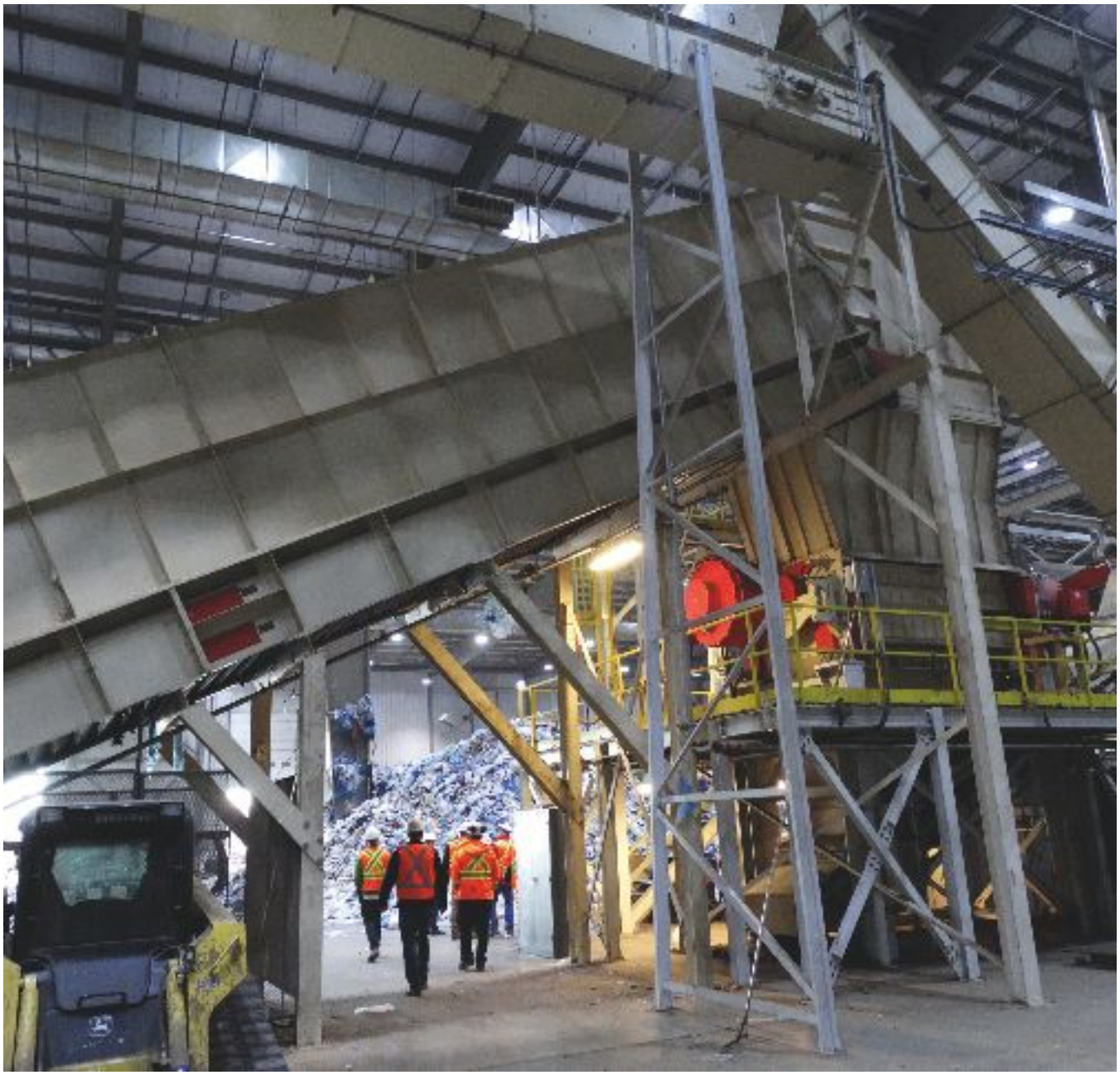
Feasibility Analysis of Mixed Waste Processing as a Means of Resource Recovery

2019 ACEC CCE Engineering Excellence Awards | Category F | Special Projects

Contents



Visiting operating facilities in Europe

Project summary

GHD Ltd. conducted a mixed-waste processing feasibility study for the Regional Municipality of Peel (Region), describing the potential for improving waste diversion under the reduce, reuse, recycle (3R) definition, while also considering the possibility of enhancing fourth R diversion through thermal conversion. **The first of its kind in Canada, the study required significant research innovation and exploration** while analyzing waste samples with different processing technologies, with the primary focus on reaching the client's 75% 3R goal.

Innovation

Recovered product loading docks

The Region's goal is to achieve 75% 3Rs and fourth R diversion to 90% from final disposal or landfill by 2034. To meet this target, we anticipate that the Region will require a combination of tactics, including the use of new 3Rs policies and programs, and possibly the deployment of a mixed-waste processing (MWP) approach to achieve additional 3Rs diversion and fourth R diversion through energy recovery.

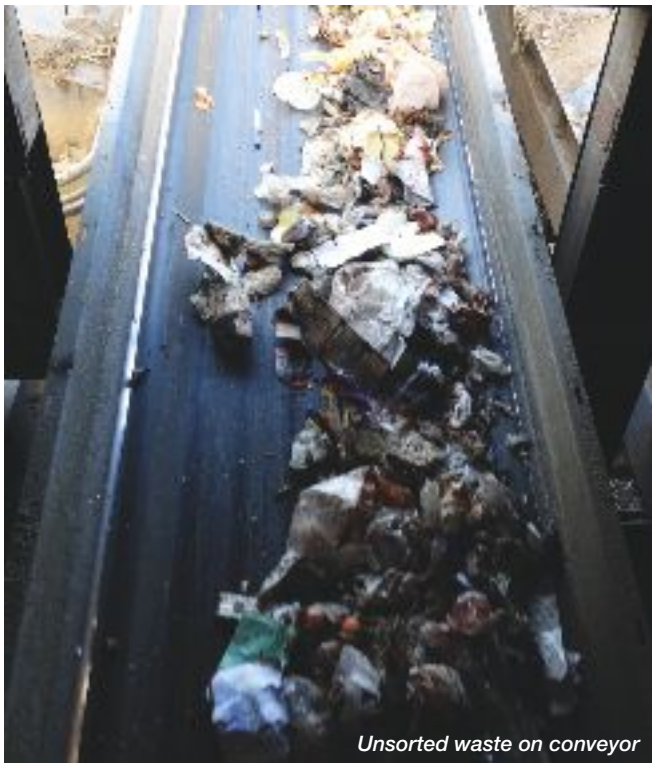
The scope of this MWP feasibility study was to investigate traditional MWP that has a biological treatment step rather than a thermal step. In this scenario, the scope was limited to systems that isolate organic materials from mixed waste and use a biological treatment step to convert them into useable final products, while also harvesting recyclables from the mixed-waste stream and converting any suitable non-recyclable or inorganic materials into a fuel stream for off-site processing.

GHD extensively studied the Region's residential garbage streams by isolating materials that fell into the above fractions, and demonstrating that such materials, if centrally sorted and processed, can produce marketable, quality products that enhance the Region's diversion metrics. This type of study is **vitally important to feasibility in determining how much material can divert from the residential garbage stream**, and to assess whether there is a risk that divertible materials in the garbage stream could contaminate by non-recyclable components that impair the quality of the divertible materials and their usability.

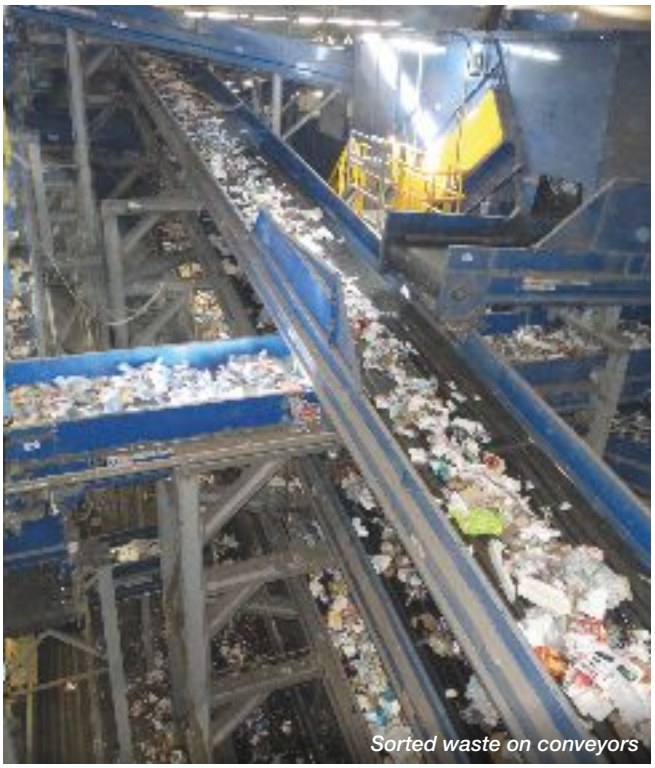
We developed **innovative engineering techniques through a MWP tonnage projection model** that estimated the 3R and 4R diversion over a 30-year period. The waste tonnage model was assessed against laboratory results and waste audits and overlaid with a jurisdictional scan pertaining to findings regarding MWP capture rates and performance metrics. The assessment also included an analysis of existing MWP plants and their ability to isolate and beneficially use recyclables and organics against local regulations.

The study is distinguishable because the model assessed a set of bounds for likely outcomes and scenarios of MWP trials, as well as what MWP can realistically produce in terms of achieving 3R and 4R targets. The model also assessed possible outcomes for mixed-waste processing based on the Region's garbage streams, accounting for changes in the garbage streams as source separated organics stream and other programmatic changes progress.

Sorted waste ready for next step in processing



Unsorted waste on conveyor



Sorted waste on conveyors

Complexity

This project had three inter-connected areas of complexity, as follows:

1. The model is **the first of its kind to be developed to analyze deployment of MWP in Canada**, based on waste stream characteristics and the regulatory environment. It involved raw research by analyzing waste samples, which modelled with different processing technologies and required significant research, innovation, and exploration. GHD sorted different waste streams and analyzed by size, material type, and quality to understand the impact of MWP on the Region's specific waste stream and diversion metrics.

2. The beneficial use of organics separated from mixed waste are currently unregulated by the Province in relation to land application and reuse requirements. We analyzed the waste stream's quality data to compare and understand the differences between source-separated organics and organics recovered through MWP. We shared this data with regulatory authorities and began discussions on how this organic material fits within the Ontario regulations.

3. Markets for alternative low-carbon fuels are still under development in Ontario. GHD **analyzed the waste stream extensively to understand the quality and composition** of the materials and their use in creating a marketable fuel desired by industry.

Social benefits

The objective of this study was to isolate materials that fall into the categories of organics, recyclables, and materials that can be used as fuels to demonstrate that such materials, if centrally-sorted and processed, can **produce quality products that are marketable and that can serve to enhance the Region's diversion metrics**. Since the majority of waste in Canada is landfilled, MWP is a real solution for increasing diversion, as existing source separation programs are not achieving complete segregation at curb. MWP is an important approach to helping recover more recyclables and organics from the waste stream. This study analyzed the waste stream to determine which diversion targets are achievable and what it will cost to achieve those targets. It was the formative step for putting together information to deploy this technology, which will drive greater diversion and sustainability for the residents of the Region. GHD's cutting-edge technology may serve as a model for other municipalities and demonstrate the Region's leadership in the field of waste and beneficial reuse.

In terms of economic benefits, the Region has no landfill and is purely subject to disposal costs established by others. The ability to minimize waste going to disposal at sites controlled by others is a benefit. Creating revenues from the products they reclaim from the waste generates a new economic benefit. **From an economic standpoint, MWP is a forward-looking approach that will generate economic returns over the long term, while also creating environmental and social benefits.**

Solid combustible fuel derived from solid waste

Environmental benefits

There are four key environmental benefits to the implementation of MWP, as follows:

1. The key environmental benefit of MWP is the increased diversion of waste from landfill. The data overall suggests that MWP as an approach can achieve significant contributions of additional diversion for the Region; most of this diversion is predicated on the ability to isolate and anaerobically process organics for the production of a beneficially usable product. Diversion of organics and recyclables can generate upwards of 40% diversion of the residential garbage stream.

2. Environmental benefits such as greenhouse gas reductions flow from the ability to divert materials from disposal in landfill, and the ability to create products that displace other conventional forms of matter or energy. Greenhouse gas emissions reductions of over 1-million tonnes of carbon dioxide equivalent are achievable through recovery of organics and recyclables from mixed waste. These emission reductions can accrue to the Region's internal goals and objectives with respect to greenhouse-gas emission reductions.

3. Recovery of the organic material from the waste stream reclaims nutrients that would otherwise be lost forever in a landfill. These nutrients are reusable, replacing some production of fertilizer.

4. Recovery of recyclables and integrating these recyclables into the reuse chain diverts the production of virgin material.

Recyclable plastics recovered from mixed-waste

Recyclable cardboard recovered from mixed-waste

Meeting client's needs

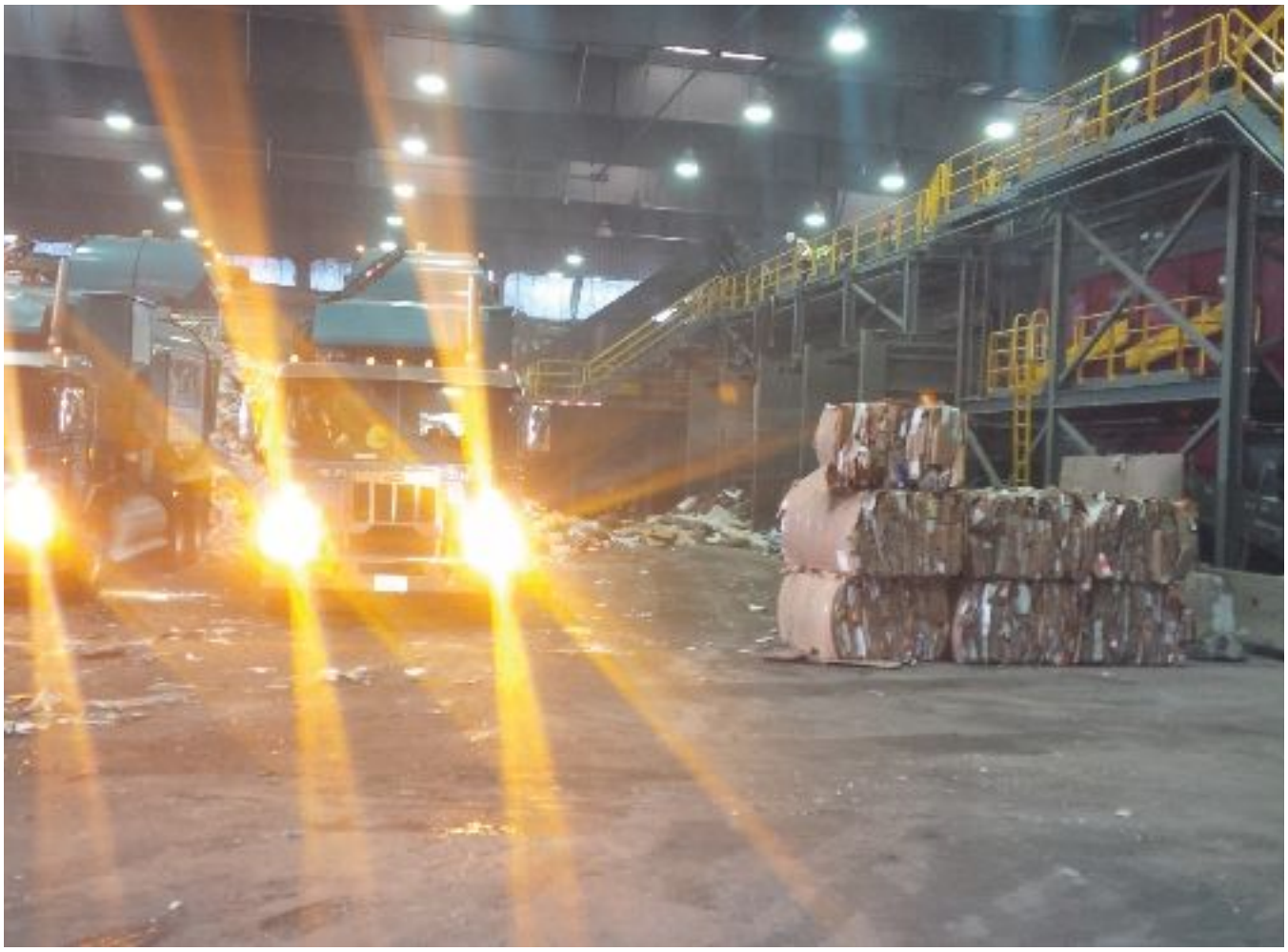
The Region retained GHD to **determine the potential for improving waste diversion under the 3Rs definition** (Reduce, Reuse, Recycle) while also considering the possibility of enhancing fourth R diversion (through thermal conversion).

The Region's goal is to achieve 75% 3Rs and fourth R diversion to 90% from final disposal or landfill by 2034. To meet this target, GHD's study and consulting work provided the Region with a combination of tactics, including the use of new 3Rs policies and programs, and the deployment of a mixed-waste processing approach to achieve additional 3Rs diversion and fourth R diversion through energy recovery.

Through in-depth analysis and modeling, GHD's MWP study accomplished the Region's goals by recommending:

- waste processing approaches or systems that have been successful in other jurisdictions;
- how to recover materials for recycling; and the most promising approaches to achieve the Region's residential garbage streams at both curbside and multi-residential levels;
- how to recover organics for eventual beneficial use; and the most promising approaches achievable with the Region's residential garbage streams; and
- options for recovering marketable alternative low-carbon fuel products from the Region's waste streams.

Hand sort station to maximize recovery



Waste reception and sorting hall

> Through in-depth analysis and modeling, GHD's MWP study accomplished the Region's goals.

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