Organics Planning Study – Executive Summary

Consolidated Recommendations

City of Winnipeg
April 11, 2023

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The information presented is based on data available/current at the time the Final report was prepared (January 2023) which includes information acquired for previous reports from 2021 to 2022, inclusive. Additional information regarding privately owned facilities is based on data developed during supplemental Technical Memo No.4 (March 2023). Assumptions regarding a residential food waste processing facility were developed in collaboration with the City with respect to feedstock, location, and infrastructure design choices. Forward looking statements are based upon expectations, estimates and projections at the time the statements were made and involve risks and uncertainties that could cause actual events to differ from those anticipated.

None of the information presented, positions taken, or recommendations made in this document were included with the intent of advancing a specific commercial interest of HDR Corporation or its existing clients.

The intent of the Study is not to prescribe a preferential or ideal design or layout, technology, equipment, or specific solution that the City of Winnipeg should adhere to. Rather, it is to provide the City with the basis for understanding the planning and cost implications of implementing a Green Cart program in Winnipeg. Any residential food waste processing facility that is developed for the City will be dependent on the City's specifications at the time of procurement and responses received from proponents to any request for proposals (RFP).

1 Introduction

In 2015, the City of Winnipeg (City) initiated an Organics Diversion Strategy and Waste Composition Study. The Organics Diversion Strategy was intended to provide the City with an implementation path for a Green Cart program in Winnipeg. The Organics Diversion Strategy was supported by a four-season residential food waste (RFW) composition study, completed in 2016, which provided waste composition information for Single Family Dwellings (SFD), Multi-family Dwellings (MFD), and Municipally Collected Non-Residential (MCNR) waste (i.e. small commercial businesses receiving waste collection by the City). The Organics Diversion Strategy, for a number of reasons, including the update of the City's Comprehensive Integrated Waste Management Strategy (CIWMS), was put on hold by the City in 2017.

The purpose of this Organics Planning Study (Study), initiated in 2021 and completed in January 2023, is to assist the City of Winnipeg in understanding its options for the development of a Green Cart program in which RFW would be collected in green carts (i.e. Green Cart materials) and sent to a processing facility. The objectives of the Study are to build upon the information from the initial work of the 2016/2017 Organics Diversion Strategy, develop conceptual layouts and cost estimates for facilities representing the two short-listed technologies, and to review common project delivery models for an RFW processing facility in Winnipeg.

2 Green Cart Program Assumptions

For the purposes of the Study, a number of assumptions regarding a future Green Cart program were developed in collaboration with City Staff to establish the constraints for the Study. City Staff advised to include the assumption that resident participation would not be enforced through a diversion by-law requiring participation, but could be incentivized in other ways, including through bi-weekly garbage collection. Potential feedstocks would include the use of BPI-certified compostable bags to promote diversion, similar to what residents used in the RFW Pilot. Pet waste and diapers would not be considered acceptable items. Separate collection and processing of Leaf and Yard Waste (LYW) was assumed to continue for the purposes of this Study.

2.1 Collection Considerations

The original Organics Diversion Strategy considered a number of collection options including:

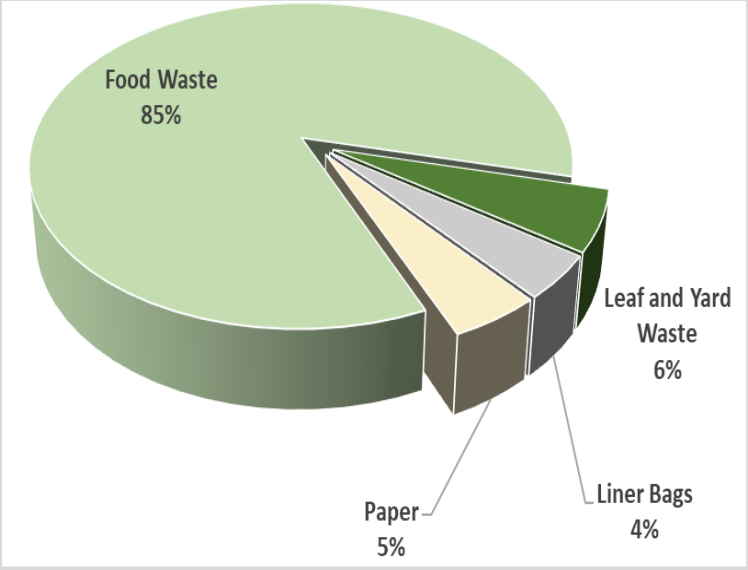
- Scenario 1 - Weekly co-collection of Black Carts and Green Carts, separate weekly collection of Blue Carts, seasonal weekly collection of LYW
- Scenario 2 - Alternating week collection of Black and Blue Carts with weekly co-collection of Green Carts, biweekly seasonal collection of LYW
- Scenario 3 - Weekly separate collection of Black, Blue and Green Carts, biweekly seasonal collection of LYW

Scenario 2 resulted in the fewest number of fleet vehicles compared to the status quo (weekly collection of Black and Blue Carts, biweekly seasonal collection of LYW). Scenario 1 had a similar number of fleet vehicles compared to the status quo and would offer efficiencies in collection (i.e. reduced transit times) if the RFW processing facility were located at the Brady Road Resource Management Facility (BRRMF). Given that the proposed timing for a facility to process RFW may not correlate with collections contracts, the City may wish to build conditions into future contracts to allow for the change to a Green Cart program.

2.2 Feedstock

The characterization of the City's Green Cart materials by weight, based on the results of the City's RFW Pilot study, is shown in Figure 1 and is comprised of approximately 85 per cent food waste (fruit and vegetable scraps, meats, bones, and dairy), six per cent LYW (placed in Green Carts and not collected separately),

Figure 1 - Composition of Feedstock Available for Composting Facility



five per cent paper (soiled paper, newspaper, kraft paper, shredded paper, and tissue/toweling), and four per cent BPI compostable liner bags.

A preliminary schedule was developed with City Staff which estimated a facility could be operational by 2033. Waste projections were developed for this timeframe using RFW Pilot data and are presented in Table 1. Based on these projections, a receiving capacity of up to 42,000 tonnes per year of residential food waste was selected for conceptual design and costing.

Table 1 - Waste Projection Estimates for Residential Food Waste (tonnes)

Year	Single Family RFW	Multi-Family & MCNR RFW	BPI-Certified Compostable Bags	Total Residential Food Waste
2033	26,106	6,446	1,432	33,983
2038	26,851	7,098	1,494	35,442
2043	27,610	7,805	1,558	36,973
2048	28,383	8,571	1,626	38,580
2053	29,171	9,400	1,697	40,268
2058	29,973	10,296	1,772	42,040

3 Technology Evaluation

The following four commonly used technologies for processing food waste in Canada were selected for evaluation with the City:

- Passive Aerobic Windrow Composting
- Covered Aerated Static Pile Composting
- In-Vessel Composting
- Anaerobic Digestion (AD)

Criteria and indicators in four categories (Environmental & Regulatory, Social, Economic, Technical) were reviewed, with weighting developed in collaboration with City Staff. Based on the evaluation, the top two technologies short-listed for conceptual design and costing for a City-owned facility were In-Vessel Composting and Covered Aerated Static Pile (CASP) composting. Since classifications of technologies and their terminology can overlap, and layouts and process flows can vary among different facilities, the following was assumed for the City-owned facilities for planning purposes:

- The conceptual CASP composting system consists of outdoor bunkers for both composting and curing, with a geotextile cover over each

bunker in the composting and curing areas. CASP composting is used at facilities located in Saskatoon (SK), Abbotsford (BC), Thorold (ON), and Vancouver (BC).

- The conceptual in-vessel composting system consists of concrete compost tunnels inside a negatively aerated building, with the composting and curing phases taking place within tunnels. In-Vessel composting is used at facilities located in Calgary (AB), Surrey (BC), Nanaimo (BC), Halifax (NS), and Ottawa (ON).

4 Conceptual Facility Location

The composting facility site (Site) designated by the City for the conceptual layouts is a triangular area located at the BRRMF at 1777 Brady Road, slightly south of the old administration building, and shown in Figure 2 in turquoise. The Site has two utility easement boundaries – a TransCanada Pipelines Ltd. easement to the north (requiring a 7 metre setback) and a Manitoba Hydro easement to the south. Water would need to be trucked in, or water service extended, as the Site does not currently have an available water source to supply the needs of a composting facility, and groundwater in the vicinity is brackish.

Figure 2 – Site Location at Brady Road Resource Management Facility



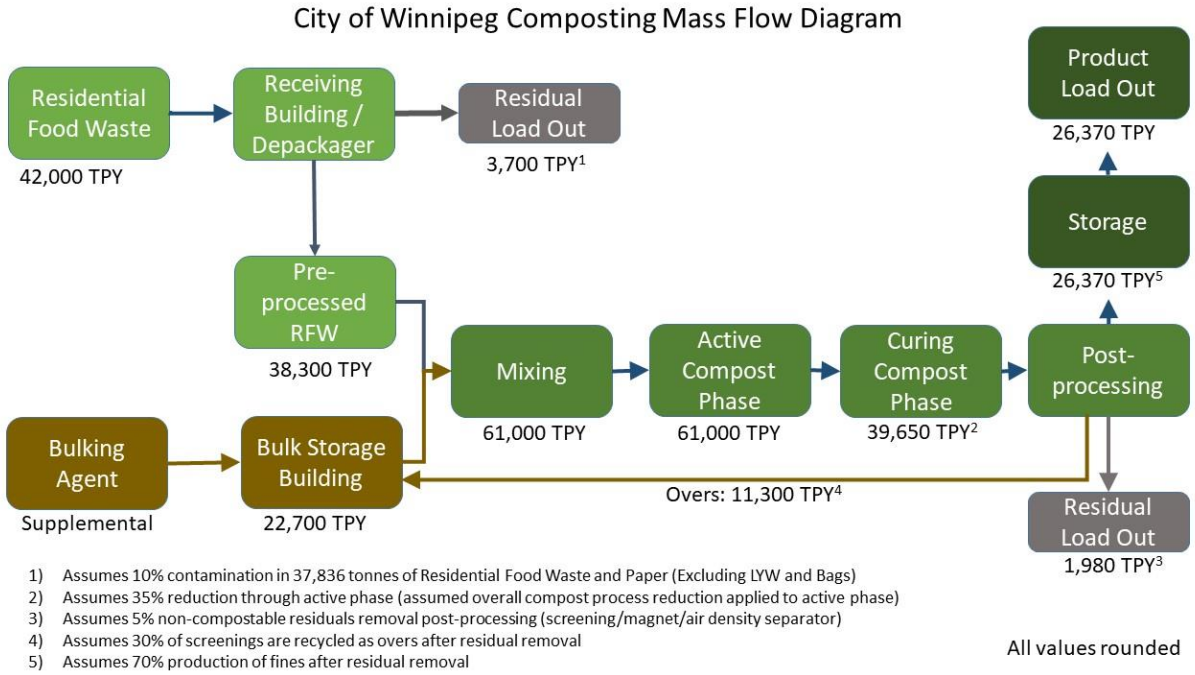
5 Facility Capacity and Flow

The conceptual composting facility is designed to accommodate a maximum receiving capacity of 42,000 tonnes of RFW per year. It is estimated that approximately 22,700 tonnes of bulking agent, such as wood chips, would be required on an annual basis to provide porosity and a carbon source for the composting process, with nearly half of the bulking agent being recycled (i.e. as “overs”, or oversized fraction) to supplement fresh bulking agent.

It is estimated that the facility would produce approximately 26,370 tonnes of compost product at its maximum receiving capacity, for a conversion rate of 41 per cent of total materials processed (RFW and bulking agent). Lower contamination rates have been observed by City Staff in the RFW Pilot, and so the City may realize lower residual rates than those used for the conceptual facilities once a program is in place.

An estimated process flow and mass balance diagram for the City’s conceptual composting facility has been provided in Figure 3, although it should be noted that process flows and operations vary among different facilities (e.g., some operators add additional screening between the composting and curing phases).

Figure 3 - Mass Flow Diagram Estimated for the Conceptual Composting Facility



6 Conceptual Layouts

The conceptual design and site layout for the CASP composting facility is presented in Figure 4, with the in-vessel composting facility site layout presented in Figure 5.

Although the processing technologies differ, each conceptual facility includes components that are similar in function and design, including a perimeter fence, administration building and parking lot, weigh scales, receiving and maintenance building, bulking agent storage building, active composting area (in-vessel tunnels or CASP bunkers), screening building (post-processing), and product storage building.

Figure 4 - CASP Conceptual Composting Facility

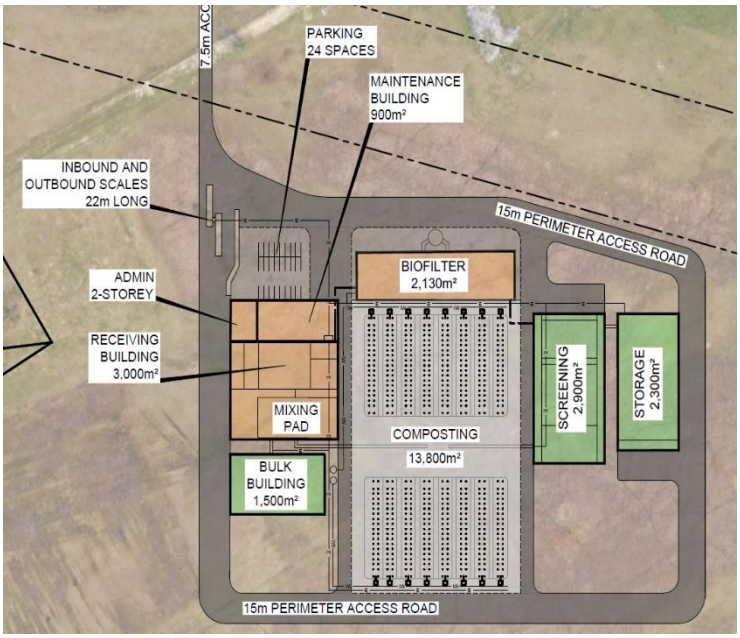
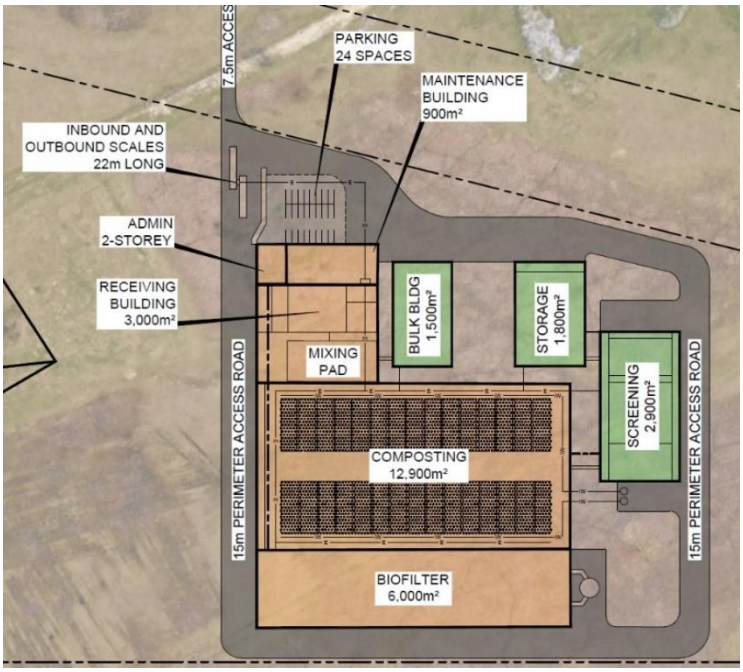


Figure 5 - In-Vessel Conceptual Composting Facility



7 Project Delivery Models

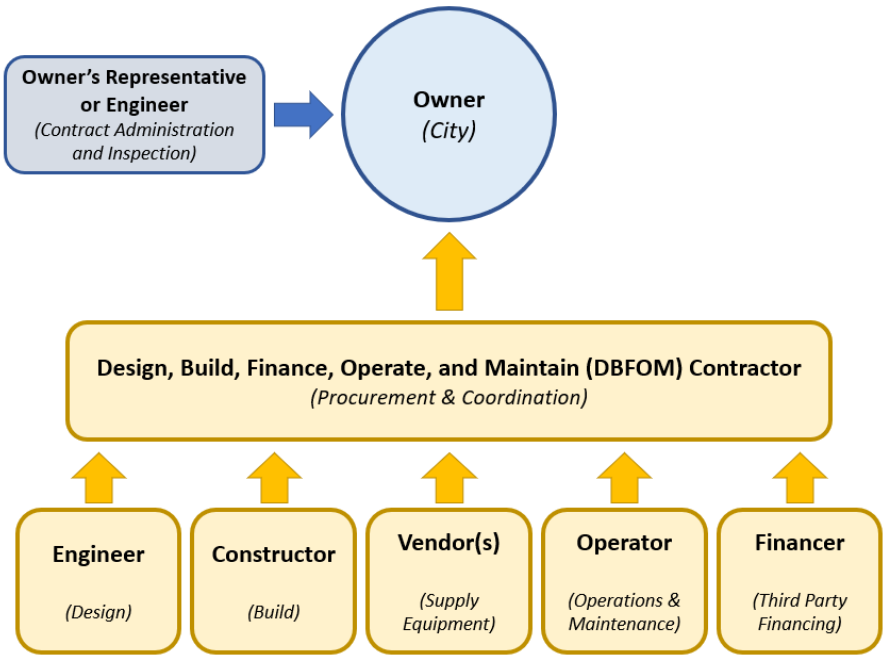
Delivery of Municipal infrastructure projects often involve partnerships with private entities by forming Public-Private partnerships. For the purposes of this study, the two Public-Private partnerships described for the City's facility include the following project delivery models:

- Design-Build-Finance-Operate-Maintain (DBFOM)
- Build-Own-Operate (BOO)

7.1 Design-Build-Finance-Operate-Maintain (DBFOM)

A DBFOM model, shown in Figure 6, would involve the City entering into a contract with a single entity, typically a consortium of businesses, to design, build, finance, operate, and maintain a composting facility that will be owned by the City. The owner (i.e. the City) defines the project requirements through a project agreement with the DBFOM contractor, which contains all contractual aspects of the design, construction, financing, and operations including performance-based guarantees, incentives, and penalties. Under common financing structures, the City would repay capital costs through a regular amortized payment, and pay operating costs through a per tonne fee. The owner's representative, or owner's engineer, oversees the design and construction on behalf of the owner, and acts as technical advisor during procurement. Examples of facilities procured under the DBFOM model include Calgary's composting facility, and Surrey's AD biofuels facility.

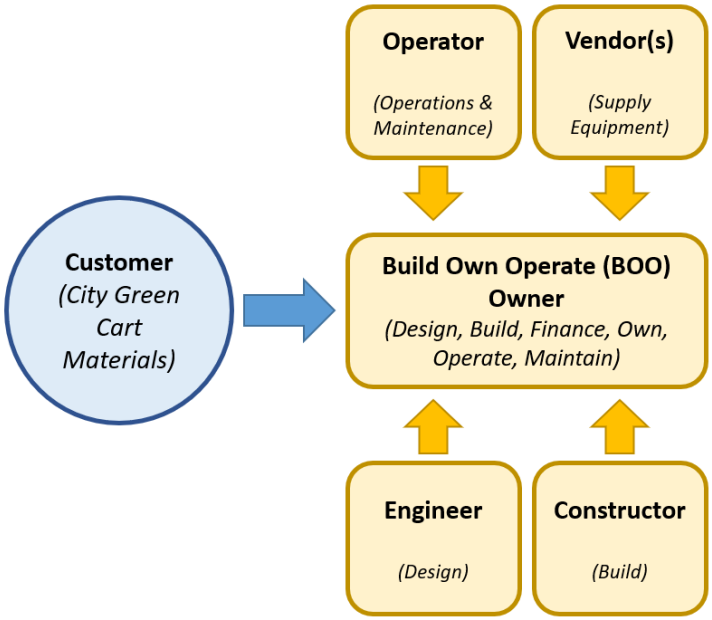
Figure 6 - DBFOM Project Delivery Model Organizational Chart



7.2 Build-Own-Operate (BOO)

A build-own-operate (BOO) project delivery model, presented in Figure 7, is a business model in which the City becomes a secured customer by entering into a long-term RFW supply agreement with a privately built, owned, and operated facility, rather than building a City-owned facility as was conceptually designed in this report. Instead of specifying a technology, the City would typically specify outcomes, with respondents proposing solutions to meet those outcomes. The private entity is free to search out feedstocks from other customers so long as it meets its contractual requirements with the City, which are specified in a service agreement for a per tonne fee with a minimum annual tonnage. Examples of facilities procured under the BOO model include Saskatoon's composting facility (currently under construction) and Winnipeg's materials recovery facility (MRF).

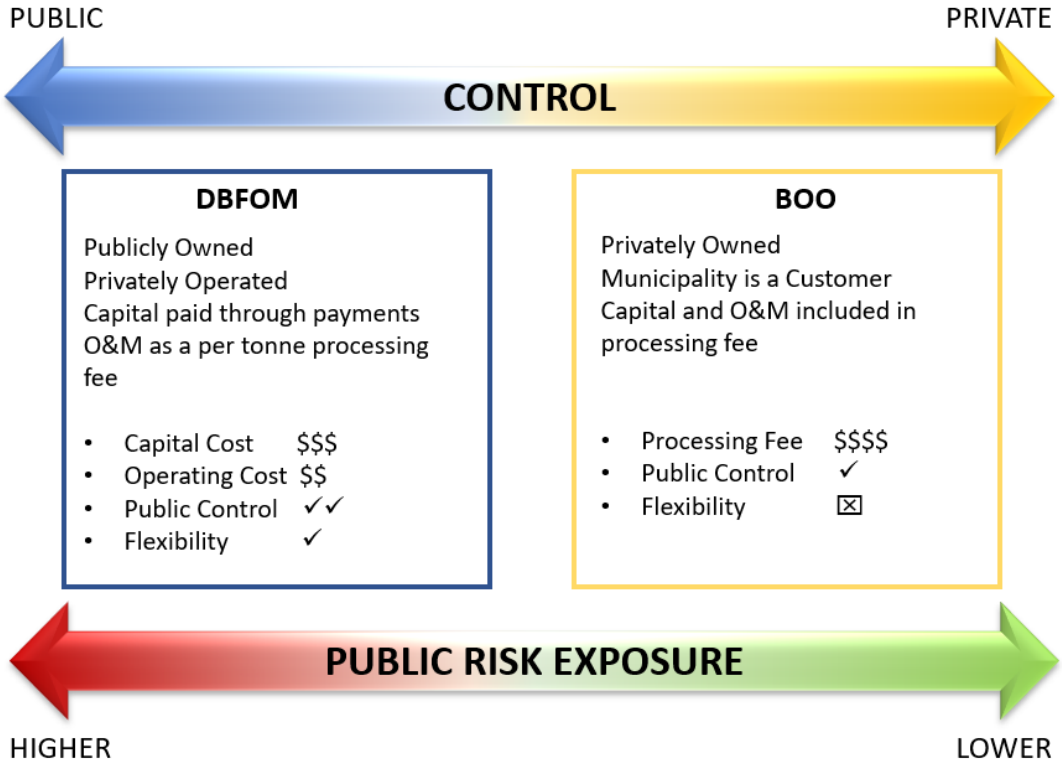
Figure 7 - BOO Project Delivery Model Organizational Chart



7.3 Risk vs Control

The selection of a project delivery decision is based on the City's desired level of control over the facility and its day to day operations, as well as the City's desired level of risk acceptance. To effectively manage risk, the party responsible for that risk must also have a degree of control. When risk is pushed to the private sector in the absence of giving control, i.e. risk off-loading, it can lead to inflated costs from the private sector in response as they assign a cost to the risk. Figure 8 shows the nuances between risk exposure and control for the two project delivery models.

Figure 8 - Risk and Control Profiles of DBFOM and BOO



8 Financial Summary

AACE Class 4 capital cost estimates for publicly owned facilities were provided by Altus Group, which include the project scope for all site work and construction for both conceptual facilities at the Site. The AACE Class 4 estimate is intended to provide a realistic budget of the hard construction costs and is not intended to predict the lowest bid.

A jurisdictional scan of publicly available information was completed of some Canadian municipalities for processing and operating costs for publicly owned and privately owned facilities. Care should be exercised when comparing costs, as the confidential terms of service and construction contracts are not publicly advertised, and what is included in these costs may not be fully understood. Further, pricing can vary based on a number of individual factors and considerations including location of the facility to other potential customers, each private vendor's business case and risk appraisal, local land and development costs, facility technology and specifications, lengths of contracts, and sizes of facilities.

Table 2 presents the estimated costs in 2022 dollars for publicly and privately owned facilities, noting that the AACE Class 4 Estimate for the publicly owned facilities has an expected accuracy range of -30 per cent to +50 per cent

accuracy. The capital costs below do not include an estimated $15.75 Million to extend water service to the BRRMF property for supplying a facility.

Table 2 - Range of Capital Costs Based on Class 4 Estimate Range

Scenario	Technology	Capital Cost Estimate	Operating/Processing Cost Estimate
Publicly Owned (DBFOM)	CASP	$ 97,420,054	$110-$135 per tonne
Publicly Owned (DBFOM)	In-Vessel	$ 148,809,092	$125 - $155 per tonne
Private (BOO)	N/A	N/A	$80 - $180 per tonne

Actual capital, operating, or processing costs for the City's facility will be dependent on a number of variables, including (but not limited to) Winnipeg's RFP and facility specifications, the intricacies of the successful proponent's solution, market conditions, the chosen project delivery model, risk allocation, and any contractual terms between the City and the successful proponent.

Potential cost offsets in the form of grants, subsidies, or reduced levies may be available to help finance an RFW processing facility in Winnipeg and include the following:

- A Made in Manitoba Climate and Green Plan –One of the potential strategies detailed in the plan to reduce organic waste in the landfill includes increasing the Waste Reduction and Recycling Support (WRARS) landfill levy and using the revenue to support compost facilities. If this strategy is enacted, any RFW that the City diverts from the landfill would not be subjected to this increased levy.
- Manitoba Composts Support Payments (MCSP)[1] – established in 2014 and funded through WRARS, the MCSP has a goal to encourage the diversion of 100,000 tonnes of organic waste from landfill each year. For a facility the size that Winnipeg would require, the City could be eligible for up to $10/tonne of diverted RFW, pending eligibility, program financial limits, and how long the Province intends to operate the MCSP program.
- Grants - Examples of some potential sources of federal and provincial funding for the City to investigate include:
  - Canada Infrastructure Bank
  - Investing in Canada Infrastructure Program
  - Green Municipal Fund

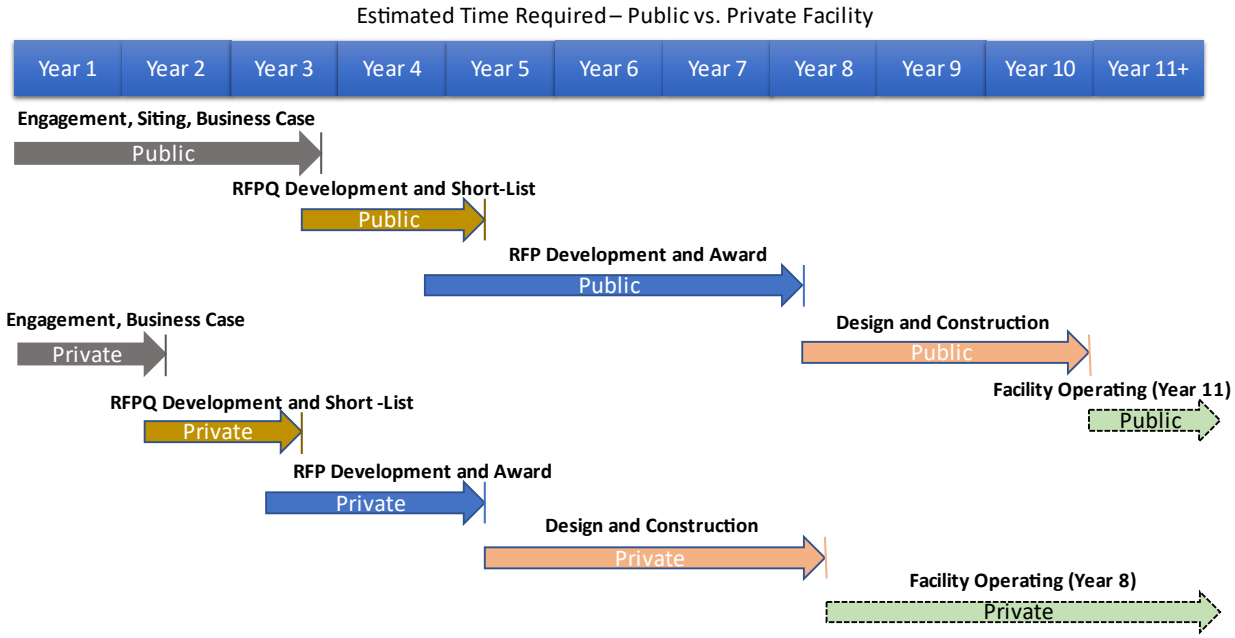
[1] https://www.gov.mb.ca/sd/wastewise/pdf/mcsp-guideline.pdf

9 Potential Schedule

Figure 9 displays the estimated schedule for both a publicly owned and privately owned facility. Timing may change based on the procurement methodology the City selects, as well as external risk factors, such as environmental approvals and supply chain availability. Overall, it is estimated that a privately owned facility could be procured more quickly than a City-owned facility due to the reduction of administration and due diligence requirements from the City, including:

- Procuring a City-owned facility would require a 30% design and Class 3 cost estimate to proceed with procurement, whereas a privately owned facility would not.
- A City-owned facility would require more effort to develop an intensive project agreement for the design, construction, and operations of the facility on City land during the RFP stage, whereas a privately owned facility would be a less-intensive, long-term RFW processing or offtake agreement.
- A City-owned facility would require more review and oversight of the design and construction, in comparison to a privately owned facility.

Figure 9 - Timeline for Facility Development



10 Greenhouse Gas Impact of RFW Diversion

According to Winnipeg's Climate Action Plan[2], waste disposal accounts for 14.9 per cent of Winnipeg's emissions, with Winnipeg's 2011 Community Greenhouse Gas Inventory and Forecast[3] attributing the majority of landfill emissions to organic waste. The City's Climate Action Plan targets advancing waste diversion and reduction initiatives as a critical part in reducing greenhouse gases (GHGs).

To view how a Green Cart program would align with the Winnipeg Climate Action Plan, GHG emissions for 25 years of diverting and composting RFW were modelled in comparison to the total landfill emissions from 25 years of disposing RFW at the BRRMF. As the City is currently reviewing the potential to upgrade landfill gas to renewable natural gas (RNG), composting was compared to two landfill scenarios: one in which the resulting landfill gas is flared, and another in which landfill gas is upgraded to RNG. Table 3 presents the results of the modelling for the three RFW management scenarios.

Table 3 - GHG Emissions from 25 Years of RFW Management

Scenario	Total Emissions from 25 years of RFW Management or Deposition (tonnes CO2eq)
Landfilling RFW and Flaring	399,719
Landfilling RFW and Generating RNG	274,955
Composting RFW	76,259

Based on the results, 25 years of composting RFW reduces total emissions by 323,460 tonnes of CO_2e in comparison to landfilling RFW and flaring the landfill gas, which is equivalent to the emissions from 99,097 passenger vehicles (3,964 cars per year for 25 years), or the consumption of approximately 138.8 million litres of gasoline.[4] Similarly, 25 years of composting RFW reduces total emissions by 198,696 tonnes of CO_2e in comparison to landfilling RFW and converting the landfill gas to RNG, which

[2] https://winnipeg.ca/sustainability/PublicEngagement/ClimateActionPlan/pdfs/WinnipegsClimateActionPlan.pdf

[3] https://www.winnipegvitalsigns.org/wp-content/uploads/Golder-and-Assoc-GHG-Report.pdf

[4] https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/calculator/ghg-calculator.cfm

is equivalent to the emissions from 60,873 passenger vehicles (2,435 vehicles per year for 25 years), or the consumption of approximately 84.6 million litres of gasoline.[15]

The results of the modelling indicate that composting RFW is the most beneficial method of the three scenarios in reducing Winnipeg's waste GHG emissions. It may be noted that the above work was modelled based on an assumed average LFG collection efficiency of 75%. If the collection efficiency at the landfill were higher than this assumption, it would decrease the landfill's emissions and reduce the difference between landfilling and composting.

11 Recommended Next Steps

The following are recommended steps to prepare the business case for the procurement of RFW processing:

1. Confirm project delivery model – DBFOM or BOO;
2. Procure an engineering technical advisor to assist the City in procuring a facility;
3. Develop a stakeholder list for consultation;
4. Confirm tonnage projections, sources and types of residential food waste, and conduct additional waste audits to confirm RFW composition;
5. Begin preliminary Site investigations to confirm the feasibility for an RFW processing facility, including siting and zoning (City-owned facility only, as a private facility would be expected to develop on their own land);
6. Develop the high-level Key Terms that will provide the strategic direction for the procurement, including minimum experience and performance requirements, eligible technologies, required outcomes, and the desired procurement methodology;
7. Explore potential funding sources (Provincial, Federal);
8. Conduct high level market sounding exercises to understand potential bidders, preferred contractual delivery methods, and available technologies.
9. Develop a risk assessment model for the project; and,
10. Finalize drafting the business case and proceed to Council for approval to procure an RFW processing facility.