outlined in Table 4. Recommended set-out has a capital expense of approximately \$51.5 million. Comparatively, the alternate set-out has a capital expense of approximately \$50.4 million. Both the recommended and alternative set-out have very similar operating expenses of approximately \$15 and \$13 million respectively.

<b>Package</b>	<b>Recommended Set-Out</b>	<b>Alternate Set-Out</b>
<b>Total Capital Cost (2020-2022)</b>	\$ 51,493,678	\$ 50,390,631
<b>Total Operational Cost (2020-2022)</b>	\$14,984,099	\$13,183,130

Table 5: Cumulative 4 Year (2020-2022) Capital and Operating Costs for recommended and alternate set-out.

The assisted waste collection program, which is offered to residents who are unable to place their organic, garbage and recycling waste at the appropriate set-out location, will continue to be provided. Reliance on this program is anticipated to grow due to the changing set-out program. The additional funding required to continue to support this program is estimated to be between \$350,000 and \$400,000 annually. This amount will be accounted for in Waste Services annual rate file.

The overall impact of the recommended set-out on the diversion rate is shown in Table 5. The recommended set-out program change is expected to increase the single unit residential waste diversion rate by between eight to two percentage points. This will help reach the 90 percent residential waste diversion goal set in the Waste Strategy<sup>25</sup>. The SSO program shows a range between five to nine percent for the diversion rate due to the dependency of the diversion on the completion of the new composting facility. All numbers assume that the current facilities at EWMC are functioning at their full capacity.

<b>Waste Services Set-Out Programs</b>	<b>Change in Diversion Rate</b>
<b>SSO Program</b>	5% to 9%
<b>Seasonal Leaf and Yard Waste Program</b>	2%
<b>Total</b>	7% to 11%

Table 6: Change in Diversion Rate for the Recommended Set-Out

<sup>25</sup> CR\_5829 Waste Strategy - Comprehensive Waste Management Strategy Report

## 8. Organizational Change Impact for the Single Unit Waste Set-Out Business Case

### 8.1. Stakeholder Requirement, Operational and Business Impacts

Table 7 below identifies the stakeholders and their requirements and the business and operational impacts associated with them.

Primary Stakeholder		
Stakeholder Name	Stakeholder Requirement	Business and Operational Impact
<b>Waste Services Branch (internal)</b>	To identify a waste collection program for residents currently receiving two-stream hand collection services, and implement a program to increase the waste diversion from landfills. The program should meet the financial, environmental and social goal	<ul style="list-style-type: none"> <li>Increased diversion from landfill by changing public behavior with the program</li> <li>Increased resource demands to meet the service level (collection and processing)</li> <li>Increased resource demands for public engagement, education and outreach</li> <li>Increased capital and operational costs for collection, processing and education</li> <li>Development of new enforcement strategies to implement the program changes</li> </ul>
<b>Fleet and Facility Services Branch (internal)</b>	To be communicated adequately on fleet and equipment procurement and maintenance needs as well as the project schedule	<ul style="list-style-type: none"> <li>Increased resource demands for fleet and processing equipment acquisition and the maintenance of the new automated fleet</li> </ul>
<b>Communications and Engagement Department (internal)</b>	To develop and deliver high quality public education, outreach, communication and engagement. To ensure 311 is ready for the program change	<ul style="list-style-type: none"> <li>Increased resource demands for providing public engagement, communication, and education</li> <li>311 needs to be fully trained on the program changes</li> </ul>
<b>Executive Leadership Team (internal)</b>	To ensure the comprehensive and complete information is provided so the ELT makes informative decisions.	<ul style="list-style-type: none"> <li>To provide directions/decisions on the project and review/approve the business case</li> </ul>
<b>City Council (internal)</b>	To ensure the comprehensive and complete information is provided,	<ul style="list-style-type: none"> <li>To review this business case and provide political directions</li> </ul>

	for the City Council makes informative decisions.	<ul style="list-style-type: none"> <li>To expect to receive resident inquiries/feedback on the program changes</li> </ul>
<b>Parks and Road Services Branch (internal)</b>	To ensure there is no negative impact on street cleaning and snow removal/plowing	<ul style="list-style-type: none"> <li>To work collaboratively with Waste Services Branch to ensure waste can be properly set out, and street cleaning and snow removal/plowing can also be performed to meet the residents needs.</li> </ul>
<b>COE Facilities (internal)</b>	To be adequately trained on the program change requirement and provided support	<ul style="list-style-type: none"> <li>To lead by example and participate in the program change</li> </ul>
<b>City of Edmonton Unions (external)</b>	To support and collaborate with Waste Services in accordance with 'Working Relationship Agreement' principles	<ul style="list-style-type: none"> <li>To support and collaborate with Waste Services in accordance with 'Working Relationship Agreement' principles</li> </ul>
<b>Single/Multi-Unit Residents receiving hand collection (external)</b>	To ensure the program change continues to meet the resident needs, the information is clearly communicated to residents, and support is in place to remove service disruption during the program change	<ul style="list-style-type: none"> <li>Increased education demands to fully implement the program changes</li> <li>Increased need to sort waste at household level</li> <li>Increased need for waste material storage space</li> <li>Need of a collection calendar</li> <li>Need of clear education and information on sorting into new streams</li> <li>Need of ongoing support</li> </ul>
<b>Waste Collection Services Vendors (external)</b>	To have adequate time to bid and prepare for the new collection contract.	<ul style="list-style-type: none"> <li>Opportunity to bid and work for the City on the new collection program</li> <li>Resource needs for providing the service to the City</li> </ul>
<b>Waste Cart Vendors (external)</b>	To have adequate time to bid and prepare for the new cart supply and distribution contract	<ul style="list-style-type: none"> <li>Opportunity to bid and work on the City cart supply and distribution contract</li> <li>Need to provide quality work and meet the City's schedule requirements</li> </ul>
<b>EPCOR (external)</b>	To ensure any changes required in the billing system and waste account setup are communicated adequately to EPCOR and all relevant staff are trained	<ul style="list-style-type: none"> <li>To update the billing system and waste account setup system. Ensure all relevant staff are trained</li> </ul>



Secondary Stakeholder		
Stakeholder Name	Stakeholder Requirement	Business and Operational Impact
<b>Financial Services Branch (internal)</b>	To ensure increased transparency in the allocation of the proposed budget and to ensure Waste meets its obligations under the Waste Management Utility Fiscal Policy	Expertise is required for providing finance support
<b>Integrated Infrastructure Services (IIS) Department (internal)</b>	To be communicated adequately on capital projects that need to be delivered by IIS as a result of the program change, and on the impacts on any other capital projects that IIS manages.	Expertise is required for providing support and delivery of all waste infrastructure projects
<b>Corporate Procurement and Supply Services Branch (internal)</b>	To be communicated adequately on project procurement needs	To provide resources to meet the project procurement needs
<b>Law Branch (internal)</b>	To be consulted on all legal items to reduce the project risks	To provide legal advice and risk management advice on Waste Services program changes, including legal advice on new procurement, existing collection contract renewal, program change enforcement, and other items
<b>Community Standards and Neighbourhood Branch (internal)</b>	To ensure the bylaw enforcement needs are communicated adequately to the Branch and the required work can be managed with the Branch's capacity	To work collaboratively with Waste Services Branch on an enforcement program, and provide bylaw enforcement according to the consent
<b>City Planning Branch (internal)</b>	To ensure the illegal suites identified during the program rollout are reported to City Planning	To follow up on the illegal suites reported by Waste Services Branch during the program rollout
<b>Employee Services (internal)</b>	To be communicated adequately on HR management needs (Hiring, etc. )	To provide resources on HR management needs (Hiring, etc)
<b>Open City and Technologies (internal)</b>	To be communicated adequately on IT needs	To provide resources on IT needs
<b>Waste OHS (internal)</b>	To ensure the project align with all OHS Acts, Codes, Regulations and the COE OHS Policies/Procedures/Directives	To provide resources to review and finalize the project OHS program
<b>Alberta Environment and</b>	to ensure the program change	To review and approve any

<b>Parks (external)</b>	meets all requirements under Alberta Environmental Protection and Enhancement Act	approval or amendment to existing approvals
<b>Media</b>	To be informed of the project decisions and progress and be provided of information required	To provide resources on reporting the project decisions and progress
<b>Corporate Enviro team</b>	To ensure the project align with the Corporate Enviro requirements	To provide resources to review and finalize the project Enviro documents
<b>City Waste Truck Contractor</b>	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
<b>Local Waste Management Organizations</b>	To be informed of the project decisions and progress and be provided of information required and to provide input	To provide input and assist the City to promote the project
<b>Business Performance Customer Experience Branch</b>	To ensure the project align with City Operations Departmental goals/initiatives	To provide resources on project procurement and provide project input

Table 7: Stakeholder Requirement, Business and Operational Impacts of the Recommended Set-outs

## 9. Single Unit Waste Set-out Business Case Key Risk(s) and Mitigating Strategy

The high impact risks and mitigation strategies for the single unit waste set-out program are summarized below. The risk impacts outlined in the table below are based on risk scores before the mitigation strategies for the set-out program are in place.

RISK(S)	IMPACT	MITIGATION STRATEGY
Difficult to determine how many residents will choose the 120L black cart vs the 240L black cart resulting in inventory excess or shortfall	High	<ul style="list-style-type: none"> <li>• Use public engagement phase 2 results to get the best estimate for the business case and correct the budget once the results are available prior to the full program implementation</li> <li>• Offer only 240L black carts for initial roll out; offer Excess Waste program to mitigate excess waste needs</li> </ul>
External cure site not in operation in fall 2020 leading to decreased processing of leaf and yard waste collected and increased tonnage of material landfilled	High	<ul style="list-style-type: none"> <li>• Find an alternate solution to process the L&amp;YW volume for fall 2020, when the program rolls out to approximately half of the city</li> <li>• Have a contingency plan for future</li> </ul>

		processing capacity options
Windrow and snow removal during the winter may be problematic	High	<ul style="list-style-type: none"> <li>• Meet with Parks and Road Services to develop a plan</li> <li>• Learn from other municipalities with similar winter conditions</li> </ul>
Procurement delays for carts, equipment and fleet due to delayed decision by Council	High	<ul style="list-style-type: none"> <li>• Develop procurement management plan</li> <li>• Develop procurement documents as early as possible to avoid delays</li> <li>• Have City leadership support on expediting procurements</li> <li>• Update business case as per Council's decision</li> <li>• Update project plan and schedule based on decision made by the Council</li> </ul>
Declining non-rate and commercial revenues as several programs including C&D, Commercial Collections and Biosolids undergo substantial programmatic changes. Also declining MRF revenue in response to global economic forces	High	<ul style="list-style-type: none"> <li>• Non-regulated program losses are mitigated through the Financial Stability Reserve loan</li> <li>• Re-negotiate contractual rights and obligations with customers/vendors</li> <li>• Implement comprehensive cost avoidance protocols</li> </ul>
Addition of grass to ADF will reduce the methane yield and revenue generation from AD	High	<ul style="list-style-type: none"> <li>• Include in the new ADF scope that the facility must be able to handle the materials including food waste and yard waste</li> <li>• Analyze the SSO from the demonstration phase and evaluate methane generation</li> </ul>
Residents do not have the adequate knowledge on the size of the black carts needed for their residential garbage needs	High	<ul style="list-style-type: none"> <li>• Provide all Phase I residents a 240L black cart to start with and allow them to change into a 120L cart</li> </ul>
Improper set-out by residents	High	<ul style="list-style-type: none"> <li>• Have public outreach and education plan finalized for the roll out</li> <li>• Apply experience and lessons learned from the demonstration project to improve communication and education</li> <li>• Have a plan in place for different thresholds and scenarios of non-compliance</li> <li>• Update Waste Bylaw</li> </ul>

**Table 8: Risk Impacts and Mitigation Strategies of the Recommended Set-outs**

## 10. Conclusion and Recommendations

### 10.1. Conclusion

This business case demonstrates the need to transition the single unit waste collection program and the importance of separating the organic waste from the current mingled garbage stream. Based on the information gathered during the phase 1 and 2 of engagement, the recommended set-out offers residents a solution to meet their needs as well as has a positive impact on the residential diversion rate. The recommended programs have a higher overall evaluation score, thus making it the most effective set-out as a whole.

On top of the recommended set-out, Waste Services can offer additional pickup services to meet the needs for additional L&YW and garbage on as needed basis. The extra waste program can be used as a one-off to dispose additional garbage collected during the week or holidays, at an extra cost to the residents. An additional seasonal leaf and yard waste pick up and extra big bin events can also be offered to collect additional L&YW generated on as needed basis.

### 10.2. Single Unit Waste Set-out Business case Final Recommendations

Based on the preceding analysis, Waste Services recommends transitioning to the new waste set-out. This set-out contains:

- 120L green cart with top-up collected weekly in spring, summer and fall and biweekly in winter,
- Manual seasonal collection of L&YW, collected twice in the spring and twice in the fall
- Resident choice between 120L or 240L black carts collected biweekly
- Manual collection of recycling in blue bags collected weekly

This set-out will serve the residents need based on what Waste Services heard from them in the public engagement and also provides the best possible residential diversion from landfill.

### 10.3. Project Responsibility and Accountability

The Waste Services Single unit set-out program Sponsor is the Branch Manager of Waste Services. The program oversight is provided by the General Supervisor of Business Strategy Planning & Support and Program Manager for Waste Strategy Development.

The overall capital program is divided into:

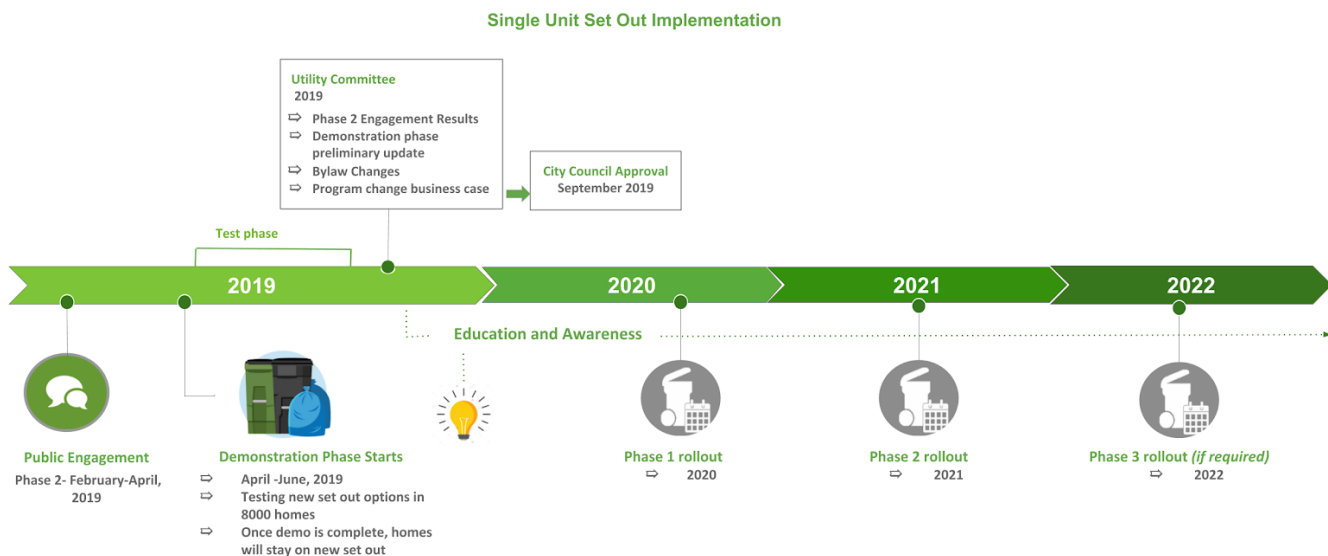
- The composter facility which will be led by Integrated Infrastructure Services (IIS), as identified in the Stantec composter business case.
- Waste Management Collection Set-out Program, outlined in this business case which will be led by General Supervisor of Operational Planning and Project Delivery.

Information to complete the business case was gathered under the supervision of the program managers by the subject matter experts from Waste Services.

## 11. Implementation Approach

The full implementation and success of the Waste Services set-out program is dependant on the public education and outreach efforts, construction of the new OPF, organic waste interim solution, update to MRF, external curesite development, update of the Waste By-law. All these separate projects and activities go hand in hand with the successful completion of the Single unit set-out project delivery.

High level implementation timeline for the single unit set-out project roll-out is outlined in Figure 11.



**Figure 11:** This figure depicts the implementation plan for the Waste Services Curbside Set-out Program changes. Public engagement activities took place in 2018-2019 followed by pilot programs and educational programming for both the Leaf and Yard Waste Program and SSO Program in 2019. Full implementation of these programs will begin in 2020 following Council approval.

### 11.1. New Organics Processing Facility Planning and Implementation

In February 2019, Waste Services delivered a business case to Utility Committee (CR\_6669) proposing further planning for the development of an organic processing facility that would digest residential organic waste and produce renewable natural gas. This business case was approved, and the administration is currently investigating the viability of a public-private partnership to deliver this infrastructure. The target completion date for this project is currently 2025. This project will impact the processing of the organic material collected at the curb and the overall diversion rate.

### 11.2. Education and Outreach Implementation

Implementation of single unit set-out program will be accompanied by a comprehensive public education and outreach strategy. This is a collaborative approach, designed to support residents through the transition, and ensure that they have the knowledge,

tools and confidence required to participate effectively in new programs. Education and outreach tactics include (but are not limited to):

- Broad reaching public communications & marketing campaign
- Development and distribution of public information and resource materials
- Digital media strategy to distribute information and collect resident feedback through various digital media channels
- Public information sessions (drop-in style) at various public locations and events across the city
- Door-to-door canvassing
- Integrated customer service/support through 311 and Waste Hotline

These methods and tactics are being tested and evaluated during the demonstration phase. Related learnings will help inform the education and outreach plan, which will be implemented over a five year period, with the highest concentration of efforts and resources allocated within the first two years of new program implementation.

### **11.3. Demonstration Phase Implementation**

The single unit waste set-out demonstration program started in April 2019 and will run through April 2020. Approximately 8,000 homes were chosen to receive the 120L green carts for SSO (top-up is allowed) and 10-20 kraft paper bags for the seasonal leaf and yard waste collection programs respectively. Approximately 4,000 homes received the 120L and 4,000 received 240L black carts for the garbage stream program. The results of the demonstration phase will be used to fine-tune the full program implementation. Waste Services will analyse the waste composition and understand residents green and black cart needs by the end of this program. Results from the demonstration phase will be used to understand residents' needs and other program rollout and implementation related issues and problems.

### **11.4. Single Unit Waste Set-out Program Changes Implementation**

The program, upon City Council approval in September 2019, will be implemented in multiple phases between fall 2020 and 2022.

### **11.5. Bylaw, Enforcement Strategy and Compliance**

The current Waste Management Bylaw 17555 is being updated concurrent to this business case. This bylaw will provide governance to complement the educational and programming strategies that will accompany the transition to the new residential waste set-out. Waste Services is collaborating with internal stakeholders such as the Community Standards Branch to develop an operational enforcement and escalation strategy that will allow residents to easily come into compliance with the new bylaw by prioritizing education and outreach; and utilizing grace periods. The bylaw project will govern the single unit set-out project compliance and is required for the proper performance management for the program.

## 11.6. Performance Indicators

Waste Services will measure the effectiveness of the program after rollout on a regular basis by measuring the key performance indicators (KPIs) such as:

- Overall Single Unit Residential Diversion Rate
- Single Unit Residential Diversion from Landfill of SSO, L&YW, Garbage and Recyclables
- Total Operating Cost per Tonne
- Tonnes of material collected for SSO, L&YW, Recycling and Garbage
- Contamination rate in garbage stream for both SSO and L&YW
- Overall residential customer satisfaction with Waste Services Program

## 11.7. Critical Dependencies Impacting Timeline

Multiple factors and decision will impact the timeline for this business case including but not limited to:

- Delay in a Council decision on the set-out program recommendation in September 2019 will impact the final program rollout in 2020 to 2022. This is the most crucial step to proceed with tendering and procurement of long lead time items such as carts and collection services.

## 12. Review and Approval Process

The following review and approval process was followed for this business case:

Review Step	Reviewer
Review 1	Team Lead of Business Integration, Working group, Project Managers for Waste Services Program and General Supervisors of Business Integration section
Review 2	Director of Business Financial Analytics, Director of Business Integration, Director of Waste Collection Services, Director of Sustainable Waste Processing, Director of Technical Services, Director of Asset Management and Branch Manager Waste Services
Review 3	Deputy City Manager
Review 4	Corporate Communications, Business Partners (IIS)
Review 5	Utility Advisor, City Manager
Review 6	Utility Committee report presented

### 12.1. Business Case Sign Off

The business case will be approved (signed and dated) by the Program Sponsor, Program Manager of the Waste Services Set-Out program, Directors of Technical Services, Sustainable Waste Processing Services, Business Integration and Safety Engagement. The final approval will be received from the Waste Services Branch Manager and the Deputy City Manager prior to submission to Utility Committee and the Council.

## 13. Appendices

Appendix A: Municipal Waste Services Program and Diversion Rates (2015-2016)  
Appendix B: Alternative Shortlisting Criteria Table (SSO Program)  
Appendix C: Assumptions for Financial Analysis for Single Unit Curbside Set-Out Business Case  
Appendix D: Costs- Financial Analysis Summary Comparison (SSO Program)  
Appendix E: Comparison of Revenue Requirement of Alternatives (SSO Program)  
Appendix F: Alternative Shortlisting Criteria Table for Collections (L&YW Program)  
Appendix G: Costs- Financial Analysis Summary Comparison (L&YW Program)  
Appendix H: Comparison of Revenue Requirement of Alternatives (L&YW Program)  
Appendix I: Alternative Shortlisting Criteria Table (Garbage Stream)  
Appendix J: Costs- Financial Analysis Summary Comparison (Garbage Stream)  
Appendix K: Comparison of Revenue Requirement of Alternatives (Garbage Stream)  
Appendix L: Alternative Shortlisting Criteria Table (Recycling Stream)  
Appendix M: Costs- Financial Analysis Summary Comparison (Recycling Stream)  
Appendix N: Comparison of Revenue Requirement of Alternatives (Recycling Stream)  
Appendix O: Alternative Scoring Methodology



## Appendix A - Municipal Waste Service Programs and Diversion Rates (2015-2016)

Municipality/ Region	Residential Diversion Rate (please see notes below)	Separate Garbage	Separate Recycling	Separate Organics	Separate Yard Waste	Clear Bags	Allow Private Bags	Mandatory Grasscycling	Garbage bag/Volume Limits
Region of York	91% **	x	x	x	x				x
Markham	81% **	x	x	x	x	x	x	x	x
Surrey	72% **	x	x	x	x				x
St. Albert	67% **	x	x	x	x				x
Metro Vancouver	63%**	x	x	x					x
Guelph	63%*	x	x	x	x	x			x
Strathcona County	61%**	x	x	x	x				x
Halifax	61% *	x	x	x	x	x	x	x	x
City of Vancouver	60% *	x	x	x	x				x
Halton	58%**	x	x	x					x
Barrie	54% **	x	x	x	x				x
Region of Niagra	54%**	x	x	x				x	x
Region of Durham	53%**	x	x	x	x				x
Edmonton	52% **	x	x						
Toronto	52% **	x	x	x	x			x	x
Leduc	51%**	x	x	x	x				x
Region of Peel	50% **	x	x	x	x				x
Montreal	47% **	x	x	x	x				x
Ottawa	44%**	x	x	x					x
Calgary	34% **	x	x	x					x
Winnipeg	33% **	x	x		x				x
Saskatoon	22%**	x	x	x***	x***				x
Fort Saskatchewan	21% **	x	x	x					
Regina	20% **	x	x						x

\* 2015 Residential Diversion Rate

\*\* 2016 Residential Diversion Rate

\*\*\* Optional at Additional Cost

The above table shows that City of Edmonton's diversion rate in 2016 was 52 percent. The new diversion rate calculation methodology for single unit residence, reviewed by the auditor and highlighted in CR\_5520 Waste Services Business Plan, was used to adjust the diversion rate. The revised 2017 and 2018 diversion rate of 39 and 36 percent for single unit residences was accepted by the auditor.

## Appendix B - Alternative Shortlisting Criteria Table (SSO Program)

Step 1 Elimination	Option	Green Cart size	Green Bin top up Y/N	Step 2 Elimination	Going Forward
	1	120L	Yes		Yes
	2	120L	No		Yes
	3	240L	Yes		No
	4	240L	No		No
	5	360L	Yes		No
	6	360L	No		No

The table above shows the two steps used to eliminate the six possible SSO collection program options to final two alternatives that were analyzed in detail in the business case. Table below illustrates the details on the two steps used for elimination above.

Elimination Steps	Step 1	Step 2
Elimination Criteria	Alignment with Corporate goals and Waste Service's 25-year business strategy	Approved Council recommendation to use plan the SSO program using the 120L green carts
	Potential feasibility/achievability of the viable options	
	Maintaining Waste service level to the City single unit residences participating in the current waste collection program	

## Appendix C - Assumptions for Financial Analysis for Single Unit Curbside Set-out Business Case

Assumptions	
<ul style="list-style-type: none"> <li>A 10 percent contingency has been added to all the final capital cost numbers to allow for unforeseen event in the future.</li> </ul>	
<ul style="list-style-type: none"> <li>The Annual compounded inflation rate is 1.9 percent based on average 2019-2022 Corporate budget guidelines was used as Consumer Price Index (CPI) for analysis. The final capital numbers are estimates and may fluctuate based on market conditions.</li> </ul>	
<ul style="list-style-type: none"> <li>Trend function was used to forecast the unit counts based on the historical data presented for growth in residential counts.</li> </ul>	
<ul style="list-style-type: none"> <li>Waste Bylaw will be updated in time for full program implementation and the resource and costs associated with this has not been included in the business case.</li> </ul>	
<ul style="list-style-type: none"> <li>Five percent of the green carts rolled out will be sufficient to maintain the cart and accessories inventory for replacing broken carts or cart parts and maintaining growth as needed.</li> </ul>	
<ul style="list-style-type: none"> <li>15 percent spare ratio in truck numbers is sufficient to count for the downtime required to maintain a healthy fleet on the road.</li> </ul>	
<ul style="list-style-type: none"> <li>Five spare arms will be sufficient to maintain the automated truck arm inventory for maintenance purposes.</li> </ul>	
<ul style="list-style-type: none"> <li>Three cart maintenance crew vehicles will be sufficient to maintain the cart roll-out program per automated stream for Waste Services.</li> </ul>	
<ul style="list-style-type: none"> <li>One cart maintenance shop and yard sufficient for storing and maintaining carts per automated waste stream</li> </ul>	
<ul style="list-style-type: none"> <li>Fuel cost is calculated at approximately \$0.929 per kilometer travelled by the vehicle based on historical trend from 2017 and 2018.</li> </ul>	
<ul style="list-style-type: none"> <li>Fleet maintenance cost is calculated at approximately \$2.70 per kilometer travelled by the vehicle.</li> </ul>	
<ul style="list-style-type: none"> <li>Automated arm maintenance is calculated at approximately \$5,000 per automated truck annually.</li> </ul>	
<ul style="list-style-type: none"> <li>Total kilometer distance for the tandem truck was calculated using the 2018 FAST data. An additional 19 percent was added to the kilometers to factor in the growth and increased distance travelled by the trucks for the SSO program and the garbage stream.</li> </ul>	
<ul style="list-style-type: none"> <li>Contractor costs are assumed to be the same as the Waste Services Collection cost of service.</li> </ul>	
<ul style="list-style-type: none"> <li>The Cure Site capacity for processing the additional tonnage is adequate.</li> </ul>	

## Appendix D - Costs- Financial Analysis Summary Comparison (SSO Program)

Waste Services Vehicle & Equipment (2019-2022)	ALTERNATIVE 1-120L cart Top UP	ALTERNATIVE 2-120L cart No Top UP
Total Capital Cost	(\$117,851,375)	(\$110,676,374)
Total Revenues	\$0	\$0
Total Operating and Maintenance Costs	(\$516,236,201)	(\$444,011,246)
Project Net Inflows (Outflows)	(\$634,087,577)	(\$554,687,620)
WACC Discount Rate	5.32%	5.32%
Net Present Value	(\$287,912,389)	(\$253,685,577)

*Note: The above table demonstrates the full life-cycle costing approach of the thirty year capital and operating requirements.*

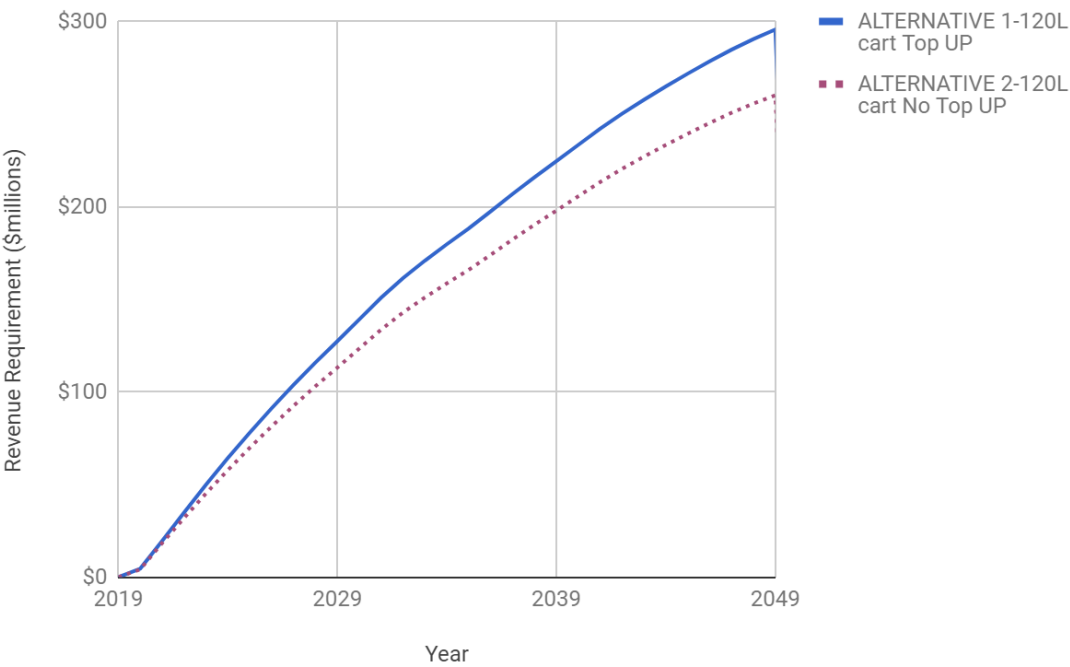
## Appendix E - Comparison of Revenue Requirement of Alternatives (SSO Program)

Cumulative Revenue Requirement (from base year)	ALTERNATIVE 1-120L cart Top UP	ALTERNATIVE 2-120L cart No Top UP
CPV @ Yr 5	64,268,324	57,772,872
CPV @ Yr 10	127,376,827	113,114,940
CPV @ Yr 15	179,724,141	158,600,422
CPV @ Yr 20	224,524,077	197,849,879
CPV @ Yr 25	264,917,935	233,338,962
CPV @ Yr 30	295,678,525	260,137,703
Capital Cost Summary (Base Year Dollars)	ALTERNATIVE 1-120L cart Top UP	ALTERNATIVE 2-120L cart No Top UP
Equipment	87,875,110	82,588,910
Building	350,000	350,000
Other (engineering/PM/etc)	0	0
<b>Total base costs</b>	<b>88,225,110</b>	<b>82,938,910</b>
<i>Add: contingency, inflation</i>		
Contingency	8,822,511	8,293,891
Inflation	20,803,754	19,443,573
<b>Total Capital</b>	<b>117,851,375</b>	<b>110,676,374</b>
<b><u>Economic Assumptions</u></b> Inflation (compounded each year) 1.90 percent Contingency 10 percent Analysis is based on 30 years to capture the full life cycle costs of the assets Assumes borrowing required at 70 percent (based on current Utility split) at four percent		

**Revenue Requirement Summary (CUMULATIVE PRESENT VALUE to use for graph)**

Year	Calendar Year	Alternatives	
		ALTERNATIVE 1-120L cart Top UP	ALTERNATIVE 2-120L cart No Top UP
0	2019	\$0	\$0
1	2020	\$4,569,573	\$4,188,148
2	2021	\$19,560,337	\$18,404,486
3	2022	\$34,868,246	\$31,913,090
4	2023	\$49,914,022	\$45,155,307
5	2024	\$64,268,324	\$57,772,872
6	2025	\$78,008,480	\$69,840,586
7	2026	\$91,176,607	\$81,398,138
8	2027	\$103,799,214	\$92,469,701
9	2028	\$115,898,936	\$103,075,669
10	2029	\$127,376,827	\$113,114,940
11	2030	\$139,147,096	\$123,405,979
12	2031	\$150,844,658	\$133,629,303
13	2032	\$161,461,316	\$142,868,539
14	2033	\$170,880,512	\$150,998,324
15	2034	\$179,724,141	\$158,600,422
16	2035	\$188,234,341	\$165,915,155
17	2036	\$197,451,477	\$173,981,151
18	2037	\$206,865,747	\$182,286,934
19	2038	\$215,885,170	\$190,238,914
20	2039	\$224,524,077	\$197,849,879
21	2040	\$233,340,594	\$205,610,016
22	2041	\$242,083,268	\$213,296,616
23	2042	\$250,191,521	\$220,418,997
24	2043	\$257,716,013	\$227,023,187
25	2044	\$264,917,935	\$233,338,962
26	2045	\$271,817,863	\$239,385,608
27	2046	\$278,426,640	\$245,172,727
28	2047	\$284,754,225	\$250,709,087
29	2048	\$290,482,511	\$255,675,436
30	2049	\$295,678,525	\$260,137,703

Cumulative Present Value Revenue Requirement Chart SSO Alternatives



## Appendix F - Alternative Shortlisting Criteria Table for Collection Services (Leaf and Yard Waste Program)

Step 1 Elimination	Option	Frequency of L&YW seasonal	Automation Y/N	City-contractor Split Y/N	Collected regular Y/N	Step 2 Elimination	Going forward	Step 3 Elimination	Going forward
	1	15/year	Y	Y	Y		YES		NO
	2	15/year	N	Y	N		YES		YES
	3	15/year	Y	N	Y		YES		NO
	4	15/year	Y	Y	N		YES		YES
	5	15/year	N	Y	N		NO		NO
	6	8/year	Y	Y	Y		NO		NO
	7	8/year	N	Y	N		NO		NO
	8	8/year	Y	N	Y		NO		NO
	9	8/year	Y	Y	N		NO		NO
	10	8/year	N	Y	N		NO		NO
	11	6/year	Y	Y	Y		NO		NO
	12	6/year	N	Y	N		NO		NO
	13	6/year	Y	N	Y		NO		NO
	14	6/year	Y	Y	N		NO		NO
	15	6/year	N	Y	N		NO		NO
	16	4/year	Y	Y	Y		YES		NO
	17	4/year	N	Y	N		YES		YES
	18	4/year	Y	N	Y		YES		NO
	19	4/year	Y	Y	N		YES		NO
	20	4/year	N	Y	N		YES		YES
	21	2/year	Y	Y	Y		NO		NO
	22	2/year	N	Y	N		NO		NO
	23	2/year	Y	N	Y		NO		NO
	24	2/year	Y	Y	N		NO		NO
	25	2/year	N	Y	N		NO		NO

The table above shows the three steps used to eliminate the six possible leaf and yard waste collection program options to final four alternatives that were analyzed in detail in the business case.



Table below illustrates the details on the three steps used for elimination above.

Elimination Steps	Step 1	Step 2	Step 3
<b>Elimination Criteria</b>	Alignment with Corporate goals and Waste Service's 25-year business strategy	Twice a year not enough for collection based on Phase I results hence eliminated; six times per year and eight times per year has the same resource and fleet requirement as 15 per year hence eliminated	Collected with current resources on Mondays with overtime to reduce fleet and resource requirement
	Potential feasibility/achievability of the viable options		
	Maintaining Waste's service level to the City single unit residences participating in the current waste collection program		

## Appendix G - Costs- Financial Analysis Summary Comparison (Leaf and Yard Waste Program)

Waste Services Vehicle & Equipment (2019-2022)	ALTERNATIVE 1- 4X manual collection	ALTERNATIVE 2- 4X manual collection contracted out	ALTERNATIVE 3-Manual Collection biweekly (15X)	ALTERNATIVE 4- -Automated 240L cart Collection biweekly (15X)
Total Capital Cost	(\$8,067,593)	(\$8,067,593)	(\$49,107,283)	(\$111,533,880)
Total Revenues	\$11,056,047	\$15,619,087	\$39,292,874	\$39,292,874
Total Operating and Maintenance Costs	(\$86,372,506)	(\$97,687,113)	(\$245,950,025)	(\$240,061,564)
Project Net Inflows (Outflows)	(\$83,384,052)	(\$90,135,619)	(\$255,764,434)	(\$312,302,569)
WACC Discount Rate	5.32%	5.32%	5.32%	5.32%
Net Present Value	(\$37,324,632)	(\$40,250,904)	(\$116,294,305)	(\$149,876,444)

*Note: The above table demonstrates the full life-cycle costing approach of the thirty year capital and operating requirements.*

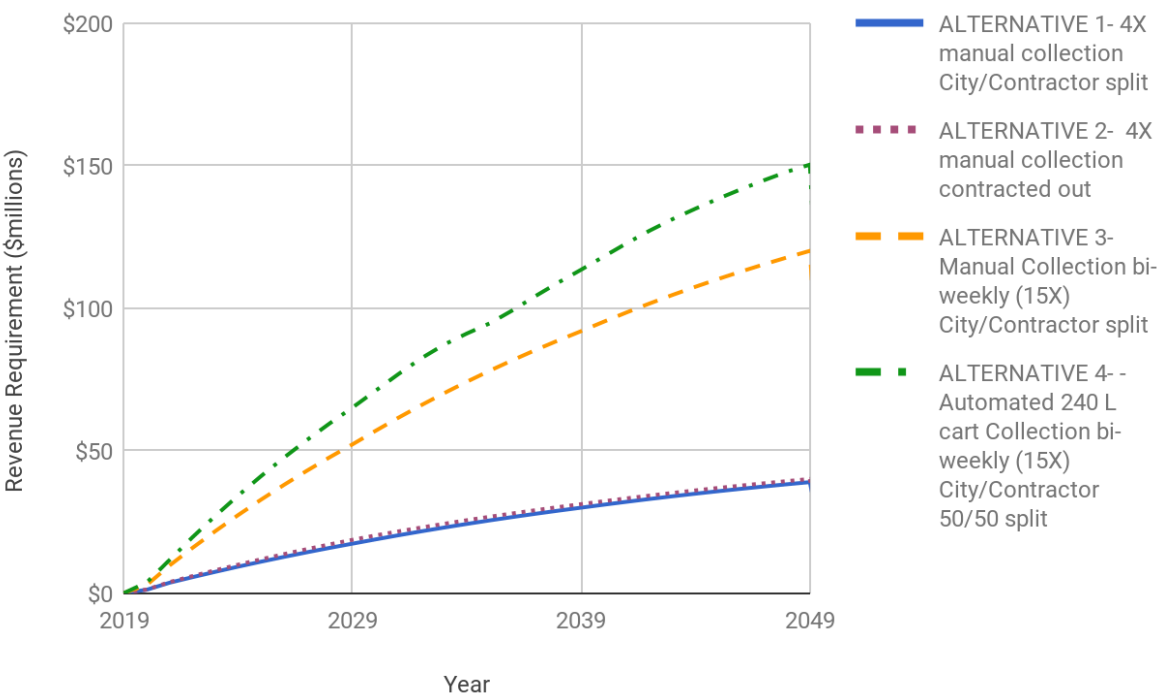
## Appendix H - Comparison of Revenue Requirement of Alternatives (Leaf and Yard Waste Program)

Cumulative Revenue Requirement (from base year)	ALTERNATIVE 1- 4X manual collection City/Contractor split	ALTERNATIVE 2- 4X manual collection contracted out	ALTERNATIVE 3-Manual Collection biweekly (15X) City/Contractor split	ALTERNATIVE 4- Automated 240 L cart Collection biweekly (15X) City/Contractor 50/50 split
CPV @ Yr 5	9,265,757	9,955,395	27,363,747	34,217,706
CPV @ Yr 10	17,328,268	18,677,947	52,170,640	65,080,667
CPV @ Yr 15	24,250,330	25,548,459	74,129,329	91,047,724
CPV @ Yr 20	29,954,679	31,191,977	91,878,556	113,434,715
CPV @ Yr 25	34,859,127	36,011,894	107,448,542	134,843,680
CPV @ Yr 30	38,905,154	40,012,647	120,033,096	150,277,383
Capital Cost Summary (Base Year Dollars)	ALTERNATIVE 1- 4X manual collection City/Contractor split	ALTERNATIVE 2- 4X manual collection contracted out	ALTERNATIVE 3-Manual Collection biweekly (15X) City/Contractor split	ALTERNATIVE 4- Automated 240 L cart Collection biweekly (15X) City/Contractor 50/50 split
Equipment	0	0	30,401,865	77,657,412
Building	6,000,000	6,000,000	6,000,000	6,000,000
Other (engineering/PM/etc)	0	0	0	0
<b>Total base costs</b>	<b>6,000,000</b>	<b>6,000,000</b>	<b>36,401,865</b>	<b>83,657,412</b>
Add: contingency, inflation				
Contingency	600,000	600,000	3,640,187	8,365,741
Inflation	1,467,593	1,467,593	9,065,232	19,510,727
<b>Total Capital</b>	<b>8,067,593</b>	<b>8,067,593</b>	<b>49,107,283</b>	<b>111,533,880</b>
Economic Assumptions Inflation (compounded each year) 1.90 percent Contingency 10 percent Analysis is based on 30 years to capture the full life cycle costs of the assets Assumes borrowing required at 70 percent (based on current Utility split) at four percent				

**Revenue Requirement Summary (CUMULATIVE PRESENT VALUE to use for graph)**

Year	Calendar Year	Alternatives			
		ALTERNATIVE 1- 4X manual collection	ALTERNATIVE 2- 4X manual collection contracted out	ALTERNATIVE 3-Manual Collection biweekly (15X)	ALTERNATIVE 4- -Automated 240 L cart Collection biweekly (15X)
0	2019	\$0	\$0	\$0	\$0
1	2020	\$1,159,289	\$1,229,411	\$2,815,534	\$3,718,186
2	2021	\$3,623,894	\$3,857,290	\$9,689,726	\$11,626,564
3	2022	\$5,567,176	\$5,958,113	\$15,837,543	\$19,571,313
4	2023	\$7,447,229	\$7,990,180	\$21,725,227	\$27,074,660
5	2024	\$9,265,757	\$9,955,395	\$27,363,747	\$34,217,706
6	2025	\$11,007,210	\$11,838,402	\$32,763,597	\$41,016,974
7	2026	\$12,681,621	\$13,649,420	\$37,934,814	\$47,488,223
8	2027	\$14,291,610	\$15,391,245	\$42,887,002	\$53,646,478
9	2028	\$15,839,689	\$17,066,562	\$47,629,347	\$59,506,070
10	2029	\$17,328,268	\$18,677,947	\$52,170,640	\$65,080,667
11	2030	\$18,813,696	\$20,206,719	\$56,876,193	\$70,920,998
12	2031	\$20,253,573	\$21,618,229	\$61,474,244	\$76,766,795
13	2032	\$21,638,214	\$22,977,745	\$65,877,005	\$82,316,669
14	2033	\$22,969,777	\$24,287,202	\$70,092,734	\$87,120,212
15	2034	\$24,250,330	\$25,548,459	\$74,129,329	\$91,047,724
16	2035	\$25,481,858	\$26,763,304	\$77,994,346	\$94,604,466
17	2036	\$26,666,266	\$27,933,456	\$81,695,012	\$99,182,343
18	2037	\$27,805,381	\$29,060,568	\$85,238,241	\$104,175,685
19	2038	\$28,900,957	\$30,146,232	\$88,630,646	\$108,922,654
20	2039	\$29,954,679	\$31,191,977	\$91,878,556	\$113,434,715
21	2040	\$31,006,607	\$32,229,146	\$95,225,857	\$118,104,252
22	2041	\$32,026,618	\$33,228,346	\$98,482,396	\$122,749,931
23	2042	\$33,007,712	\$34,190,980	\$101,601,198	\$127,158,548
24	2043	\$33,951,399	\$35,118,397	\$104,588,064	\$131,178,088
25	2044	\$34,859,127	\$36,011,894	\$107,448,542	\$134,843,680
26	2045	\$35,732,286	\$36,872,720	\$110,187,942	\$138,368,835
27	2046	\$36,572,213	\$37,702,074	\$112,811,341	\$141,673,905
28	2047	\$37,380,188	\$38,501,113	\$115,323,600	\$144,812,496
29	2048	\$38,157,442	\$39,270,947	\$117,729,369	\$147,792,340
30	2049	\$38,905,154	\$40,012,647	\$120,033,096	\$150,277,383

Cumulative Present Value Revenue Requirement Chart Leaf and Yard Waste Alternatives



## Appendix I - Alternative Shortlisting Criteria Table (Garbage Stream)

Step 1 Elimination	Option	Collection Method	Weekly/ Biweekly	Step 2 Elimination	Going forward	Step 3 Elimination	Going forward
	1	120L	Weekly		YES		NO
	2	120L	Biweekly		YES		NO
	3	240L	Weekly		YES		YES
	4	240L	Biweekly		YES		YES
	5	360L	Weekly		NO		NO
	6	360L	Biweekly		NO		NO
	7	120L + 240L	Weekly		YES		YES
	8	120L + 240L	Biweekly		YES		YES
	9	Unlimited Black Bags	Weekly		NO		NO
	10	Unlimited Black Bags	Biweekly		NO		NO
	11	Clear Bags	Weekly		NO		NO
	12	Clear Bags	Biweekly		NO		NO

The table above shows the three steps used to eliminate the six possible garbage stream collection program options to final four alternatives that were analyzed in detail in the business case.

Table below illustrates the details on the three steps used for elimination above.

Elimination Steps	Step 1	Step 2	Step 3
Elimination Criteria	Alignment with Corporate goals and Waste Service's 25-year business strategy	Eliminate 360L and manual collection	Eliminate 120L
	Potential feasibility/achievability of the viable options		
	Maintaining Waste's service level to the City single unit residences participating in the current waste collection program		

## Appendix J - Costs- Financial Analysis Summary Comparison (Garbage Stream)

Waste Services Vehicle & Equipment (2019-2022)	ALTERNATIVE 1- 240L Biweekly Automated	ALTERNATIVE 2-120L or 240L Biweekly automated	ALTERNATIVE 3- 240L weekly automated	ALTERNATIVE 4-120L or 240L weekly Automated
Total Capital Cost	\$ (17,969,775)	\$ (19,310,936)	\$ (40,062,256)	\$ (40,748,913)
Total Revenues	\$ -	\$ -	\$ -	\$ -
Total Operating and Maintenance Costs	\$ 409,459,839	\$ 407,658,870	\$ 224,236,290	\$ 224,300,084
Project Net Inflows (Outflows)	\$ 391,490,064	\$ 388,347,934	\$ 184,174,033	\$ 183,551,170
WACC Discount Rate	\$ 0	\$ 0	\$ 0	\$ 0
Net Present Value	\$ 163,722,274	\$ 161,201,406	\$ 72,619,268	\$ 71,937,553

*Note: The above table demonstrates the full life-cycle costing approach of the thirty year capital and operating requirements.*

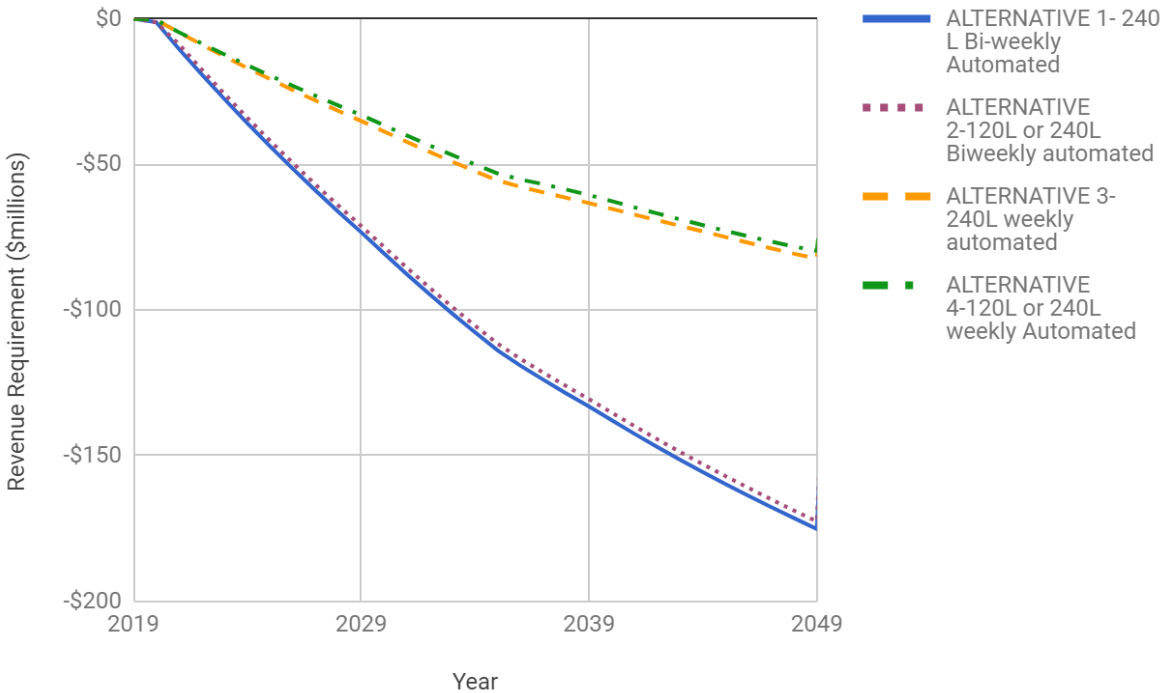


## Appendix K - Comparison of Revenue Requirement of Alternatives (Garbage Stream)

Cumulative Revenue Requirement (from base year)	ALTERNATIVE 1-240L Biweekly Automated	ALTERNATIVE 2-120L or 240L Biweekly automated	ALTERNATIVE 3-240L weekly automated	ALTERNATIVE 4-120L or 240L weekly Automated
CPV @ Yr 5	(35,844,954)	(33,994,977)	(16,904,459)	(15,932,496)
CPV @ Yr 10	(73,344,682)	(71,176,065)	(35,122,036)	(33,098,563)
CPV @ Yr 15	(107,734,023)	(105,442,496)	(52,373,780)	(50,031,725)
CPV @ Yr 20	(133,201,449)	(130,658,472)	(63,313,485)	(60,557,488)
CPV @ Yr 25	(155,731,536)	(153,033,768)	(73,044,163)	(70,900,491)
CPV @ Yr 30	(175,235,276)	(172,649,043)	(82,342,017)	(79,715,945)
Capital Cost Summary (Base Year Dollars)	ALTERNATIVE 1-240L Biweekly Automated	ALTERNATIVE 2-120L or 240L Biweekly automated	ALTERNATIVE 3-240L weekly automated	ALTERNATIVE 4-120L or 240L weekly Automated
Equipment	13,490,912	13,876,667	30,246,010	29,929,441
Building	350,000	75,000	75,000	75,000
Other (engineering/PM/etc)	0	0	0	0
<b>Total base costs</b>	<b>13,840,912</b>	<b>13,951,667</b>	<b>30,321,010</b>	<b>30,004,441</b>
<i>Add: contingency, inflation</i>				
Contingency	1,384,091	1,495,167	3,032,101	3,100,444
Inflation	2,744,772	2,864,103	6,709,145	6,644,028
<b>Total Capital</b>	<b>17,969,775</b>	<b>18,310,936</b>	<b>40,062,256</b>	<b>39,748,913</b>
<b><u>Economic Assumptions</u></b>				
Inflation (compounded each year) 1.90 percent				
Contingency 10 percent				
Analysis is based on 30 years to capture the full life cycle costs of the assets				
Assumes borrowing required at 70 percent (based on current Utility split) at four percent				

Revenue Requirement Summary (CUMULATIVE PRESENT VALUE to use for graph)					
		Alternatives			
Year	Calendar Year	ALTERNATIVE 1- 240L Biweekly Automated	ALTERNATIVE 2-120L or 240L Biweekly automated	ALTERNATIVE 3- 240L weekly automated	ALTERNATIVE 4-120L or 240L weekly Automated
0	2019	\$0	\$0	\$0	\$0
1	2020	-\$1,182,913	-\$1,234,692	-\$330,273	-\$361,918
2	2021	-\$10,356,013	-\$8,737,360	-\$4,753,896	-\$4,631,559
3	2022	-\$19,119,250	-\$17,431,035	-\$8,910,761	-\$8,501,500
4	2023	-\$27,612,865	-\$25,841,035	-\$12,960,183	-\$12,258,424
5	2024	-\$35,844,954	-\$33,994,977	-\$16,904,459	-\$15,932,496
6	2025	-\$43,823,386	-\$41,900,433	-\$20,745,869	-\$19,524,775
7	2026	-\$51,555,802	-\$49,564,771	-\$24,486,674	-\$23,036,363
8	2027	-\$59,049,623	-\$56,995,148	-\$28,129,114	-\$26,468,403
9	2028	-\$66,312,060	-\$64,198,526	-\$31,675,404	-\$29,822,068
10	2029	-\$73,344,682	-\$71,176,065	-\$35,122,036	-\$33,098,563
11	2030	-\$80,570,838	-\$78,364,063	-\$38,711,319	-\$36,577,026
12	2031	-\$87,709,845	-\$85,479,598	-\$42,284,830	-\$40,088,159
13	2032	-\$94,610,164	-\$92,357,919	-\$45,749,553	-\$43,497,140
14	2033	-\$101,282,355	-\$99,009,713	-\$49,111,550	-\$46,810,820
15	2034	-\$107,734,023	-\$105,442,496	-\$52,373,780	-\$50,031,725
16	2035	-\$113,972,517	-\$111,663,535	-\$55,539,120	-\$53,162,323
17	2036	-\$119,215,050	-\$116,860,075	-\$57,781,182	-\$55,224,511
18	2037	-\$124,009,314	-\$121,586,692	-\$59,649,459	-\$56,843,100
19	2038	-\$128,669,636	-\$126,184,437	-\$61,493,119	-\$58,641,893
20	2039	-\$133,201,449	-\$130,658,472	-\$63,313,485	-\$60,557,488
21	2040	-\$137,902,042	-\$135,315,253	-\$65,278,865	-\$62,651,419
22	2041	-\$142,567,930	-\$139,949,440	-\$67,271,610	-\$64,788,813
23	2042	-\$147,090,889	-\$144,443,345	-\$69,224,404	-\$66,873,736
24	2043	-\$151,477,423	-\$148,803,503	-\$71,140,037	-\$68,910,712
25	2044	-\$155,731,536	-\$153,033,768	-\$73,044,163	-\$70,900,491
26	2045	-\$159,854,511	-\$157,124,462	-\$74,994,597	-\$72,843,836
27	2046	-\$163,851,925	-\$161,142,761	-\$76,956,126	-\$74,741,523
28	2047	-\$167,720,129	-\$165,098,259	-\$78,866,042	-\$76,535,369
29	2048	-\$171,513,783	-\$168,934,192	-\$80,725,519	-\$78,238,278
30	2049	-\$175,235,276	-\$172,649,043	-\$82,342,017	-\$79,715,945

Cumulative Present Value Revenue Requirement Chart Garbage Stream Alternatives



## Appendix L - Alternative Shortlisting Criteria Table for Recycling Stream

	Option	Collection Method	Weekly/ Biweekly		Going forward		Going forward		Going forward
Step 1 Elimination	1	120L Co-mingled	Weekly	Step 2 Elimination	YES	Step 3 Elimination	NO	Step 4 Elimination	NO
	2	120L Co-mingled	Biweekly		YES		NO		NO
	3	120L Dual Stream	Weekly		NO		NO		NO
	4	120L Dual Stream	Biweekly		NO		NO		NO
	5	240L Co-mingled	Weekly		YES		YES		YES
	6	240L Co-mingled	Biweekly		YES		YES		NO
	7	240L Dual Stream	Weekly		NO		NO		NO
	8	240L Dual Stream	Biweekly		NO		NO		NO
	9	360L Co-mingled	Weekly		YES		NO		NO
	10	360L Co-mingled	Biweekly		YES		NO		NO
	11	360L Dual Stream	Weekly		NO		NO		NO
	12	360L Dual Stream	Biweekly		NO		NO		NO
	13	Manual Co-mingled	Weekly		YES		YES		YES
	14	Manual Co-mingled	Biweekly		YES		YES		NO
	15	Manual Dual	Weekly		NO		NO		NO
	16	Manual Dual	Biweekly		NO		NO		NO

The table above shows the four steps used to eliminate the six possible recycling collection program options to final two alternatives that were analyzed in detail in the business case.

Table below illustrates the details on the four steps used for elimination above.

Elimination Steps	Step 1	Step 2	Step 3	Step 4
<b>Elimination Criteria</b>	Alignment with Corporate goals and Waste Service's 25-year business strategy	MRF strategy will be presented in 2019 which will address multiple streams, eliminate dual stream	Based on municipal scan and data from surrounding municipalities and the tonnage collected by Edmonton 240L is sufficient to cover the recycling needs of the residents at this time	Eliminate biweekly; will be addressed in strategy
	Potential feasibility/achievability of the viable options			
	Maintaining Waste's service level to the City single unit residences participating in the current waste collection program			

## Appendix M - Costs- Financial Analysis Summary Comparison (Recycling Stream)

Waste Services Vehicle & Equipment (2019-2022)	ALTERNATIVE 1 Weekly manual bag collection; comingled (status Quo)	ALTERNATIVE 2 Weekly automated 240L cart collection; comingled	Alternative 2 Net Change from Status Quo
Total Capital Cost	\$ -	\$ (66,022,766)	\$ (66,022,766)
Total Revenues	\$ -	\$ -	\$ -
Total Operating and Maintenance Costs	\$ -	\$ (26,517,795)	\$ (26,517,795)
Project Net Inflows (Outflows)	\$ -	\$ (92,540,560)	\$ (92,540,560)
WACC Discount Rate	\$ 0	\$ 0	\$ -
Net Present Value	\$ -	\$ (48,892,682)	\$ (48,892,682)

*Note: The above table demonstrates the full life-cycle costing approach of the thirty year capital and operating requirements.*

## Appendix N - Comparison of Revenue Requirement of Alternatives (Recycling Stream)

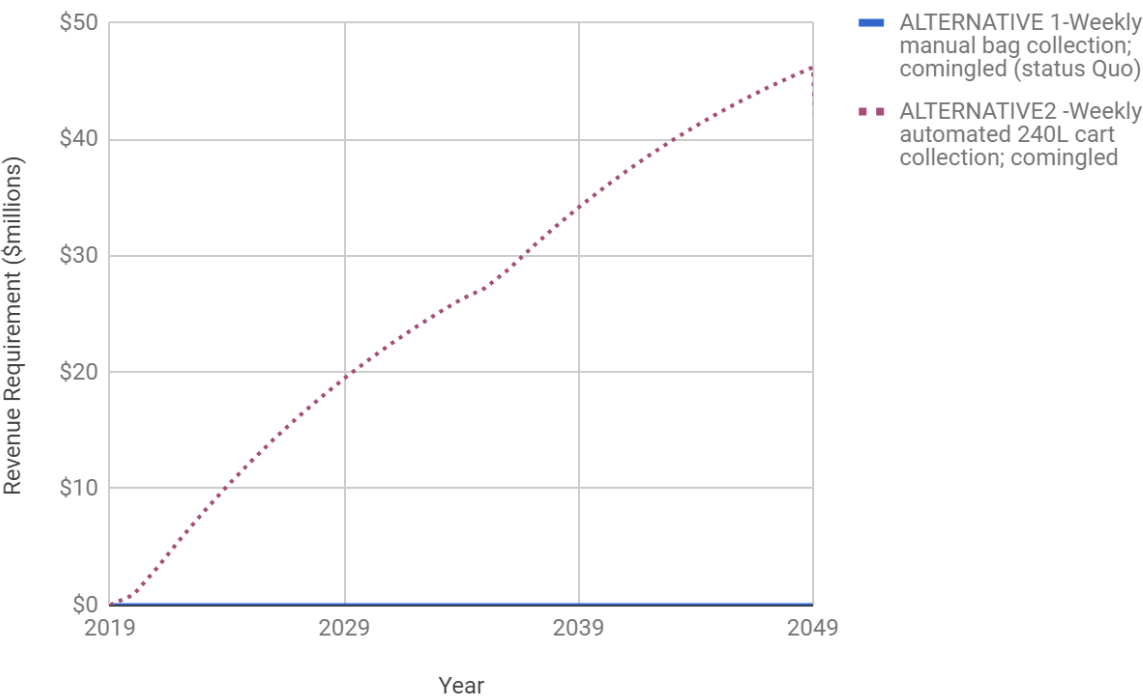
Cumulative Revenue Requirement (from base year)	ALTERNATIVE 1-Weekly manual bag collection; comingled (status Quo)	ALTERNATIVE2 -Weekly automated 240L cart collection; comingled
CPV @ Yr 5	0	10,219,107
CPV @ Yr 10	0	19,460,330
CPV @ Yr 15	0	26,265,229
CPV @ Yr 20	0	34,143,644
CPV @ Yr 25	0	41,133,815
CPV @ Yr 30	0	46,174,727
Capital Cost Summary (Base Year Dollars)	ALTERNATIVE 1-Weekly manual bag collection; comingled (status Quo)	ALTERNATIVE2 -Weekly automated 240L cart collection; comingled
Equipment	0	49,294,943
Building	0	350,000
Other (engineering/PM/etc)	0	0
<b>Total base costs</b>	<b>0</b>	<b>49,644,943</b>
<i>Add: contingency, inflation</i>		
Contingency	0	4,964,494
Inflation	0	11,413,328
<b>Total Capital</b>	<b>0</b>	<b>66,022,766</b>
<b><u>Economic Assumptions</u></b> Inflation (compounded each year) 1.90% Contingency 10% Analysis is based on 30 years to capture the full life cycle costs of the assets Assumes borrowing required at 70% (based on current Utility split) at 4%		

**Revenue Requirement Summary**

Year	Calendar Year	Alternatives	
		ALTERNATIVE 1-Weekly manual bag collection; comingled (status Quo)	ALTERNATIVE2 -Weekly automated 240L cart collection; comingled
0	2019	\$0	\$0
1	2020	\$0	\$879,696
2	2021	\$0	\$3,164,262
3	2022	\$0	\$5,657,966
4	2023	\$0	\$8,007,136
5	2024	\$0	\$10,219,107
6	2025	\$0	\$12,300,850
7	2026	\$0	\$14,258,988
8	2027	\$0	\$16,099,816
9	2028	\$0	\$17,829,315
10	2029	\$0	\$19,460,330
11	2030	\$0	\$20,994,282
12	2031	\$0	\$22,441,362
13	2032	\$0	\$23,801,528
14	2033	\$0	\$25,074,656
15	2034	\$0	\$26,265,229
16	2035	\$0	\$27,207,085
17	2036	\$0	\$28,809,129
18	2037	\$0	\$30,693,471
19	2038	\$0	\$32,470,546
20	2039	\$0	\$34,143,644
21	2040	\$0	\$35,715,846
22	2041	\$0	\$37,200,246
23	2042	\$0	\$38,597,376
24	2043	\$0	\$39,907,666
25	2044	\$0	\$41,133,815
26	2045	\$0	\$42,283,844
27	2046	\$0	\$43,359,430
28	2047	\$0	\$44,362,934
29	2048	\$0	\$45,300,215
30	2049	\$0	\$46,174,727



Cumulative Present Value Revenue Requirement Chart Recycling Stream Alternatives



Note: Alternative 1 revenue requirement is zero as it assumes no incremental costs (status quo).

## Appendix O - Alternative Scoring Methodology

Waste Services used the recommendation methodology outlined on page 25 of CR\_7173 Attachment 1- Set-out Business Case to evaluate business case alternatives. The methodology is outlined below:

Criteria	Percentage
	Weighting
Risks	20.0
Net Present Value (\$)	35.0
Environmental- Diversion rate	20.0
Social Impact/ resident preference	25.0
Total (%)	100

**Table 2: Recommendation Matrix Criteria and Weighted Scoring**

The four criteria listed in the table above (Risks, Net Present Value, Environmental and Social Impact) each play an important role in comparing each alternative through individual scoring and weighting. Scores were calculated for each category, by alternative, and weighted according to the percentages above. Scores for each category were then summarized to calculate a total score for each alternative, out of 100.

The Risk Score was calculated through analysis of identified risks for each alternative. The total risk score includes both common risks (that are the same between each alternative) and specific alternative risks that are associated with respective alternatives. The risk scores were scored based on the following table:

Risk Impact	Risk Score
Low	1
Medium	3
High	5

Net Present Value for each alternative was calculated based on a financial model that considered forecasted operating and capital expenses for 30 years related to implementation of the alternative. Once calculated, lower NPV values lead to lower scores in the matrix whereas higher NPV values lead to higher scores.

Environmental Scores were calculated using estimated waste diversion rates. Alternatives with higher estimated diversion rates scored higher in the matrix.

Social Impact scores are derived from research done through eight months of public engagement. Indicators considered include those which reflect overall support/rejection of the approach.

The following sections show the detailed scoring summaries for each alternative considered in the business case.

SSO Program Change Recommendation Score Table (Figure 6)

SSO Program Change analyzed two major alternatives:

- 1. Weekly (bi-weekly in winter) automated pickup of organic waste in 120L green cart with top-up allowed; and
- 2. Weekly (bi-weekly in winter) automated pickup of organic waste in 120L green cart with no top-up allowed.

The shortlisted alternatives for the SSO program are described in Figure 6.

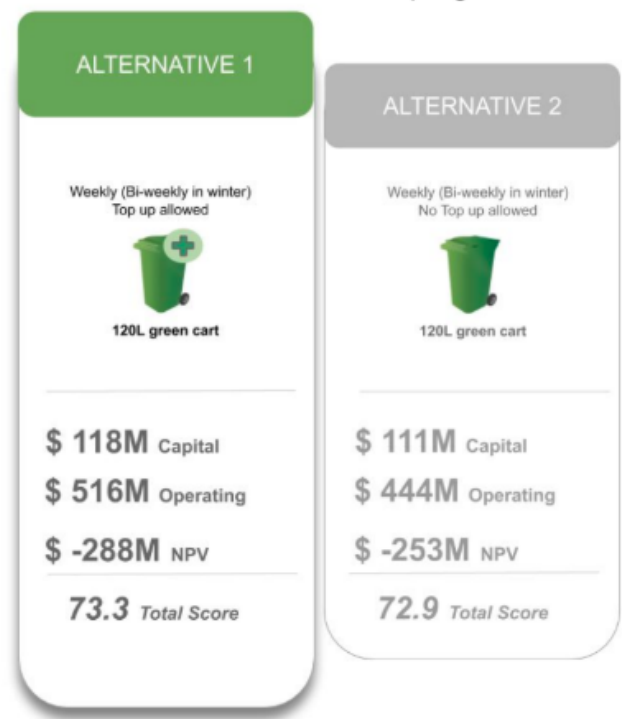


Figure 6: Shortlisted alternatives for SSO Program including Thirty Year (2020-2049) Cost Impact.

The following scores were obtained using the method described for the SSO Program change alternatives.

Criteria	Percentage	Alternative 1	Alternative 2
	Weighting	Score	Score
Risks	20.0	10.0	9.3
Net Present Value (\$)	35.0	30.7	35.0
Environmental - Diversion rate	20.0	16.3	12.7
Social Impact/ Citizen preference	25.0	16.3	15.9
<b>Total (%)</b>	<b>100</b>	<b>73.3</b>	<b>72.9</b>

Factors contributing to differential scores in the above matrix for the SSO Stream are described in details below:

1. Risk Factors:

The total risk score was calculated by calculating the average total risk scores of the common risks (to all the alternatives) and alternative specific risks. Examples of risks identified for this alternative are highlighted in the table below.

Alternative Risks Contributing to Differential Risk Score	Alternative 1	Alternative 2
	Adding grass to digester may reduce methane yield (high)	Cart access for collection in winter (high)
	Residents have more organic waste than fits in the green cart (medium)	Contamination in the green cart due to empty space (medium)
	Residential infrastructure challenges for cart placement (low)	Improper cart set out by residents not allowing collection (low)

As a result of the risk analysis, the cumulative risk scores out of 100 for alternative 1 is 50.0 and for alternative 2 is 46.7 before weighting (20%) is factored in.

## 2. NPV Factor

Waste Services Vehicle & Equipment (2019-2022)	ALTERNATIVE 1-120L cart Top UP	ALTERNATIVE 2-120L cart No Top UP
Total Capital Cost	(\$117,851,375)	(\$110,676,374)
Total Revenues	\$0	\$0
Total Operating and Maintenance Costs	(\$516,236,201)	(\$444,011,246)
Project Net Inflows (Outflows)	(\$634,087,577)	(\$554,687,620)
WACC Discount Rate	5.32%	5.32%
Net Present Value	(\$287,912,389)	(\$253,685,577)

*Note: The above table demonstrates the full life-cycle costing approach of the thirty year capital and operating requirements.*

## 3. Environmental Factors

Environmental Factors Contributing to Differential Environmental Score	Alternative 1	Alternative 2
	9% expected diversion rate impact.	7% expected diversion rate impact

## 4. Social Factors

Social Factors Contributing to Differential Social Score	Alternative 1	Alternative 2
Use of Cart System vs non-cart system Survey results	27	27
Receptiveness to the new program	12.4	12.4
Top-Up	11	9
Agreement About Importance of Diversion	15	15
Total Social Score	<b>65.4</b>	<b>63.4</b>

### Seasonal Leaf and Yard Waste (L&YW) Stream (Figure 7)

Seasonal L&YW Stream had four major alternatives:

1. Manual Collection provided by the City and Contractor: 2 collections in spring and 2 collections in fall
2. Manual Collection provided by Contractor only: 2 collections in spring and 2 collections in fall
3. Manual Collection provided by the City and Contractor: Bi-weekly in spring and fall
4. Automated Collection provided by the City and Contractor: Bi-weekly in spring and fall

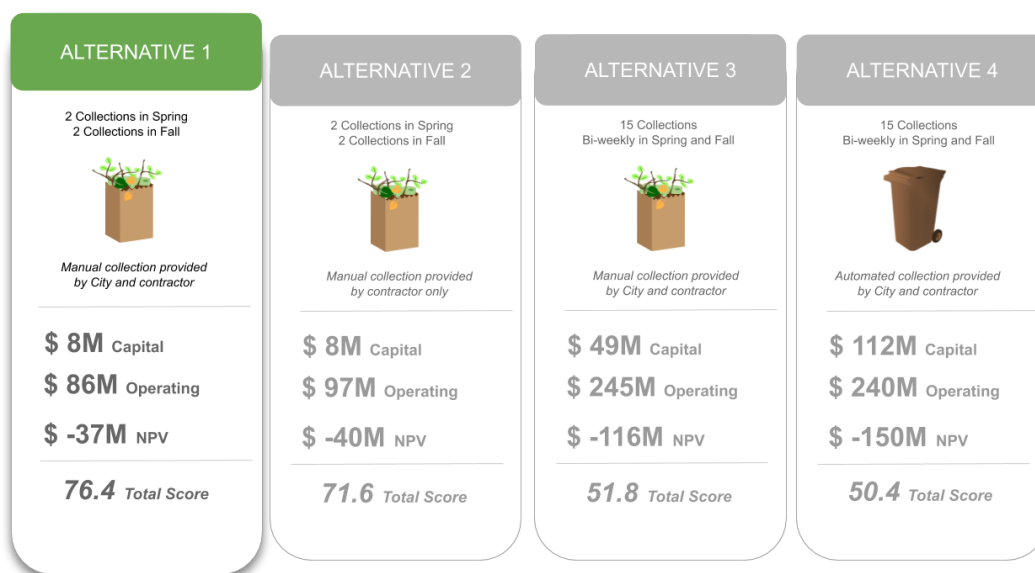


Figure 7: Shortlisted alternatives for L&YW Program including Thirty Year (2020-2049) Cost Impact.

The following recommendation scores were obtained using the method below for the L&YW Stream alternatives.

Criteria	Percentage	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	Weighting	Score	Score	Score	Score
Risks	20.0	9.4	7.1	8.6	9.7
Net Present Value (\$)	35.0	35.0	32.5	11.2	8.7
Environmental-Diversion Rate	20.0	19.0	19.0	20.0	20.0
Social Impact/Citizen Preference	25.0	13.0	13.0	12.0	12.0
<b>Total (%)</b>	<b>100</b>	<b>76.4</b>	<b>71.6</b>	<b>51.8</b>	<b>50.4</b>

Factors contributing to differential scores in the above matrix for the L&YW Stream are described in details below:

#### 1. Risk Factors

The total risk score was calculated by calculating the average total risk scores of the common risks (to all the alternatives) and alternative specific risks. Examples of risks identified for this alternative are highlighted in the table below.

<b>Risks Contributing to Differential Risk Score</b>	<b>Alternative1</b>	<b>Alternative 2</b>	<b>Alternative 3</b>	<b>Alternative 4</b>
	Contamination in the garbage stream (medium)	Cure site infrastructure limitation (high)	Increased road traffic due to multiple stream collection (medium)	Cart procurement delays (high)
	COE Collector injuries increase as L&YW is heavy (medium)	Not enough interest from vendors (medium)	Contamination in the stream (low)	Residential infrastructure challenges related to cart placement (medium)
	Hiring risk for seasonal staff (high)	Contamination in the garbage stream (medium)	Cure site infrastructure limitation (high)	Incidences of damaged or missing carts (low)

As a result of the risk analysis, the cumulative risk scores out of 100 for alternative 1 is 47, for alternative 2 is 36, for alternative 3 is 43 and for alternative 4 is 48, before 20% weighting is factored in.

## 2. Net Present Value

Waste Services Vehicle & Equipment (2019-2022)	ALTERNATIVE 1- 4X manual collection	ALTERNATIVE 2- 4X manual collection contracted out	ALTERNATIVE 3-Manual Collection biweekly (15X)	ALTERNATIVE 4- -Automated 240L cart Collection biweekly (15X)
Total Capital Cost	(\$8,067,593)	(\$8,067,593)	(\$49,107,283)	(\$111,533,880)
Total Revenues	\$11,056,047	\$15,619,087	\$39,292,874	\$39,292,874
Total Operating and Maintenance Costs	(\$86,372,506)	(\$97,687,113)	(\$245,950,025)	(\$240,061,564)
Project Net Inflows (Outflows)	(\$83,384,052)	(\$90,135,619)	(\$255,764,434)	(\$312,302,569)
WACC Discount Rate	5.32%	5.32%	5.32%	5.32%
Net Present Value	(\$37,324,632)	(\$40,250,904)	(\$116,294,305)	(\$149,876,444)

*Note: The above table demonstrates the full life-cycle costing approach of the thirty year capital and operating requirements.*

## 3. Environmental Factors

Environmental Factors Contributing to Differential Environmental Score	Alternative1	Alternative 2	Alternative 3	Alternative 4
	2% expected diversion rate impact	2% expected diversion rate impact	4% expected diversion rate impact	4% expected diversion rate impact

## 4. Social Factors

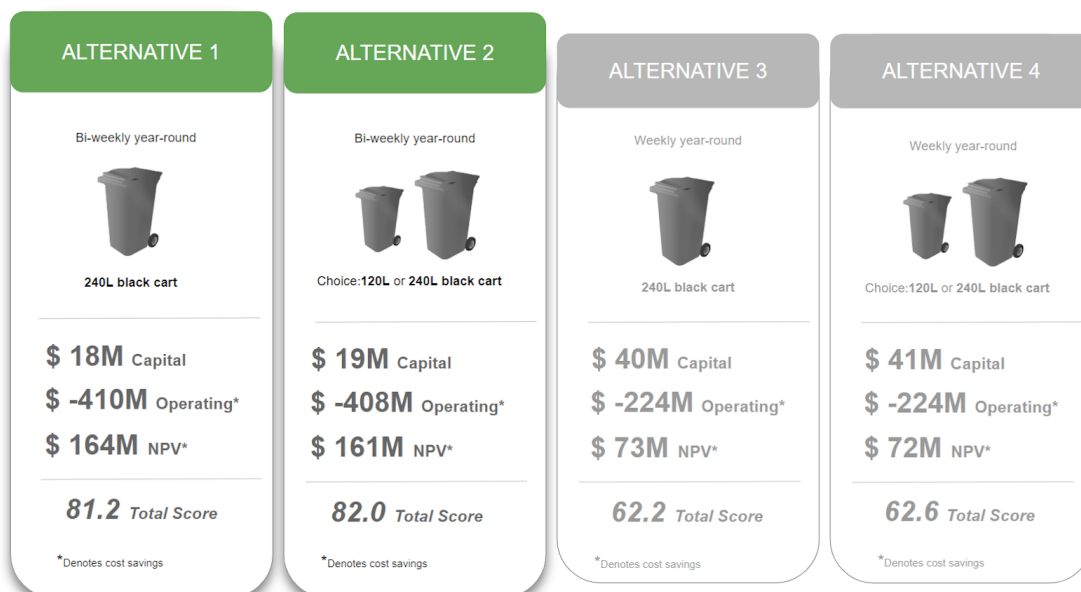
Social Factors Contributing to Differential Social Score	Alternative1	Alternative 2	Alternative 3	Alternative 4
	Resident preference for four times collection was 52%	Resident preference for four times collection was 52%	Resident preference for 15 times collection was 48%	Resident preference for 15 times collection was 48%



## Garbage Program (Figure 8)

Garbage program had four major alternatives:

1. Automated Bi-weekly collection in 240L black carts
2. Automated Bi-weekly collection in 120L and 240L black cart (optionality)
3. Automated Weekly collection in 240L black carts
4. Automated Weekly collection in 120L and 240L black cart (optionality)



Following recommendation scores were obtained using the method below for the garbage program alternatives.

Criteria	Percentage	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	Weighting	Score	Score	Score	Score
Risks	20	10.2	11.5	11.0	11.5
Net Present Value (\$)	35	35.0	34.5	15.8	15.6
Environmental-Diversion rate	20	20.0	20.0	19.5	19.5
Social Impact/Citizen preference	25	16.0	16.0	16.0	16.0
<b>Total (%)</b>	<b>100.0</b>	<b>81.2</b>	<b>82.0</b>	<b>62.2</b>	<b>62.6</b>

Factors contributing to differential scores in the above matrix for the garbage program are described in details below:

### 1. Risk Factors

The total risk score was calculated by calculating the average total risk scores of the common risks (to all the alternatives) and alternative specific risks. Examples of risks identified for this alternative are highlighted in the table below.

<b>Risks Contributing to Differential Risk Score</b>	<b>Alternative 1</b>	<b>Alternative 2</b>	<b>Alternative 3</b>	<b>Alternative 4</b>
	Change in recycling market increases volume in garbage stream (high)	Difficult to determine how many people will choose the 120L option vs the 240L option (high)	Some residents may complain they were not offer a different size of cart to choose (medium)	Difficult to determine how many people will choose the 120L option vs the 240L option (high)
	Increased volume may not meet the demand (low)	Separate inventory management for both carts with related costs (low)	Residents have more waste than fits in the cart (low)	Separate inventory management for both carts with related costs (low)
	Some residents may complain they were not offer a different size of cart to choose (medium)	Residential infrastructure challenges for cart placement (medium)	Change in recycling market increases volume in garbage stream (high)	Residential infrastructure challenges for cart placement (medium)

As a result of the risk analysis, the cumulative risk scores out of 100 for alternative 1 is 51, for alternative 2 is 58, for alternative 3 is 55 and for alternative 4 is 58, before 20% weighting is factored in.

## 2. Net Present value

Waste Services Vehicle & Equipment (2019-2022)	ALTERNATIVE 1- 240L Biweekly Automated	ALTERNATIVE 2-120L or 240L Biweekly automated	ALTERNATIVE 3- 240L weekly automated	ALTERNATIVE 4-120L or 240L weekly Automated
Total Capital Cost	\$ (17,969,775)	\$ (19,310,936)	\$ (40,062,256)	\$ (40,748,913)
Total Revenues	\$ -	\$ -	\$ -	\$ -
Total Operating and Maintenance Costs	\$ 409,459,839	\$ 407,658,870	\$ 224,236,290	\$ 224,300,084
Project Net Inflows (Outflows)	\$ 391,490,064	\$ 388,347,934	\$ 184,174,033	\$ 183,551,170
WACC Discount Rate	\$ 0	\$ 0	\$ 0	\$ 0
Net Present Value	\$ 163,722,274	\$ 161,201,406	\$ 72,619,268	\$ 71,937,553

*Note: The above table demonstrates the full life-cycle costing approach of the thirty year capital and operating requirements.*

## 3. Environmental Factors

Environmental Factors Contributing to Differential Environmental Score	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	1% expected diversion rate impact	1% expected diversion rate impact	Nil expected diversion rate impact	Nil expected diversion rate impact

## 4. Social Factors

Social Factors Contributing to Differential Social Score	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Use of Cart System vs non-cart system Survey results	27%	27%	27%	27%
Receptiveness to the new program	12.4%	12.4%	12.4%	12.4%
Agreement About Importance of Diversion	15%	15%	15%	15%
Preference of cart system	9.6%	9.6%	9.6%	9.6%
Total Social Score	64%	64%	64%	64%

## Recycling Program (Figure 9)

Recycling program had two major alternatives:

1. Weekly, manual, unlimited blue bags (Status Quo)
2. Weekly, automated, 240L blue carts

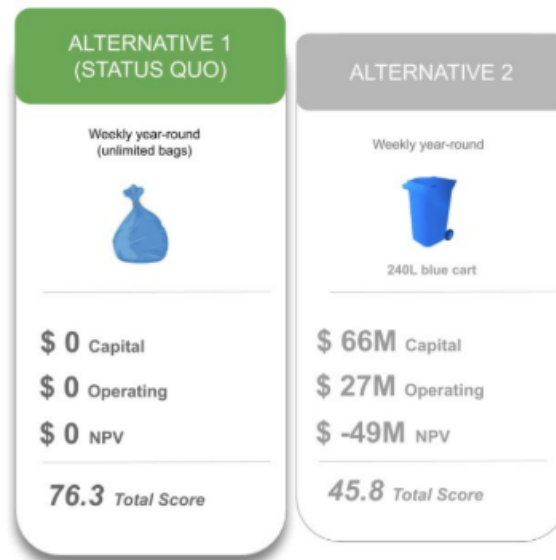


Figure 9: Shortlisted alternatives for Recycling Program including Thirty Year (2020-2049) Cost Impact.

Following recommendation scores were obtained using the method below for the recycling program alternatives

Criteria	Percentage	Alternative 1 (Status Quo)	Alternative 2
	Weighting	Score	Score
Risks	20	10.0	12.0
Net Present Value (\$)	35	35.00	0.0
Environmental - Diversion rate	20	20.00	20.0
Social Impact/ Citizen preference	25	11.3	13.8
<b>Total (%)</b>	<b>100</b>	<b>76.3</b>	<b>45.8</b>

Factors contributing to differential scores in the above matrix are described in details below:

### 1. Risk Factors

The total risk score was calculated by calculating the average total risk scores of the common risks (to all the alternatives) and alternative specific risks. Examples of risks identified for this alternative are highlighted in the table below.

Risks Contributing to Differential Risk Score	Alternative1	Alternative 2
	Increased collector workplace safety incidents/accidents due to manual lifting (low)	Procurement delays (medium)
	Contamination in this stream (medium)	Damaged/stolen carts (low)
	Infrastructure challenges at the MRF (high)	Windrow and snow removal during the winter (high)

As a result of the risk analysis, the cumulative risk scores out of 100 for alternative 1 is 50 and for alternative 2 is 60 before weighting is factored in.

### 2. NPV Factor

Waste Services Vehicle & Equipment (2019-2022)	ALTERNATIVE 1 Weekly manual bag collection; comingled (status Quo)	ALTERNATIVE 2 Weekly automated 240L cart collection; comingled	Alternative 2 Net Change from Status Quo
Total Capital Cost	\$ -	\$ (66,022,766)	\$ (66,022,766)
Total Revenues	\$ -	\$ -	\$ -
Total Operating and Maintenance Costs	\$ -	\$ (26,517,795)	\$ (26,517,795)
Project Net Inflows (Outflows)	\$ -	\$ (92,540,560)	\$ (92,540,560)
WACC Discount Rate	\$ 0	\$ 0	\$ -
Net Present Value	\$ -	\$ (48,892,682)	\$ (48,892,682)

*Note: The above table demonstrates the full life-cycle costing approach of the thirty year capital and operating requirements.*

### 3. Environmental Factor

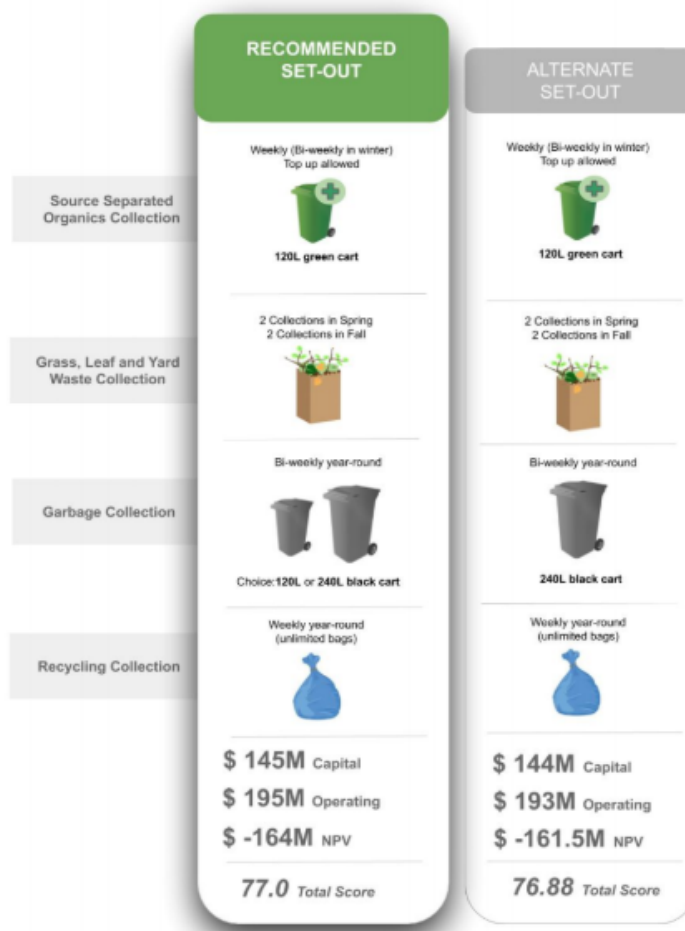
Environmental Factors Contributing to Differential Environmental Score	Alternative1	Alternative 2
	Nil expected diversion rate impact	Nil expected diversion rate impact

## 4. Social Factor

Social Factors Contributing to Differential Social Score	Alternative 1	Alternative 2
	55% of respondents prefer blue cart	45% of residents prefer blue bag

**Recommended Program Set-Out (Figure 10)**

The final recommended set-out Waste Services curbside collection is outlined in Figure 10 as follows.



**Figure 10: Two Possible Waste Services Curbside Program Set-outs and their associated capital and operating costs**

The overall scores for the recommended and the alternate set-out are average percent scores of the respective programs/streams within it.