1. Introduction

GHD Limited (GHD) and Ernst & Young Orenda Corporate Finance Inc. (EY) have been retained by the Regional Municipality of Durham (Region) to investigate the inclusion of mixed waste processing and organics processing of the Region's waste streams. Mixed waste processing or pre-sorting (pre-sort) of mixed waste (i.e., black bag) materials relates to processing the "black bag" waste to remove organics and recyclables. Organics processing relates to the source-separated organics (SSO) currently collected by the Region's Green Bin program and composted via a private sector operator as well as to the organic fraction of mixed waste that could be liberated from that stream via a pre-sort system.

2. Background

The Region manages municipal solid waste within its jurisdiction serving single-family (SF) residences and multi-family residential properties (multi-residential) (MR) from Pickering, Ajax, Clarington, Brock, Scugog, Uxbridge, Whitby, and Oshawa.

The Region managed approximately 233,600 tonnes of municipal solid waste in 2015, of which approximately 120,828 tonnes was diverted from disposal. The majority of the Region's waste is collected curbside with the remainder being collected at the Region's three waste management facilities (WMFs) that are open to the public. The Region's waste tonnages from 2015 relevant to the scope of the study from its curbside collection program, its WMFs, residual material from its Material Recover Facility (MRF), SSO, and leaf and yard waste are presented in Table 1.

Table 1 2015 Mixed/Residue Waste, SSO, and Leaf and Yard Waste Tonnages

Mixed/Residue Waste				SSO	Leaf and Yard Waste	
Single Family	Multi-Residential	WMFs	MRF	SF/MR	SF	WMFs
77,602	13,492	19,403	2,326	26,796	25,588	1,966

The curbside residual waste is collected and transferred through the Region's transfer station or a transfer station provided by a private contractor.

The collected SSO material is processed by a private contractor to generate a compost that meetings the current Ontario Composting Guidelines for 'AA' grade compost.

Leaf and yard waste is processed by private contractors. The leaf and yard waste collected in Ajax and Pickering is co-collected with the SSO and processed at the composting facility in Pickering.

Recyclable material is processed at the Region-owned material recovery facility (MRF), which is operated by a private contractor.

The mixed waste and residual waste from the MRFs is disposed of at the Durham York Energy Centre (DYEC), which is operated by private contractor.

The Region manages the collection of mixed waste, recyclables, SSO, and leaf and yard waste from the six lower-tier municipalities, with the exception of Whitby and Oshawa, which manage their own collection of mixed waste, SSO, and leaf and yard waste. The Region's collection services are contracted to private contractors. Waste and leaf and yard waste are collected every two weeks, while recyclables and SSO are collected weekly.

The Region also collects mixed waste, leaf and yard waste, recyclables, and other materials at its WMFs in Oshawa, Scugog, and Brock. Other materials collected include household hazardous waste (HHW), bulky goods, waste electrical and electronic equipment (WEEE), metal goods, bulky white polystyrene, used tires, agricultural bale wrap plastic signs, porcelain, drywall, and wood. The quantity of organics collected at the WMFs is low compared to that found in the mixed waste collected from the SF and MR sector. The collection of the material from the WMFs is contracted to private contractors or managed by material stewards.

Additionally, the Region has a program for the curbside collection of batteries that are processed by a private contractor.

The Region provides waste collection services and recyclables collection to approximately 24,000 MR low to medium-density units in Pickering, Ajax, Clarington, Brock, Scugog, and Uxbridge. The Region currently collects WEEE from 51 low to medium density MR units and batteries from 54 low to medium density MR units.

The Region has a conventional leaf and yard waste collection system that permits the following materials: brush and thatch, Christmas trees, fallen fruit from trees, gourds, garden trimmings, hedge and tree trimmings/branches, house and garden plants, leaves, pumpkins, and decorative corn stalks.

The Region provides SSO collection to SF and MR residences (e.g., apartments, townhouses and condominiums) in the Region. The SSO program includes the collection of a wide array of organic materials (typically food wastes and paper fibers) and allows for residents to utilize paper or compostable bags to line their SSO bins. At this point, the Region does not allow for animal waste or personal products in the SSO stream. Leaf and Yard Waste Materials Accepted

While the Region does provide collection of SSO for low-to medium density MR residences, there is no SSO collection by the Region at high-density MR residences (e.g., high-rise apartments). Given there are unique challenges in the collection of SSO form high-density MR residences based in part on the lack of infrastructure for separation of the waste stream, the MR sector considered in this Study is limited to the high-density MR residences. The Region is not considering the expansion of the SSO program to include high-density MR residences.

3. Drivers

In 2015, the Region had a diversion from disposal metric of 55 percent. This figure includes the following diverted materials that make up the majority of this diversion metric:

- Approximately 28,000 tonnes per year of leaf and yard waste sent for composting
- Approximately 27,000 tonnes per year of SSO sent for composting at a private sector-owned composting facility located in Pickering
- Approximately 49,000 tonnes per year of Blue Box recyclable material sent for processing at the Region-owned Materials Recycling Facility

Approximately 114,000 tonnes mixed waste were sent to the DYEC for thermal processing and generation of electricity in 2015. It should be noted that thermal processing in Ontario does not count towards diversion metrics, and is treated as an alternate form of disposal.

With the DYEC, the Region operates a highly integrated and unique waste management system. Effective management of organic materials and Blue Box recyclable materials coupled with final disposal that is not dependent on landfill makes the Region one of the most unique systems in Canada, as few other municipalities have access to this final disposal mechanism that produces proportionately such a high amount of energy output. In many respects, the Region's system has evolved towards a modern waste management system of a type that is common in Europe, where regulations and land limitations have sponsored highly-integrated systems, but that is rare in North America.

The above notwithstanding, there are a number of drivers being encountered by the Region that dictate moving towards completion of its integrated waste management system. Arguably, the most complex component of the system has already been developed by the Region (the DYEC); the additional components of this system are in part dictated by the Region's waste profile and existing assets, the Region's goals, and the additional drivers and opportunities generated by new legislation.

Driver #1: Capacity at the DYEC

The current capacity of the DYEC is 140,000 tonnes per year, and the asset's usage is restricted to waste from the Region and its partner, the Region of York. At this point, the Region is generating and having to deal with approximately 114,000 tonnes per year of mixed waste, which is in excess of its available capacity at the DYEC; 110,000 tonnes per year nominated for the Region with the 30,000 tonnes per year balance dispensed to the Region of York. As of the current time, the DYEC is thus at capacity and offers the Region no opportunity to manage mixed waste unless an expansion is pursued. This is particularly problematic for the Region given that Region is one of the fastest-growing population bases in Ontario. Growth expectations in the approximately 197,500 single family homes (SF) is expected to be in the 3 percent per year range in the near term, and not lower than 2 percent out to 2046. Even more pronounced, growth in the approximately 24,000 multi-family residences (MR) is expected to be over 3 percent in the near term and to increase to a maximum of 4.5 percent before stabilizing to a rate similar to the long-term projection for SF. This

essentially means that the DYEC cannot accommodate growth in the Region of Durham under its current configuration and with the current integrated waste management system in the Region.

In the current climate of Ontario, expansion of the DYEC presents a number of challenges for the Region. First, the timeline for permitting an expansion is expected to be lengthy and is uncertain. Since the DYEC's permitting and construction, there have been no further energy-from-waste (EfW) assets constructed in Ontario, and general signals from the Ministry of the Environment and Climate Change (MOECC) are that they are not supportive of this technology platform at this time. This is exemplified by the province having rescinded the EfW Standard Offer Program on September 28, 2016; this Standard Offer Program was the mechanism by which EfW projects could sell electricity at 8 cents/kWh over a long-term period. Additional reinforcement is provided by the fact that the province has deemed EfW in Ontario to be a net emitter of greenhouse gas reductions, and has for example designated the DYEC as an emitter in the context, potentially requiring the Region to apply for compliance against cap-and-trade obligations.

Of further note, an expansion of the DYEC, even pending permitting, will take time and significant capital cost. Given that the DYEC already is at capacity, this means that the Region will need to rely on landfill for a portion of its disposal into the future.

Driver #2: Diversion

As noted, the DYEC does not provide diversion from disposal in the Ontario context. The Region's current metric is 55 percent, largely built on the foundational elements of the Region's leaf and yard, SSO and Blue Box systems, as well as a number of other programs and initiatives that have been developed over time, such as the implementation of WMF's to capture additional materials. However, at this point, the Region has implemented all of the typical suite of diversion programs that could be reasonably, practically and cost-effectively be implemented for a population base of this size and configuration. The overall goal of the Region is to attain 70 percent diversion, which will be difficult/impossible to achieve using additional diversion programs or enhanced education.

Given the above, a supplemental approach for the Region is required, namely to implement a further component of its uniquely-integrated waste management system to capture additional materials in its waste stream and to return these materials to viable markets. For example, at this point, the capture rate of SSO in the Region's Green Bin program is approximately 54 percent; this suggests that a large quantity of organic material resides in the Region's mixed waste. Should this material be diverted to appropriate uses, this would increase the Region's diversion metric markedly.

Driver #3: Expiration of Existing Contracts

While the DYEC contract has just begun and the Region has processing capacity into the future at its MRF, the Region does not own or control its SSO processing asset, currently owned and operated by Miller Waste in Pickering. Given that the contract for this processing asset concludes in 2018, this creates an additional need for processing capacity, especially given that the Miller facility is reported to be at capacity. One of the foundational elements of organics processing that has occurred in Ontario over time is a relatively rapid shift from the provision of this service via merchant capacity to a model of municipal ownership or public-private-partnerships. In part, this is due to

odour and product quality performance issues in merchant capacity facilities, including short-term and long-term shut-downs all the way to permanent closures.

Given that the current SSO processing contract is expiring, the existing service provider is at capacity, and there is no other at-scale SSO processor with capacity in or near the Region, it is imperative that the Region develop or solicit processing capacity in the near future in order to continue effective and appropriate management of its SSO stream. This may include development of a new organics processing facility that is specifically intended to align with new regulations and to ensure that product quality complies with pertinent regulations. The need to develop this capacity is imminent, as the development, permitting, design, construction and commissioning life cycle of these types of projects is on the order of years (3 at absolute minimum). This emphasizes the need for action by the Region.

Driver #4: Climate Change Mitigation and Low-Carbon Economy Act

The Climate Change and Low-Carbon Economy Act, was passed in 2016 and came into full force in January 2017. Popularly known as cap-and-trade, this legislation identifies a number of large greenhouse gas emitters in the province (approximately 150 facilities in total) and levels a cap on their emissions that decreases with each subsequent year. In order to achieve compliance with the cap obligations, large emitters can reduce their own emissions, purchase allowances from other large emitters who are already beneath their cap, purchase offsets from projects that voluntarily reduce emissions, or purchase compliance by buying governmental allowances during quarterly auctions. As of March 22, 2017, the first auction of governmental allowances was fully subscribed, suggesting that large emitters will primarily utilize this mechanism for achieving compliance. The total proceeds generated were in excess of $450 million during this auction. These proceeds will now largely flow to implementing greenhouse gas (GHG) emission reduction projects.

One of the mechanisms for dispensing these funds is the Ontario Centers of Excellence, which is currently funding GHG emission reduction projects. Implementation of a project by the Region to incrementally decrease GHG emissions (i.e., by procuring additional recyclables from the mixed waste for use in the recyclables market and organics that will avoid disposal and create fertilizers) can access funds from this mechanism, and thus provides an opportunity. At this point, it is understood that the cap on funding allocation is $5 million under Ontario Centers of Excellence Target GHG fund and this may be increased over time as additional auction revenues are generated with each quarterly auction.

A further potential opportunity for the Region is to access offset credits from the implementation of a voluntary project. Harvesting incremental amounts of organics and recyclables from the Region's waste stream can conceptually generate emission reduction offsets that can then be serialized and verified, for sale into the provincial cap-and-trade system. Typically, offset credits achieve a price point just lower than governmental allowances, which traded at $18.08 per tonne of carbon dioxide equivalent in the March 22, 2017 auction. This represents, pending the release of MOECC protocols, a viable additional source of revenue to the Region to offset the cost of developing the final critical component of its integrated waste management system.

Driver #5: Waste-Free Ontario Act

The Waste-Free Ontario Act was passed in 2016 and represents the second major piece of legislation, in addition to the Climate Change Mitigation and Low-Carbon Economy Act, that has been passed by the MOECC over the last year and that has had a profound impact on waste management in Ontario. The basic components of the Waste-Free Ontario Act are that producers of waste adopt fuller responsibility for the final management of waste products. This is most directly related to, for example, Blue Box recyclable processing systems where the cost of managing recyclables was previously shared by municipalities and producers. In the new regime, this responsibility will pass entirely to the producers.

With respect to organics management, straight-line delineation of responsibility for organic materials is difficult, and thus the MOECC is pursuing a different set of policies, revolving around an Organics Action Plan. This plan is currently being developed by a set of working groups for stakeholder and general consultation in the fall of 2017. One of the mechanisms that has been noted as a possibility in the Organics Action Plan is a disposal ban on organics. This was noted in the Strategy for a Waste-Free Ontario: Building the Circular Economy, released February 2017. The possibility of a disposal bans on food waste may impact the Region as organics continues to be present in the Region's mixed waste stream as the Green Bin program capture rate is only at 54 percent of the available organics and only for the SF and the low to medium rise MR sector; the Green Bin program does not service the high-rise MR sector. It is possible that a disposal ban could be implemented by 2021; in the context of the development cycle of organic waste facilities, this is a relatively short timeframe, as executing a procurement in 2017 would result in earliest estimated deployment of capacity by the 2020 timeframe.

In the above context, continuing to send organics in mixed waste to the DYEC could not fall in alignment with the Waste-Free Ontario Act. Given that similar organics bans have been implemented in other jurisdictions (Nova Scotia, Quebec, British Columbia, New York City, Connecticut, Rhode Island, Vermont, Massachusetts and California, the precedent for this regulatory instrument is well-established in North America and represents a key driver for the Region in completing its integrated waste management system.

Drivers Summary

With respect to the drivers, a pre-sort and organics processing element achieves the following alignment:

- A mixed waste pre-sort systems that harvest organics and recyclables from the black bag will decrease the amount of materials that need to be processed by the DYEC. This preserves capacity at the DYEC for current and future volumes of waste, accommodates growth in the Region, and extends the timeline for expansion of this asset.
- A mixed waste pre-sort systems that harvest organics and recyclables that are currently being sent for disposal at the DYEC will represent incremental diversion for the Region on its road towards a 70 percent diversion goal. Mixed waste pre-sort systems are a foundational component of European integrated waste management systems because they offer proportionately large amounts of diversion from disposal at relatively low per-diverted tonne metrics. It is expected that the implementation of this type of system, which is the only viable

approach for isolating organics from mixed waste, as part of the Region's completed integrated waste management system would increase diversion towards the Region's goal.

- As the Region has an expiring organics processing contract, an investment in organics processing is necessary. The existing composting capacity provided by the private sector is reported to be at capacity and additional/new capacity is required. Per the drivers noted above, it is important to align new capacity with the provincial legislation, in order to ensure that diversion from disposal is real, which related to the quality of final organic products, and that revenue opportunities are fully leveraged (e.g., funding and revenues related to cap-and-trade).
- Mixed waste pre-sort systems can harvest incremental volumes of recyclables and organics, which can then be used to demonstrate greenhouse gas reductions and to justify funding applications or the production of greenhouse gas offsets. This results in additional revenues streams for the Region, on its road towards adding infrastructure to complete its integrated waste management system.'
- Mixed waste pre-sort systems and organics processing systems can successfully cull organics from black bag garbage, attending to the requirements that could be imposed when/if an organics disposal ban is brought into bear. Should an organics ban be implemented, the Region may need to develop this type of system to align with regulation.

The above analysis illustrates that the Region is required to develop infrastructure or solicit additional services commencing in the near-term in order to satisfy the above drivers. The implementation of mixed waste pre-sort and organics processing capacity can be viewed as a necessity for the Region as a result. The existing baseline situation does not address any of the drivers identified.

4. Organic Management System Technologies

In terms of mixed waste pre-sort and organics processing systems, there are a wide range of technologies available throughout the world. Mixed waste pre-sort systems are not common in Canada; the two main facilities in operation at a scale approaching the requirements of the Region are located in Edmonton and Halifax. Organics processing systems, particularly for SSO material, are much more common and are divided into generally two different categories of aerobic (i.e., with oxygen) and anaerobic (i.e., in the absence of oxygen).

Mixed Waste Pre-Sort

Mixed waste pre-sort systems open bagged mixed waste, remove hazardous or dangerous materials using equipment or manual sorting, and then utilize mechanical equipment to sort out organics. Once organics are removed from the stream – where these organics are those which are not currently processed by the Region as part of a diversion mechanism – the remaining waste is sent to mechanical automated equipment that can sort a variety of recyclable products: metals, aluminum, fibers, different grades of plastics, glass, etc. These commodities can then be sent into the recyclables market to reduce the use of virgin materials in manufacturing. Currently, the organic and recyclable in the mixed waste are combusted in the DYEC. The organic materials culled from the mixed waste can then be processed using organics processing technologies to create energy

and/or fertilizer products that displace more carbon-intensive commodities. The closest similarity to this technology and anything owned by the Region is the Region's MRF, although that facility is not equipped to receive mixed waste.

Organics Processing

There are two primary mechanisms of organics processing: aerobic composting or anaerobic digestion. In the simplest sense, composting is a technology that utilizes energy, in the form of airflow, to degrade organic matter into simpler humic molecules that can then be used as a solid fertilizer on land. No energy is produced in composting, and the only final product is compost; this technology can produce a narrow band of final marketable products and produces no energy. Composting is also space-intensive, as the processing elements are built horizontally and consume large spaces. Further, composting involves pushing air through organic material, which then creates substantial amounts of odorous air that then must be treated to avoid adverse effect/nuisance on neighbor. While composting has been employed successfully for decades in Ontario for SSO processing, its deployment has been reducing over the last decade in favor of anaerobic digestion.

Conversely, anaerobic digestion occurs in the absence of oxygen and thus the air required for composting is avoided. Further, organic materials breaking down in the absence of oxygen create biogas, which is rich in methane (i.e., natural gas but biologically-based), and this methane can be used to create a variety of products such as electricity, renewable natural gas for injection into the natural gas distribution system, vehicle fuel for fueling trucks and buses, and possibly for liquid fuels to supplement ethanol blend requirements. The production of a fuel product further displaces fossil-based fuels and can generate revenues as a low-carbon fuel or from cap-and-trade offsets, (this option is not available via aerobic composting, as no fuel is produced. Finally, anaerobic digestion can produce a variety of final products, including liquid fertilizer, solid fertilizer, or compost. The ability of this technology to produce diverse outputs and to align with legislation such as cap-and-trade have given rise to its steady adoption through Ontario. Of further note, anaerobic digestion is less space-intensive than aerobic composting and because it does not utilize air for processing, generally generates much less potential for odour impact. Of further note, specific types of anaerobic digestion have the ability to generate quality final organic products that can be beneficially-utilized, increasing diversion metrics.

One of the critical items regarding energy streams produced by organics processing via anaerobic digestion is soliciting and finding a market for renewable electricity, renewable natural gas, vehicle fuel, liquid fuel, etc. This is a key challenge in the current climate and a possible mitigation for this risk factor is finding a partner who is tied into the energy markets to optimize revenue streams and market access.

Application Analysis

The application of an organic management system consisting of a mixed waste pre-sort and organics processing components to supplement the Region's existing waste management infrastructure is expected to generate a number of positive outcomes, including the following:

- More than doubling the amount of organics capture compared to the Region's current baseline, adding an initial approximately 36,000 tonnes per year of organic material into the Region's diversion stream. This material will necessitate additional processing and represents a new

diversion stream. This approach will further isolate initially approximately 2,000 tonnes per year of additional recyclable materials.

- Decrease the total amount of waste sent to the DYEC to approximately 82,000 tonnes per year initially, allowing for excess capacity and growth in the Region. This defers the timeline for expansion of the DYEC.
- Provides additional possible benefits such as driving revenues from cap-and-trade funding, while positioning the Region to be in full alignment with provincial legislation that is already in place. Further, additional benefits could be driven from advanced technologies such as anaerobic digestion, which can produce energy streams that can be commoditized.

5. Business Case Assumptions and Results

The business case has been predicated on assessing organic management system scenarios in addition to the Status Quo. In the context, and as identified above, the Status Quo for the Region is not viable, as it does not address the drivers and is not considered a viable go-forward approach for the Region.

Each of the scenarios include a mixed waste pre-sort facility and transfer station to deal with mixed waste and the residual material for the organic management system process. Each scenario includes either and in-vessel aerobic composting or anaerobic digestion process. Typical costs to design and construction these types of facilities were utilize for the assessment. A further option was included to consider merchant capacity for SSO and organics from the mixed waste pre-sort system. The objective of the business case analysis is to differentiate forecasted costs between the technological solutions along with merchant capacity. Other key assumptions include:

- 20-year project date
- Mixed waste pre-sort capacity based on 160,000 tonnes per year to reflect growth over time, with various levels of recovery of metals and hard plastics and recovery of 80 percent of organics from mixed waste
- 110,000 tonnes per year of organics processing to include existing and future SSO tonnages and tonnages of organics from the mixed waste pre-sort system
- Excess capacity at the organics facility sold and excess capacity created at the DYEC as a result of reduced volumes also sold
- No revenues from cap-and-trade funding or offsets, or from high-value biogas sales from anaerobic digestion systems
- Inflation and escalation for consumables and operating costs over time, and a 5 percent discount rate
- High and low capital and operating costs for mixed waste pre-sort, in-vessel anaerobic composting and anaerobic digestion systems were taken from costs noted for constructed facilities, and merchant capacity costs were estimated

The business case illustrated the following net present cost for the Status Quo and the net preset cost ranges for the other scenarios studied:

- Status Quo: $279.4M
- Mixed waste pre-sort/in-vessel aerobic composting: $444.5M to $547.9M
- Mixed waste pre -sort/anaerobic digestion: $446.1M to $554.6M
- Mixed waste pre -sort/merchant capacity: $496.4M to $633.8M

Per the above analysis, the scenarios studied present increases in overall costs compared to the Status Quo option. As noted, Status Quo does not represent a viable option going forward, as it does not address the drivers noted.

The relative cost differences between in-vessel aerobic composting and anaerobic digestion systems are relatively modest, although it should be noted that additional revenues from biogas and greenhouse gas credits from biogas have not been considered in the analysis of the anaerobic digestion scenarios. Further, composting presents a risk factor in that composting of SSO currently presents issues for a number of processors in terms of meeting the new Ontario Compost Quality Standards; it can viably be expected that composting of organics from mixed waste pre-sort systems, where the organics are potentially contaminated by other items in mixed waste, will be more contaminated than SSO and will be more difficult to convert into acceptable final product that contributes to the Region's diversion. In contrast to aerobic composting, anaerobic digestion offers a system that can generate a number of different high-quality final products and is generally pursued where incoming organics are fairly contaminated. Generally, anaerobic digestion can offer greater potential for diversion from SSO and mixed waste pre-sort organics, generates additional revenues from biogas, and can generate additional greenhouse gas emission reduction revenues while typically operating on a smaller overall footprint (e.g., less land cost).

A particular component of anaerobic digestion is the means of accessing energy markets for biogas-derived products. At the present, there is limited opportunity for the Region to access Feed-In Tariff pricing for electricity generated from biogas due to the cancellation of the large renewables procurement process; irrespective, it is possible to undertake behind-the-meter deployments where electricity is directly supplied to large consumers, including the Region itself. Renewable natural gas (RNG) can also be a viable product, for injection into the distribution grid. While this approach directly and fully displaces a fossil fuel (i.e., natural gas), and markets are developing with ongoing upwards pricing in the RNG, the markets in Ontario and other markets that utilize RNG (e.g., California) are in flux. In order to derive the optimal benefit from these energy markets, it is recommended that the Region work with an energy partner in order to drive value from this output should anaerobic digestion be deployed.

For the merchant capacity scenario, it is noted that at the present time, there is no mixed waste pre-sort capacity of any significance in Ontario. The ability to solicit merchant capacity for mixed waste pre-sorting was thus not studied. With respect to organics processing, there is merchant capacity treatment of organics in the province, focused to SSO, but there is little excess capacity at this time. Given the implementation of potential organics bans, the available capacity is expected to be sparser over time, and merchant capacity rates are expected to increase accordingly. There is no

system currently licensed in the province to accept organics from mixed waste pre-sort systems, and the ability to solicit merchant capacity for this service is currently an uncertainty.

In terms of service delivery options, there are two primary models that have been deployed in this space:

- Design-build-operate where the Region capitalizes a facility or multiple facilities and the private sector undertakes a one-price design-build contract, and subsequently operates for a set time. This puts the burden of financing on the Region but allows the Region to control the asset from a performance standpoint, and to ensure compliance with environmental standards and final product quality. Typically, these facilities are undertaken on publicly-owned land.
- Merchant capacity where the private sector fully owns and operates the asset on private land. The Region relinquishes significant amounts of control over the asset in this configuration, and the potential for shut-downs or issues with environmental performance increase in this scenario.

It is recommended that any procurement process be an open process that allows for consideration of either service delivery model in order to drive value for the Region. Further, the procurement should be open to a variety of technology platforms, including in-vessel aerobic composting and anaerobic digestion for organics processing. Per the above, the industry trend is towards anaerobic digestion for the reasons identified, and it is expected that this technology will drive additional revenues as well as product quality. In order to maximize the value, the Region should also identify and solicit an energy partner to maximize the value of energies created from biogas.

6. Conclusions and Recommendations

Given the drivers identified, the Status Quo organics management approach is not viable for the Region. The various drivers, including increasing diversion, expiry of existing service contracts, limitations at the DYEC, and implementation of new legislation support the Region adding another component to complete its integrated waste management system that can further be enhanced by revenues related to GHG emission reductions, GHG funding, and revenues from sale of biogas-related products. Given the relative advantages of anaerobic digestion, it is expected that this technology will prevail in an open procurement over in-vessel aerobic composting technologies. The specific recommendations are:

- That the Region prioritize the implementation of a mixed waste pre-sort and organics processing system to address the important drivers identified by proceeding to next stage of this study that includes site selection permitting and procurement.
- That the procurement be open to either a design-build-operate or merchant capacity option in order to drive value for the Region
- That the procurement be open to either in-vessel aerobic composting or anaerobic digestion systems

7. Supporting Studies

The studies completed to support the conclusions and recommendations include:

- Background Research, Technical and Options Analysis Report, AD Study, Regional Municipality of Durham, GHD Ltd. June 2017
- Pre-Sort/Transfer and Organics Management, Preliminary Business Case Financial Analysis, EY and GHD. June 2017
- Pre-Sort/Transfer and Organics Management, Service Delivery Model Assessment, EY and GHD. June 2017.