CITY OF OTTAWA

Integrated Curbside Waste Collection Model Development – Task B Technical Memorandum Synopsis

CIF Project 1043

October 2019 – 18-8124

Executive Summary

The City of Ottawa's (the City's) curbside waste collection contracts expire on May 31, 2023. The City requires a cost benefit analysis (CBA) of potential waste diversion policies to assist with meeting City diversion targets in light of the future tender for the new curbside collection contracts. In July 2018, the City and the Continuous Improvement Fund (CIF) retained Dillon Consulting Limited (Dillon) to complete two tasks:

- **Task A:** Conduct a CBA through the completion of a jurisdictional review to determine costs and benefits of different waste diversion policies; and
- **Task B:** Develop an integrated curbside waste collection model (CCM) utilizing the information obtained in Task A to identify appropriate collection approaches for the next curbside tender, considering the potential transition of the recycling programs under Extended Producer Responsibility (EPR).

The CCM was designed as a tool to assist municipal staff in developing curbside collection options and/or new policies. It is based in Microsoft Excel and includes the preferred waste diversion policies presented in the Task A Technical Memo. This tool permits input of household information, collection seasons/periods, materials collected per collection model, truck compartment parameters and utilization, collection factors and collection costs for a municipality's baseline scenario which is used to compare against several collection and policy options. A collection scenario is defined as a change in how waste material(s) are collected; a policy scenario is defined as a change in legislation regarding how waste material(s) must be sorted or set out for collection. A municipality has the ability to compare new collection and policy options against status quo parameters including costs, vehicles required for servicing, diversion rates, and greenhouse gas (GHG) impacts.

The modelling for the status quo scenario required a waste tonnage breakdown by material type (garbage, organics/fibres, organics/containers and separate LYW collection). This data was based on 2017 tonnage data. Other input parameters related to the City's curbside waste collection systems that were needed for the CCM included the following:

- Community demographics, e.g., households served, participation rates, set out frequencies;
- Materials collected, e.g., capture rates, quantities collected, densities;
- Truck capacity, e.g., compaction ratio, compartment utilization, volume;
- Collection factors, e.g., time spent driving, dumping, collecting and on breaks, vehicle speed (on and off route), average time utilization and pass spacing; and
- Collection costs, e.g., contract costs for garbage, recycling, organics and LYW.

The CCM was based on the City of Ottawa's curbside collection system; however, it is adaptable if other municipalities are interested in analyzing their integrated waste collection system.

The model produced several outputs which included the following:

- Number of trucks required (per season, per collection stream – with and without spares);
- Number of hours required to collect materials (per season, per collection stream);
- Total annual cost per household and per person ($);
- Capture rate (kg/person);
- Diversion rate (%); and
- GHG Impacts (tonnes CO_2 equivalents per year).

To calibrate the model, the model's outputs of the total number of trucks required for servicing each waste material were compared against the actual number of trucks required per season. The difference between the two were compared to determine how close the model outputs were to Ottawa's actual collection system. Based on the results of the calibration, minor changes were made to the model inputs in consultation with the City.

The following sections highlight the results of the customized CCM for the City of Ottawa.

Diversion Rates

Collection and policy scenarios reviewed all resulted in similar outcomes with respect to diversion rates. This may indicate that one specific collection and/or policy scenario is not likely to yield the highest diversion rates, but rather implementing stricter collection and policy set out requirements may yield higher diversion results.

Estimated Costs

Higher costs are attributed to collection scenarios where there is weekly co-collection of blue and black box over a four day collection week and where there is weekly collection of recyclables and LYW. These higher costs are due to the number of vehicles that would be required for each scenario. The lowest costs are expected to be in status quo, and separate weekly or bi-weekly LYW collection due to a lower number of vehicles being required than the other scenarios.

Greenhouse Gas Impacts

Separate bi-weekly LYW collection may produce less CO_2 equivalents per year than status quo for all policy scenarios. Weekly co-collection of blue / black box under a four day collection week is likely to produce the most CO_2 equivalents per year due to the number of vehicles required and hours collecting waste materials.

Cost Effectiveness and Greenhouse Gas (GHG)

There appears to be a correlation between collection system cost effectiveness and greenhouse gases (GHG); higher costs are attributed to model runs that have the higher number of CO_2 equivalents per year. The model runs with the higher costs and CO_2 equivalents per year are also the model runs with the higher number of collection vehicles; more trucks on the road indicates a higher cost and a higher amount of CO_2 equivalents per year while less trucks on the road indicates a lower cost and a lower amount of CO_2 equivalents per year.

Transition of Recyclable Stream to Full Producer Responsibility

With proposed future changes to the Province's, Resource Recovery and Circular Economy Act (RRCEA), the City will need to make decisions regarding its level of involvement in the Blue Box Program. The results of the CCM will be considered and used as the City develops its transition plan, (i.e. shift to Full Producer Responsibility). Given the uncertainty of the Full Producer Responsibility framework, the City may choose to adjust collection and policy scenarios in order to transition existing blue and black box contracts particularly where recyclables are co-collected with other waste streams.

Conclusion

Based on the results of the CCM, increased diversion rates are expected to be achievable with some of the modelled collection and policy scenarios. The next steps for the City include the following:

1. Determine what the City's priorities are for the next collection contract (e.g., costs, diversion, GHG or a combination of priorities);
2. Evaluate the results of the CCM against the City's priorities to determine the preferred collection and policy scenario(s). As part of this evaluation the City will need to determine what additional costs there may be such as education and communication strategies, implementation costs and additional staffing requirements (e.g., enforcement); and
3. Use the results of the CCM as one tool in the development of the City's next collection contract.

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1.0 Background and Purpose

The City of Ottawa's (the City's) curbside waste collection contracts are set to expire on May 31, 2023. The City requires a cost benefit analysis (CBA) of potential waste diversion policies to assist with meeting City diversion targets in light of the future tender for the new curbside collection contracts.

Potential waste diversion policies and collection service contracts for the City must also consider the future transition to 100% full producer responsibility of the Blue Box program in Ontario and the recent framework approved by the Ministry of Environment Conservation and Parks (MECP) for increased organics diversion targets for Ontario municipalities.

In July 2018, the City and the Continuous Improvement Fund (CIF) retained Dillon Consulting Limited (Dillon) to complete two tasks:

- **Task A:** Conduct a CBA through the completion of a jurisdictional review to determine costs and benefits of different waste diversion policies; and
- **Task B:** Develop an integrated curbside waste collection model (CCM) utilizing the information obtained in Task A to identify appropriate collection approaches for the next curbside tender, considering the potential transition of the recycling programs under Extended Producer Responsibility (EPR).

The CCM was designed for adaptability should other Ontario municipalities be interested in analyzing their integrated waste collection system by revising the inputs to the model and minor customizations. It is acknowledged that this study only looks at households that receive curbside collection.

This Technical Memorandum provides an overview of the approach and methodology utilized in the development of the CCM. The model is based in Microsoft Excel and includes the preferred waste diversion policies presented in the Task A Technical Memo.

2.0 Approach and Methodology

The following subsections describe the approach and methodology utilized to develop the CCM. This includes the following:

- Model purpose and description;
- Status Quo input parameters and assumptions;
- Model validation;
- Model runs (policy scenarios and collection scenarios); and
- Model output.

2.1 Model Purpose and Description

The CCM was designed as a tool to assist municipal staff in developing curbside collection options and/or new policies. This tool permits input of household information, collection seasons/periods, materials collected per collection model, truck compartment parameters and utilization, collection factors and collection costs for a municipality's baseline scenario which is used to compare against several collection and policy options.

A municipality has the ability to compare new collection and policy options against status quo parameters including costs, vehicles required for servicing, diversion rates, and greenhouse gas (GHG) impacts. The CCM was based on the City of Ottawa's curbside collection system; however, it is adaptable if other municipalities are interested in analyzing their integrated waste collection system.

A collection scenario is defined as a change in how waste material(s) are collected; a policy scenario is defined as a change in legislation regarding how waste material(s) must be sorted or set out for collection. The modelled collection scenarios have been highlighted in **Table 1** and the modelled policy scenarios are summarized in **Table 2**. As noted, the status quo scenario for both the policy and collection scenario is based on the City of Ottawa's curbside collection system.

Table 1: Modelled Collection Scenarios

Collection Scenario	Description
1 - Status Quo	- Status Quo - Separate bi-weekly garbage collection - Duel stream recycling, collected on alternate weeks - Weekly co-collection of organics and recycling in a split-bodied truck - Separate weekly collection of leaf and yard waste in peak season only - Bi-weekly collection of bulky materials, with garbage - Five-day collection week

Collection Scenario	Description
2 - Weekly Co-Collection of Blue/Black Box	- Separate bi-weekly garbage collection - Co-collection of both recycling streams on a weekly basis - Co-collection of green bin/leaf and yard waste (LYW) collection, weekly collection (noting that during peak weeks LYW may be collected separately)
3 - Status Quo 4 Day Collection Week	- Four day collection week based on scenario #1 (status quo)
4 - Weekly Co-Collection of Blue/Black Box 4 Day Collection Week	- Four day collection week based on scenario #2
5 - Separate Weekly LYW Collection	- Bi-weekly garbage collection (status quo) - Co-collection of recyclables and organics, weekly collection (status quo) - Separate weekly LYW collection
6 - Separate Bi-weekly LYW Collection	- Bi-weekly garbage collection (status quo) - Co-collection of recyclables and organics, weekly collection (status quo) - Separate bi-weekly LYW collection
7 - Weekly Collection of Recyclables and LYW	- Separate bi-weekly garbage collection - Co-collection of both recycling streams on a weekly basis - Separate weekly organics collection - Separate weekly LYW collection

Table 2: Modelled Policy Scenarios

Policy Scenario	Description
a - Status Quo	- Status Quo (Six Bag Limit - Not Enforced)
b - Bag and container limits	- Restrictions on the number of garbage bags or containers that can be placed out for collection
c - Pay as you throw	- User-pay based waste collection approach to generate revenue to cover waste management costs Requires resident to pay for either all bags of garbage or any bags above a set number
d - Containerized garbage	- Collection of residential garbage typically in wheeled carts. Curbside collection may be semi or fully automated
e - Clear bag garbage program	- Transparent bags for curbside garbage collection (with or without a bag limit)
f - Material bans – Organics	- Ban on organics in the waste stream for residential collection
g - Material bans – Recyclables	- Ban on recyclables in the waste stream for residential collection
h -Material bans – Organics and Recyclables	- Ban on organics and recyclables in the waste stream for residential collection

The costs and changes to diversion rates for each policy scenario are based on current market research (Task A technical memorandum) and previous CIF municipal projects. Information from municipalities that have implemented new policies was obtained to estimate results achievable; however, this model was not intended to predict, estimate or otherwise infer the exact costs, vehicles required for servicing, diversion rates, capture rates, GHG impacts or any other results to change existing collection options or policies. The information generated by the model is provided only for the purposes of discussion.

The CCM is presented to a user in Microsoft Excel in a tabular input format where users enter their municipal information in highlighted cells. The inputs are automatically processed through a series of formulas and options to calculate and display detailed estimates of collection outputs on individual model run tabs. A summary of all of the model runs, including a comparison against status quo, is also presented in the CCM.

2.2 Status Quo Input Parameters and Assumptions

The modelling for the status quo scenario required a waste tonnage breakdown by material type (garbage, organics/fibres, organics/containers and separate LYW collection). This data was based on 2017 tonnage data. The assumptions that were used to determine the breakdown are also provided in this table and were developed with input from the City. Other input parameters related to the City's curbside waste collection systems that were needed for the CCM included the following:

- Community demographics, e.g., households served, participation rates, set out frequencies;
- Materials collected, e.g., capture rates, quantities collected, densities;
- Truck capacity, e.g., compaction ratio, compartment utilization, volume;
- Collection factors, e.g., time spent driving, dumping, collecting and on breaks, vehicle speed (on and off route), average time utilization and pass spacing; and
- Collection costs, e.g., contract costs for garbage, recycling, organics and LYW. This does not include any implementation costs (e.g., new infrastructure - cost of trucks and carts or additional enforcement).

These parameters were provided by the City and are based on 2017 data from the current collections program. It should be noted that costs for LYW collection were provided by the City; however, the costs for the ten weeks of peak LYW collection identified in the model are an estimate only as the City was not provided with a cost breakdown from their current collection providers for this ten week peak collection.

2.3 Model Validation

To calibrate the model, a total number of trucks required for servicing (a model output) versus the actual number were compared. Following the calibration of the model, the model was further developed to relate each of the collection and policy scenarios to the status quo scenario.

A total of 55 model runs were developed and assessed (seven collection scenarios multiplied by eight policy scenarios minus the status quo scenario). As previously noted, the model was setup in a tabular input format which allows for information to be input into highlighted cells. Inputs are automatically processed through a series of formulas and options to calculate and display detailed estimates of collection output.

The model costs and changes to diversion rates based on policy changes are based on current market research, the Task A technical memorandum and previous CIF municipal projects. A summary of all of the model runs, including a comparison against status quo was included in the model.

2.4 Model Output

The model produced several outputs which included the following:

- Number of trucks required per season, per collection stream – with and without spares;
- Number of hours required to collect materials per season, per collection stream;
- Total annual cost per household and per person ($);
- Capture rate (kg/person);
- Diversion rate (%); and
- GHG Impacts (tonnes CO_2 equivalents per year).

The outputs were calculated based on a series of formulas that incorporated the model inputs. This included the following calculations:

Waste Diversion Calculation:

$$\frac{\text{Weight of Recycling}}{\text{Weight of Recycling + Weight of Garbage}}$$

GHG Calculation:

Number of trucks required x tonnes CO_2 equivalents per year

The model used 95.9 tonnes of CO_2 equivalents per year. This is based off of the emissions for one curbside waste collection vehicle in Ontario using diesel. [1]

[1] OWMA, GHG and the Ontario Waste Management Industry. Dec. 2015

3.0 Summary of Findings

The Summary of Findings have been omitted from the synopsis for confidentiality purposes.