Better Together

How a Deposit Return System Will Complement Ontario's Blue Box Program and Enhance the Circular Economy

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Prepared for: Clarissa Morawski, Reloop

Prepared by Sarah Edwards, Sydnee Grushack, Laurence Elliot, Jade Kelly, Daniel Card

Approved by

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Sarah Edwards

Eunomia Research & Consulting Inc.
33 Nassau Ave.
Brooklyn, NY
11222

Tel: +1-646-256-6792

Web: www.eunomia-inc.com

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Foreword

Ontario is facing a pivotal moment – to decide how to tackle the growing waste crisis facing the globe. Litter is soiling our streets and plastic is overwhelming our lakes and seas.

In an effort to combat these issues, more and more jurisdictions are turning to deposit return systems for the recovery of beverage containers. These systems have proven to be the most effective at reducing litter and increasing closed loop recycling. Yet, they often face opposition from various stakeholders.

For decades, the most vocal opponents of deposit programs have cited the high cost of such programs. Another common argument is that deposit systems will take the value out of curbside recycling systems and make them economically unsustainable.

This report proposes a detailed design of a deposit return system for non-alcoholic beverages that is cost effective and can work alongside the Blue Box program to enhance recycling across the province. This model, designed especially for Ontario, can help to dispel some of the misconceptions around deposit programs and illustrate the complementary nature of a deposit program within the existing Ontario landscape.

Reloop's vision is a world where resources remain resources and where they create jobs in a circular economy. A world where we prioritize waste prevention, advocate reuse, and promote closed-loop recycling, while incineration, landfill, and littering are minimized and ultimately eliminated.

Deposit return systems help to fulfil this vision, and to facilitate the shift toward a circular economy. Additionally, they provide benefits across the triple bottom line – for people, for profit and for the planet. I look forward to sharing this report with you and to pursuing a cleaner and healthier future for all Ontarians.

Clarissa Morawski

Managing Director, Reloop

Executive Summary

Ontario has long been a global leader in waste and recycling programs. In 1981, it became the birthplace of the first established curbside recycling program in the world, which became known as the Blue Box Program.[1] The Blue Box Program boasts a 62.4% recycling rate however, this is propped up by consistently high recycling rates for printed paper (80%) and corrugated cardboard (98%). Conversely, recycling rates for non-alcoholic beverage containers are falling; they were only 45% in 2016, down from 56% in 2012.[2]

At the same time, the government of Ontario has taken great strides towards a more sustainable future with the passage of the *Resource Recovery and Circular Economy Act 2016* (*RRCEA*). The *RRCEA* creates the legislative framework for an extended producer responsibility (EPR) model that puts the financial responsibility for collecting and managing materials on individual producers. [3]

In March 2019, Ontario released its *Reducing Litter and Waste in Our Communities: Discussion Paper*, in which the Province states that it is, "committed to make producers responsible for the waste generated from their products and packaging, and to outline actions to explore how to recover the value of resources in waste, provide clear rules for compostable products and packaging, and support competitive and sustainable end-markets for Ontario's waste."[4]

This resource recovery focus is aligned with the shift away from a traditional linear cradle-to-grave system for products towards a circular economy – one in which products are no longer created and disposed of without regard for the waste they create. The circular economy is in part a response to the problems associated with the mass production and consumption of single-use items, with products designed for greater durability, recyclability and incorporating recycled content.

EPR employs collection mechanisms such as container deposit return systems (DRS), that collect clean, high quality, recyclable material and also protect communities from the impact of global markets that they cannot control. China's National Sword policy, which

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[1] Stewardship Ontario. "The Story of Ontario's Blue Box." <http://stewardshipontario.ca/wp-content/uploads/2013/02/Blue-Box-History-eBook-FINAL-022513.pdf>

[2] 2018 PIM data for 2016. https://stewardshipontario.ca/stewards-bluebox/fees-and-payments/fee-setting-flow-chart/the-pay-in-model/

[3] Waste Free Ontario Act, 2016. <https://www.ontario.ca/laws/statute/S16012>

[4] Ontario Ministry of the Environment, Conservation and Parks. "Reducing Litter and Waste in Our Communities: Discussion Paper." <https://prod-environmental-registry.s3.amazonaws.com/2019-03/Reducing%20Litter%20and%20Waste%20in%20Our%20Communities%20Discussion%20Paper_0.pdf>

placed strict restrictions on imports of recyclable material based on quality, is the latest reminder of the need to minimize contamination. Because of its high quality, DRS material – unlike the outputs from typical single stream programs – is a desired commodity in domestic markets.[5]

One of the pressing challenges facing this generation is reducing the current leakage of plastic into the environment. More than 10,000 tonnes of plastic end up in the Great Lakes every year, eventually breaking down into microscopic pieces which have been shown to end up in our seafood and drinking water, posing potential risks for human health.[6,7] It is estimated that beverage containers account for approximately 40% of litter by volume[8], and according to the 2016 Toronto Litter Audit, PET beverage bottles alone accounted for 15.4% (by weight) of all the large recyclable litter surveyed around the city.[9]

DRSs provide a mechanism for effectively capturing beverage containers to reduce litter and produce a high-quality material to feed into Ontario's circular economy. Ontario already has a DRS in place for alcoholic beverages, operated by The Beer Store, which achieved an 81% return rate in 2018. Ontarians almost universally (91%) support the expansion of deposit return to non-alcoholic beverage containers.[10] All other Canadian provinces, except for Manitoba, have a deposit system for non-alcoholic beverages. Figure E-1 compares the recycling performance for non-alcoholic beverage containers in Ontario compared to other Canadian provinces.

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[5] Seldman, Neil. "Recycling is Crashing? Far from It." *Governing*. August 20, 2018. <http://www.governing.com/gov-institute/voices/col-recycling-survival-china-restrictions.html>

[6] Alliance for the Great Lakes. "Great Lakes Plastic Pollution." < https://greatlakes.org/great-lakes-plastic-pollution-fighting-for-plastic-free-water/>

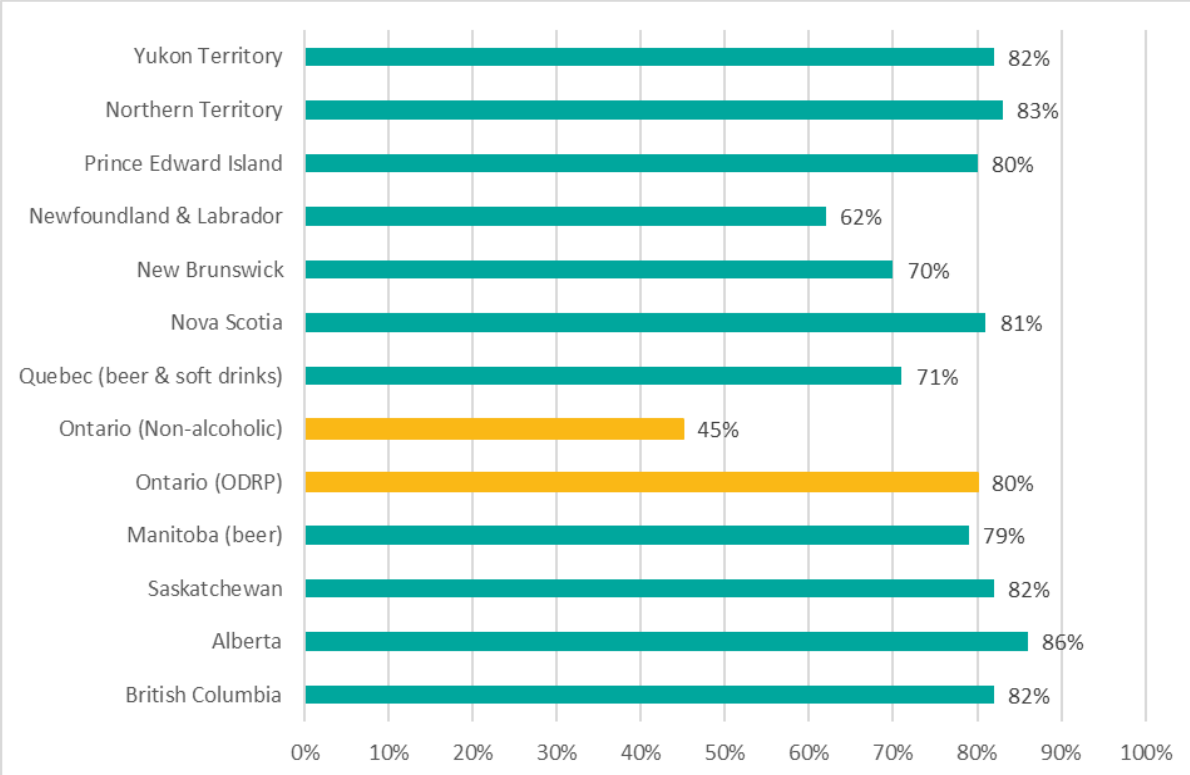
[7] Smith, Madeline; Love, David; Rochman, Chelsea; and Neff, Roni. "Microplastics in Seafood and the Implications for Human Health. "Current *Environmental Health Reports.* August 16, 2018. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6132564/>

[8] Eunomia. (2017) Impacts of a Deposit Refund System for One-way Beverage Packaging on Local Authority Waste Services. 11th October 2017

[9] AET Group, Inc. "2016 Toronto Litter Audit." October 27, 2016. < https://www.toronto.ca/wp-content/uploads/2017/10/8ed5-Toronto-Litter-2016-Final-Report_App_Final.pdf>

[10] On behalf of Environmental Defence (ED), the Gandalf Group conducted a survey among 800 Ontarians to assess support for a Deposit Return Program for plastic bottles and programs to protect waterways from agricultural run-off. Online interviews were completed between March 4th and 7th, 2016. A probability sample of this size yields a margin of error of +/- 3.5%, 19 times out of 20. Data is weighted to represent the gender, age, and regional distribution of the province.

Figure E-1: Provincial Recycling Rates for Non-refillable Containers



Source: CM Consulting "Who Pays What," 2018.

British Columbia applies EPR to two complimentary collection systems including a producer operated and financed curbside collection system for packaging and printed paper (PPP) and to DRS. British Columbia recognizes that achieving a high recycling rate for beverage containers requires the specific economic incentives inherent to a deposit system.

In March 2019, the European Commission passed a Single-Use Plastics Directive that mandates the collection of 90% of plastic bottles by member states over the next decade.[11] With the passage of the *RRCEA*, Ontario is poised to move in the same direction. Ontarians need a mechanism that will enable them to easily recycle beverage containers in order to divert as much waste as possible and facilitate a circular economy.

This report provides an Ontario-specific cost benefit analysis of operating a DRS for non-alcoholic beverage containers. It will establish the complementary nature of operating a DRS for non-alcoholic beverage containers alongside the province's existing curbside Blue Box

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[11] Zoete, Tom. "EU agrees on single-use plastics Directive." *Recycling Network*. December 19, 2018. <https://recyclingnetwerk.org/2018/12/19/europe-has-reached-an-agreement-on-the-single-use-plastics-directive/>

and DRS for alcoholic beverage containers, with serious consideration given to the impact of the new program on viability of the existing programs. The study examined the costs and impacts of the proposed program as well as detailing the likely environmental, social, and economic benefits that can be delivered.

E.1.0 Deposit Return System

The proposed DRS for non-alcoholic beverage containers has been modelled to operate alongside the existing Ontario Deposit Return Program (ODRP) or alcoholic beverage containers, and in partnership with a producer operated Blue Box system. The system takes best practices from high performing, low cost systems from across the world to achieve return rates in excess of 90%, reduce waste to landfill and litter, and guarantee quality recycling.

In order to achieve this outcome, the system needs to be designed to meet the following conditions:

- **Targeted:** A 90% recycling rate for used beverage containers;
- **Engaging Incentive:** The deposit set at a level that will incentivise consumers to return, assessed as being $0.15 for non-alcoholic beverages in Ontario.
- **Convenient:** A return network that is sufficient in number and location to enable consumers to return empty containers as part of their every day activities. Redemption must be as easy as purchasing;
- **Comprehensive**: All beverage types to be included, preventing free riders and making the program simple for consumers to understand;
- **Accountable:** The latest information technology is deployed to ensure the accurate capture of return rates, to allow correct payments and to mitigate fraud;
- **Flexible:** Producers have the control to put in place the most cost-efficient system to meet the 90% target.

DRSs that consistently achieve high redemption rates (in excess of 80%) at low cost (somewhere between $0.01 and $0.02 per container sold), have similar characteristics, including:

1) **Governance**: Legislation that is not overly prescriptive on process, with the focus on outcomes. Specifically:
    a. Setting and enforcing a recycling target;
    b. Establishing the need for continuous improvement by putting in place mechanisms to adjust the level of deposit if recycling targets are not being achieved for an agreed-upon number of consecutive years and ensuring that that consumers can conveniently redeem containers; and

    c. Establishing the responsibilities of government to include audit, oversight and enforcement.

    The fewer details that are in the legislation, the more flexibility producers have to react to factors that affect achievement of program goals.

2) **Management**: Those parties responsible for the supply and, in some cases, sale of beverages (essentially producers, distributors and retailers) are given the shared responsibility for meeting the requirements of the legislation through a collaborative administrative approach and free market driven operational delivery, ensuring cost efficiency and compliance. This includes:
    a. Putting in place a producer responsibility organization (PRO) to oversee the system;
    b. Procurement and commissioning of services that:
        i. Deliver redemption infrastructure and options to ensure consumers can conveniently redeem;
        ii. Offer technology driven solutions that drive efficiencies in respect to transport and provide transparent and accurate data;
        iii. Optimize costs through a market-driven approach to infrastructure and fees.
3) **Delivery:** Organizations appointed through the PRO, given the responsibility for operational delivery and required to report through Performance Management Indicators to demonstrate achievement of, and compliance with program financial, legal, environmental and social goals.

E.1.1 DRS Design

E.1.1.1 Producer Responsibility Organization (PRO)

Responsibility for success of the program lies primarily with the producers. A management board consisting of representatives from producers, retailers or other responsible parties appoints a not-for-profit PRO. The PRO is responsible for:

- The operational aspects of discharging producers' responsibilities under law;
- Procurement and commissioning of services such as the transport of containers from redemption locations to counting houses, and provision of reverse vending machines (RVMs);
- Demonstrating that mandatory recycling targets are met on behalf of their members;
- Delivering cost efficiency; and
- Putting in place measures to mitigate fraud

The PRO handles the incoming revenue from sold material, all unclaimed deposits, and outflow of payments to any appointed operators of the system. It determines the level of producer administration fee necessary to ensure cost coverage.

A system managed by and paid for by industry reduces the likelihood of free-riders; the industry is self-policing in this respect with all producers paying their share into the system. There will also be greater focus on mechanisms to reduce fraud and ensure accurate accounting.

E.1.1.2 Infrastructure

The infrastructure network is critical in ensuring redemption is convenient, the return rates are accurately calculated and as such the program has the required impact.

The proposed mechanisms for redemption and container verification in Ontario combine those seen in high performing jurisdictions, including Norway and Oregon, and include four redemption options for consumers, as described in Table E-1. The redemption infrastructure allows for consumers to redeem small quantities whilst they shop or in bulk, as well as offering facilities for commercial businesses collecting from the hospitality sector. The redemption channels have been modelled to ensure adequate geographic coverage across the province to enable all Ontarians to be adequately served.

Table E-1: Ontario DRS Infrastructure Summary

Infrastructure	Description	Number of Locations
Consolidation and Counting Centres	Count and verify all containers that are not redeemed through reverse vending machines (RVM), as RVM verify containers at the point of redemption. Also carry out some processing of material, such as baling. Counting and verifying all containers helps identify fraudulent activity and ensures payment is only made on eligible containers, reducing overall system cost. The entire process is automated.	3
Retail Stores, Manual Collection	Any retailer that sells a deposit-initiated beverage can opt-in to redeem and collect empty containers and return the deposit to the consumer. Retailers who don't sell deposit initiated non-alcoholic beverages but do sell deposit bearing alcoholic beverages may also wish to opt-in.	1,356
Retail Stores, Automated Collection (Reverse Vending Machines (RVMs))	Most larger retail stores would install RVMs to automate the process of redeeming containers by consumers.	1,241

Infrastructure	Description	Number of Locations
Dedicated Redemption Centres (Depots)	These centres, often situated in retail spaces or warehouses on the outskirts of a town, are privately owned businesses established solely for redeeming deposit containers. Would be used primarily by industrial, commercial and institutional (IC&I) redeemers plus haulers that collect from the hospitality sector for example.	58
Bag Drops	Consumers drop off bags of recyclables to unstaffed, standalone outlets and receive credit to their accounts once containers are verified.	240
Total	Total number of redemption points modelled in this analysis	2,895[12]

Source: Eunomia calculations

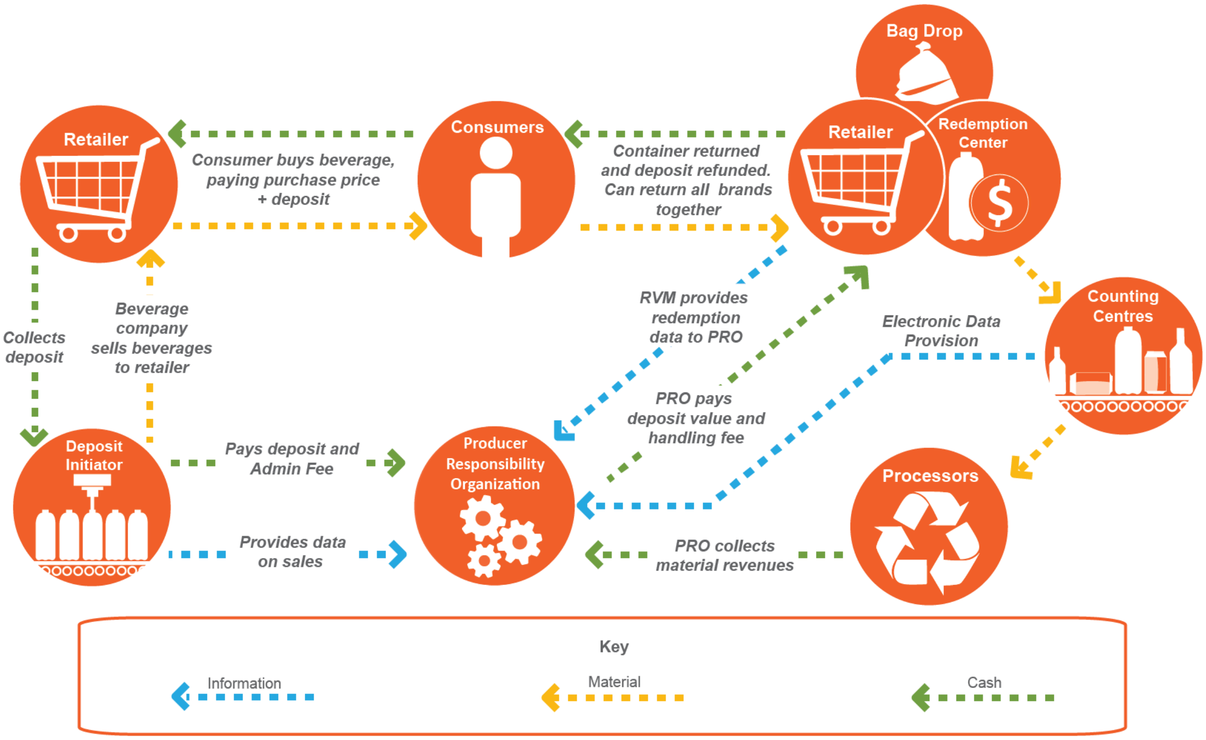
In order to achieve the modelled target of 90% redemption, recycling rates for all covered containers need to increase from current rates. Setting the recycling target prior to the development of the infrastructure allows the market to determine the most efficient distribution of redemption methods across the province in order to capture the deposit material most effectively within varying geographic and demographic zones. Regional counting centres are then established to count and verify containers from all redemption methods.

E.1.1.3 DRS Design Summary

The diagram in Figure E-1 illustrates the program's operation, financial flows and transfer of information. The system design is typical of most DRSs in Canada; the deposit is paid by the retailers to the producers and by the consumers to the retailers when purchasing beverages. After consumption, the consumer returns the empty beverage container through one of the redemption routes and is refunded the deposit. The producer/PRO refunds the redemption infrastructure provider for the deposit and pays a handling fee to compensate their costs.

[12] Counting centres are not redemption points, but secondary locations for counting and sorting materials.

Figure E-1: Proposed Material and Financial Flows in Ontario's DRS for Non-Alcoholic Beverage Containers



E.1.2 DRS Program Costs

The calculated cost to operate a DRS for non-alcoholic beverage containers in Ontario, based on the design outlined in Section 4.0, is summarized in Table E-2 and equates to $0.0091 per container.

Table E-2: Costs for DRS for Non-Alcoholic Beverages

	Total Cost ($M)	Cost per Container Redeemed (cents)
Producer Responsibility Organization	9.73	0.26
Handling Fees - Retailers, Redemption Centres, Bag Drops	93.96	2.49
Transport Costs	44.89	1.19
Counting Centre Costs	12.38	0.33
Materials Income	-63.35	-1.68

	Total Cost ($M)	Cost per Container Redeemed (cents)
Unclaimed Deposits	-68.81	-1.82
Fraudulently Claimed Deposits	5.67	0.15
Net Cost (Producer Administration Fee)	**34.48**	**0.91**

Source: Eunomia Calculations

E.2.0 Existing Recycling Infrastructure

E.2.1 Curbside

A DRS for non-alcoholic beverages removes material from both the Blue Box and the residual waste stream. This presents three main opportunities:

1) The potential to reduce curbside recycling and residual collection frequencies;
2) The potential to capture additional quantities of other packaging material that currently have low capture rates such as HDPE and boxboard; and
3) The potential to reduce processing costs.

The draft amended BBPP, released in December 2017, acknowledged the potential to reduce collection frequencies in creating a more efficient system. A collection frequency reduction for Blue Box and residual waste services, combined with movement of material from the Blue Box to the DRS results in an estimated curbside collection cost saving of $47.35M.

A growth in curbside food waste collection programs, required to deliver on the 2018 *Food and Organic Waste Policy Statement* commitments,[13] will significantly reduce the quantity of residual waste supporting a move to every other week collections. Food waste collection programs have also been shown to lead to an increase in the capture of dry recycling when introduced, further supporting increased capture of Blue Box material.

Further collection cost reductions could be possible through route optimization based on operating uniform services across municipalities. These potential savings have not been included in the analysis.

[13] Minister of the Environment and Climate Change. “Food and Organic Waste Policy Statement.” <https://www.ontario.ca/page/food-and-organic-waste-policy-statement#section-3>

The impact of the change in material flow and reduced frequency of curbside collections is highlighted in Table E-3. The loss of revenue associated with the movement of beverage containers from the Blue Box to the DRS is offset by reduced collection, treatment, transfer, and disposal costs.

Table E-3: Impact of Proposed DRS on Treatment, Transfer and Disposal Costs Associated with PPP

Activity	Cost of Current Service ($M)	Cost of Future Service (with move to bi-weekly curbside) ($M)	Change ($M)
Cost of recycling collection	186.17	156.80	-29.36
Cost of recycling treatment	115.41	112.55	-2.85
Cost of transfer (recycling only)	27.02	26.35	-0.67
Other costs (promotions, administration of Blue Box etc.)	25.76	25.12	-0.64
Material revenue	-96.37	-94.15	2.22
Cost of residual collection (% of costs associated with PPP[14])[15]	24.60	15.90	-8.70
Cost of residual disposal (% of total cost associated with PPP)	30.36	23.01	-7.36
Curbside Subtotal	***312.94***	***265.59***	***-47.35***

Source: Eunomia calculation using 2016 BB Cost & Revenue Report

E.2.2 Ontario Deposit Return Program

The existing deposit return system for alcoholic containers is performing well at 87% redemption – which makes it among the highest performing deposit return systems in the world. The proposed system is designed to complement the existing deposit system by targeting non-alcoholic beverage containers to increase the overall recycling rate. This

[14] Assumes 17% of residual waste is PPP under the current program and this is reduced to 13.45% under future program

[15] Producers do not always cover the costs associated with residual collection, but under a true EPR system, producers are responsible for all packaging placed on the market, regardless of final destination.

complementary system would expand the number of redemption opportunities to include retail stores and bag drop locations to make redemption as convenient as purchasing in the first place.

The ODRP program has an existing network of convenient redemption locations and established logistics and management system. This study does not analyze or calculate the implications of possible partnerships between both systems for instance in respect to sharing redemption infrastructure and transportation. This could be modelled to assess further potential efficiencies.

E.3.0 System Benefits

E.3.1 Financial

Table E-4 summarizes the cost of the current system (Blue Box only) versus that of operating a DRS for non-alcoholic beverages in addition to an optimized Blue Box system and shows a decrease in costs of approximately $12.87M. Table E-5 sets out the cost per tonne of material recycled, which falls from $313.93 to $269.26.

Table E-4: Overall Cost of Current vs Future Programs

Service Area	Cost of Current Service ($M)	Cost of Future Service (with move to every other week curbside collection) ($M)	Change ($M)
Curbside	312.94	265.59	-47.35
DRS – Non-Alcoholic Beverages	-	34.48	34.48
System Costs	312.94	300.07	-12.87

Source: Eunomia Calculations

Table E-5: Cost per Tonne of Material Recycled

	Current System	Proposed DRS and Blue Box
Total Cost of System ($M)	312.94	300.07
Tonnes Recycled	996,854	1,114,421
Cost per Tonne of Material Recycled ($M)	313.93	269.26

	Current System	Proposed DRS and Blue Box
% of Total Packaging Recycled	**65.8%**	**73.9%**

Source: Eunomia Calculations

The cost per tonne of material recycled is 14% less under the proposed system than the current program, and the overall recycling rate (for Blue Box and proposed DRS) increases from 65.8% to 73.9%.

Additional savings may be gained through reduction in litter clean-up costs due to the reduction in beverage container litter as a result of the DRS. In Canada, litter clean-up costs, which are higher than the costs of properly-disposed waste, fall on the municipalities. `Toronto alone budgeted $36M in 2018 for "City Beautification" efforts, which includes litter collection and education.[16] Instituting a DRS is proven to reduce beverage container litter by up to 80%. [17]

E.3.2 Environmental

Environmental benefits associated with the introduction of a DRS occur from the following processes:

1) Recycling of additional beverage containers;
2) Reduction in disposal of beverage containers;
3) Additional collection and transportation of containers to recyclers; and
4) Reduction in impact to personal amenity associated with litter.

Items 1) to 3) above impact greenhouse gas (GHG) emissions and air quality impacts. In addition, there is a very real cost associated with the impact of litter on a person's amenity – that is, the amount a person is willing to pay for a litter free environment. The impacts on GHG emissions, air quality, and personal amenity can all be quantified and assigned an economic value.

Operating curbside services alongside a DRS for non-alcoholic beverage containers delivers a reduction of 48,498 tonnes of CO_2e GHG emissions. Associated monetized benefits of environmental services equals $2.03B, the vast majority of which is attributed to the

[16] City of Toronto. "2018 Toronto Budget." 2018. <https://www.toronto.ca/wp-content/uploads/2017/11/931b-Budget-Notes-SWMS-op-nov17-503p.pdf>
[17] Eunomia (2017) Impacts of a Deposit Refund System for One-way Beverage Packaging on Local Authority Waste Services, 11th October 2017

reduction in terrestrial and marine litter, the additional derived from improved air quality and reduced of CO_2e GHG emissions, as set out in Table E-6.

Table E-6: Environmental Impact Summary

Service	Environmental Impact (Tonnes)	Monetized Environmental Impact ($M)
Air Quality	-	-2.25
GHG, CO_2e	-48,498	-2.40
Subtotal		**-4.65**
Disposal Reduction	-100,898	
Recycling Increase	117,567	
Litter Reduction (Amenity impact)	-8,291	-2,029
Total Environmental Cost Benefit	**-**	**-2,033**

Source: Eunomia Calculations.

E.3.3 Social

There are additional social benefits that result from the introduction of a DRS for non-alcoholic beverage containers in Ontario.

The current Ontario Blue Box system creates 7,105 direct full-time equivalent (FTE) jobs and a further 5,471 indirect and induced jobs, bringing the total to 12,576 FTE. The proposed system (Blue Box and proposed DRS) increases this number by 12% to 14,064. The sources of these jobs are set out in Table E-7.

Table E-7: Summary of Employment Impacts

Job Activity	Number of Jobs Created by Current Blue Box Program	Number of Jobs Created by Proposed Program
Curbside		
Blue Box Collection	2,121	1,733
Residual Waste Collection	2,729	2,301
Sorting, Processing, Disposal	2,255	2,816
Subtotal Curbside	**7,105**	**6,851**
Subtotal DRS	**-**	**1,095**
Total Direct	**7,105**	**7,946**
Total Indirect and Induced	**5,471**	**6,118**
Total Direct, Indirect and Induced	**12,576**	**14,064**

Source: Eunomia Calculations

Gross Value Added (GVA) is a common approach to measuring the contribution of a sector to overall Gross Domestic Product of a region. The GVA to the Ontario economy of the current system is approximately $709.74M, with the government recovering $58.84M in tax revenue. The proposed system has an associated GVA of $798.45M, and total tax potential of $66.43M.

E.3.4 Benefit Summary

Ontario needs to increase its recycling rate to achieve a more circular economy and deliver the diversion goals it has laid out in its discussion paper *Reducing Litter and Waste in Our Communities.* DRSs are proven to out-perform the curbside programs that they complement, in terms of the recycling rates achieved, contamination levels and loss rates. A DRS for non-alcoholic beverage containers in Ontario increases the overall recycling rate from 65.8% to 73.9%, bringing the province one step closer to its peers and its own zero waste goals. The full monetized benefits of operating a DRS alongside an optimized Blue Box program are summarized in Table E-8.

Table E-8: Current vs. Proposed system

Cost/Benefit		Current Program ($M)	Proposed Program ($M)
Cost	Operating Costs (DRS, Blue Box + % Residual associated with PPP and DRS)	312.94	300.07
Benefit	GVA	-709.74	-798.45
	Tax Revenue	-58.84	-66.43
	Monetized GHG		-4.65
	Amenity (associated with reduced litter)		-2,029
Total		**-456**	**-2,598**

Source: Eunomia Calculations.

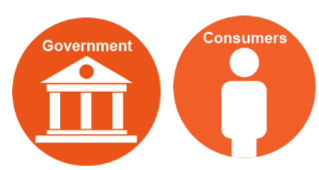
Further benefits include:

- Reduction in cost per kg of PPP placed on the market from $0.31 to $0.27;
- Reduction of 48,498 tonnes of CO_2e GHG emissions and improved air quality;
- 80% reduction in beverage container litter; and
- 117,567 additional tonnes of material recycled.

E.4.0 Stakeholder Impact

The stakeholder benefits of operating a non-alcoholic beverage DRS alongside the Blue Box program and ODRP are summarised in Table E 9.

Table E 9: Stakeholder Impact

Benefit	Description	Stakeholders Benefitting
Financial	• Ability for producers to fully control the redemption infrastructure through the PRO to ensure targets are met • Reduction in cost per kg of packaging placed on the market from $0.31 to $0.27 • Reduction in cost per tonne recycled from $313.93 to $269.26 • $63.35M in material revenue • Increase consumer visits to retailers that choose to redeem containers • Low retailer impact resulting from mix of RVM, over the counter and bag drop redemption • Tax revenue of $66.60M under proposed program • $800.54M GVA under proposed DRS • Reduction in municipal litter costs associated with 80% reduction in beverage container litter	
Environmental	• Recycling rate increases from 65.8% to 73.9% • 117,567 additional tonnes of material recycled, replacing virgin material on the market and feeding into the circular economy • 48,498 tonnes of CO_2e GHG emissions saved • 80% reduction in terrestrial and marine beverage container litter • Monetized environmental benefits of $2.03B	
Social	• 14,064 FTE jobs associated with the proposed system, an increase of 1,488 over the current system • $2.029B amenity benefit associated with reduction in litter	

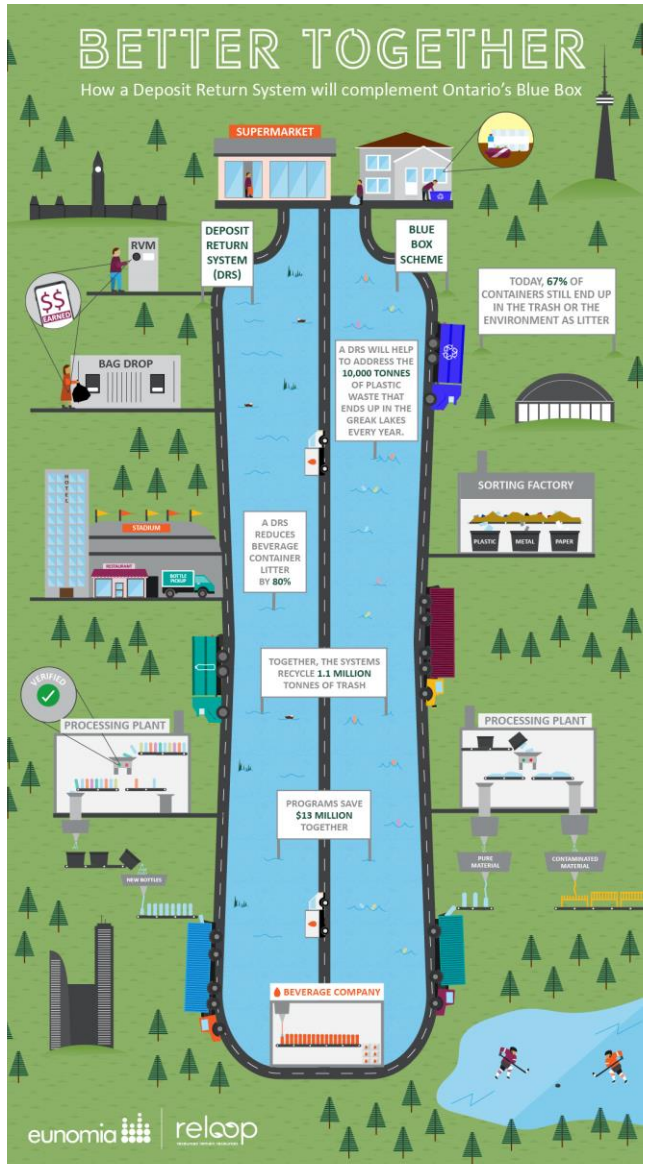
E.5.0 Conclusion

If Ontario is seriously committed to furthering waste reduction, reducing litter and moving toward a circular economy, it should consider implementing a DRS for non-alcoholic beverages along side its existing Blue Box program.

The report demonstrates how the systems are financial, environmentally and socially, better together and that an optimized Blue Box program alongside a DRS for non-alcoholic beverage containers has the potential to:

- Reduce beverage container litter by up to 80%;
- Increase the Ontario recycling rate for paper and packaging to 73.9% from the current 65.8%[18];
- Reduce overall system cost by over $12M annum;
- Reduce the cost per tonne recycled from $313.93 to $269.26; and
- Provide producers with food grade secondary material to replace virgin material and enable them to meet minimum recycled content goals.

Figure E 2: Benefits of a DRS for Non-Alcoholic Beverages Working Together with the Blue Box



Together the Blue Box program alongside a non-alcoholic DRS can provide Ontarians with recycling convenience and choice, and offers producer a cost-effective mechanism to responsibly manage their packaging at the end of

[18] Excludes material currently collected through ODRP

life through the achievement of high recycling rates. For a cost of $0.0091 per unit redeemed or $0.0082 per container sold producers can ensure that over 90% of all beverage containers sold are collected for recycling and reduce beverage container litter by up to 80%.

Ontario already has an existing successful DRS for alcoholic beverage containers which offers a network of convenient return locations. Although, not considered in this report, these redemption locations could also accept non-alcoholic beverage containers, providing an even greater level of convenience for consumers.

Designing an integrated system where a DRS is extended to non-alcoholic beverage containers, and the Blue Box program is further optimized, potentially in the light of considerations as to how other streams, such as food waste, should be targeted for separate collection, is the next logical step for Ontario in the move toward zero waste and a more sustainable future.

Contents

1.0 Definitions

Below are the definitions of terms as they are used throughout this report.

Administration Fee – Fee paid by producer under an EPR model to cover the proportion of the cost of the system not covered by material revenue and unclaimed deposits.

Bag Drop – A redemption route for deposit return systems in which consumers drop-off filled bags of empty beverage containers to a designated location. Beverage containers are later verified and counted and consumers are refunded their deposits through a digital account.

Deposit – A sum of money required by law to be exchanged for a product in addition to the purchase price, in order to incentivize its return to the system.

Deposit Initiator - The first bottler, distributor or agent to collect the deposit on a beverage container. Also known as “producers,” see definition below.

Deposit Return System (DRS) – A system in which a beverage container is purchased at the point of sale for a set sum of money (deposit) in addition to the purchase price. This sum is returned when the empty beverage container is redeemed.

Extended Producer Responsibility (EPR) – A system in which producers are operationally and financially responsible for the cost of recycling their product at the end of its life.

Handling Fee – Fee paid to parties providing redemption infrastructure calculated to cover the cost of receiving beverage containers from consumers and storing them prior to collection.

Manual Redemption – A redemption method where retailers collect beverage containers from consumers by hand, over the counter, store them and take them to redemption centres for return to producers.

Non-alcoholic beverage container - Receptacle used to hold liquid beverages (excluding beer, wine, wine products, cider and spirits) for consumer consumption. Container can be made of a variety of materials, including: glass, plastic, metal or cartons.

Paper Products and Packaging (PPP) – Packaging is materials that are used for the containment, protection, handling, delivery or presentation of goods supplied to consumers and made of glass, metal, paper, plastic or any combination thereof. A Paper Product is any material that is not Packaging, but is printed with text or graphics as a medium for communicating information.[19]

Processor – Parties that provide services that may include: counting, weighing, measuring, controlling, surveying and verifications. They may be responsible for scrap buying/selling, overseas shipping and brokering, and materials transformation.

Producer – Brand owners, manufacturers or distributers of beverage products. Produce products and place the items on the market. Producers sell their products to retailers, who sell them to consumers. These parties are also known as deposit initiators, as they are the originators of the deposit return process.

Producer Responsibility Organization (PRO) – Organization appointed by producers to manage the DRS program on their behalf.

Retailer – Sellers of beverages to consumers. These parties buy from producers and sell to consumers through a licensed establishment.

Redemption Centre – A dedicated establishment for the collection of beverage containers in exchange for a deposit refund.

Reverse Vending Machine (RVM) – A machine through which beverage containers are returned, verified and compacted and deposits are automatically refunded. Used by consumers at redemption locations.

[19] Abridged definition from Stewardship Ontario. More precise definition can be found in the Stewardship Ontario Blue Box Program Plan (2003) and Canadian Stewardship Services Alliance National Stewards Guidebook (2018): the https://guidebook.cssalliance.ca/wp-content/uploads/2019/01/CSSA-Guidebook_Jan2019.pdf

2.0 Introduction

Ontario is going through a transition. Recycling rates of beverage containers have fallen from 56% in 2012 to 45% in 2016.[20] At the same time, with the passage of the *Waste Free Ontario Act 2016 (WFOA)*, which enacted the *Waste Diversion Transition Act 2016* (WDTA) and the *Resource Recovery and Circular Economy Act 2016* (RRCEA), Ontario is moving towards a system in which producers are financially and operationally responsible for end-of-life management of designated products and packaging,[21] effectively establishing a full extended producer responsibility (EPR) model.

In this transition Ontario must ensure that it has a system that captures high quality material in a cost-effective manner, mitigating environmental impacts and simultaneously benefiting all Ontarians. Ontario's long-standing curbside recycling system, also known as the Blue Box program, is robust and accepts a wide variety of materials, but recycling performance across those materials varies widely. Additionally, The Beer Store, a private retailer, operates a deposit system for the beverage containers that it sells, as well as those sold through the Liquor Control Board of Ontario (LCBO) retail outlets through the Ontario Deposit Return Program (ODRP). This system recovers higher rates of materials within its scope than the Blue Box program is able to achieve.

Overall, the Blue Box program boasts a 62.4% recycling rate,[22] including exceptional performance with respect to paper, with capture rates above 90%, the highest in North America.[23]

Conversely, the rate of recycling for single-use, non-alcohol beverage containers was only 45% in 2016, the lowest across all of Canada.[24] Concurrently, The Beer Store collects 87% of the beverage containers that its sells, and 81% of those sold through both The Beer Store and LCBO combined (in 2018).[25] The stark contrast in the performance of these systems is likely

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[20] CM Consulting. "Who Pays What 2018." <https://www.cmconsultinginc.com/wp-content/uploads/2018/10/WPW-2018-FINAL-5OCT2018.pdf>

[21] Waste Free Ontario Act, 2016. <https://www.ontario.ca/laws/statute/S16012>

[22] Stewardship Ontario. "2017 Annual Report." <https://stewardshipontario.ca/wp-content/uploads/2018/06/SO-2017-Annual-Report.pdf>

[23] Stewardship Ontario. "Amended Blue Box Program Plan – Draft for Consultation." 2018. <https://stewardshipontario.ca/wp-content/uploads/2017/12/DRAFT-for-Consultation-Amended-Blue-Box-Program-Plan.pdf>

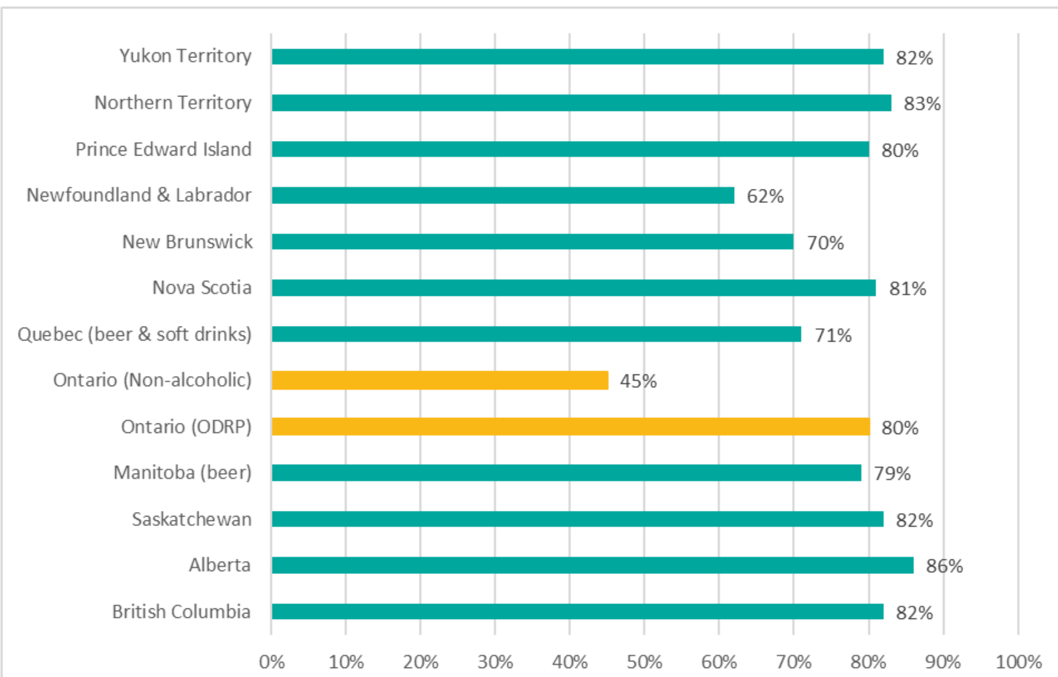
[24] CM Consulting. "Who Pays What 2018." <https://www.cmconsultinginc.com/wp-content/uploads/2018/10/WPW-2018-FINAL-5OCT2018.pdf>

[25] The Beer Store. "Reuse & Recycle for a Cleaner, Greener Ontario, 2018 Responsible Stewardship Performance." <https://www.thebeerstore.ca/wp-content/uploads/2019/04/StewardshipReport2018.pdf>

attributable to the incentive provided by the deposit as well as the return-to-retail nature of the ODRP program. The disparity between beverage container recycling through the Blue Box and that of the ODRP highlights the efficacy of deposit programs. There appears to be an opportunity for a deposit return system (DRS) for beverage containers to boost recycling rates, thereby reducing greenhouse gas (GHG) emissions, minimizing the littering of beverage containers on land and in our waterways, and contributing to the economic prosperity of Ontario.

Across Canada, deposit programs for beverage containers are common and effective. Figure 2-1 shows the recycling rates for non-refillable containers across Canada for 2016. Nearly all of the provinces have recycling rates at 80% or higher, including Ontario's ODRP program. The Blue Box, by contrast, is much less effective at capturing containers and diverting them from the landfill or from being littered. In the 2016 Toronto Litter Audit, PET beverage bottles accounted for 15.4% of large litter surveyed.[26]

Figure 2-1: 2016 Recycling Rates for Non-refillables Beverage Containers Across Canada



Source: CM Consulting "Who Pays What 2018"

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[26] AET Group, Inc. "2016 Toronto Litter Audit." October 27, 2016. < https://www.toronto.ca/wp-content/uploads/2017/10/8ed5-Toronto-Litter-2016-Final-Report_App_Final.pdf>

In British Columbia, there are two producer-funded and operated DRS programs for both domestic beer and all other beverage types, with the exception of milk. In aggregate, these programs regularly exceed the target redemption rate of 75% and work alongside a fully producer-operated Blue Box program.[27] The overall recycling rate is 75%.[28] The redemption rate for the non-alcoholic beverage container program is 78% and the beer deposit program has a return rate of 90.6%.[29] The 78% recycling rate for packaging in total is only achievable by combining a curbside collection and a DRS program for all beverages.

As Ontario transitions to a program fully funded by producers, recycling as much material as possible in a cost-effective manner, is key. A modernized DRS helps to divert a greater amount of material from the landfill, in line with the province's diversion goals, and ensures that producers are achieving the greatest impact for their money. Improving the quality of recyclable materials, reducing GHG emissions, and reducing litter further emphasize the need for a DRS.

In March 2019, the European Commission passed a Single-Use Plastics Directive that mandates the collection of 90% of plastic bottles by member states over the next decade.[30] With the passage of the WFOA, Ontario is poised to move in the same direction. Ontarians need a mechanism that will enable them to easily recycle beverage containers in order to divert as much waste as possible and facilitate a circular economy.

This report examines the impacts of a broad scope DRS for soft drinks, bottled water and other beverage containers not already covered by the ODRP that works in conjunction with the Blue Box system. The financial costs and benefits are explored, as well as the impacts on producers, municipalities and other key stakeholders.

2.1 Why Consider a Deposit Return System for Non-Alcoholic Beverages Now?

With the move towards full EPR, it is prudent to evaluate how to capture high levels of high-quality packaging material in a cost-effective manner. Introducing a DRS for non-alcoholic beverage containers that complements the upcoming changes to the Blue Box system will maximize the value of recycling across the province. The proper design of such a system is

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[27] Bottlebill.org "British Columbia." < http://www.bottlebill.org/legislation/canada/britishcolumbia.htm>
[28] RecycleBC. "Annual Report 2017." <https://recyclebc.ca/wp-content/uploads/2018/07/RecycleBCAR2017-June292018.pdf>
[29] CM Consulting. "Who Pays What 2018." < https://www.cmconsultinginc.com/wp-content/uploads/2018/10/WPW-2018-FINAL-5OCT2018.pdf>
[30] Zoete, Tom. "EU agrees on single-use plastics Directive." *Recycling Network*. December 19, 2018. <https://recyclingnetwerk.org/2018/12/19/europe-has-reached-an-agreement-on-the-single-use-plastics-directive/>

essential to ensure that it is most effective for all of Ontario, from the city centres to the rural north, and to complement existing programs. A variety of factors have aligned recently that make such a system not only feasible, but necessary:

- The Ontario government has indicated that the Blue Box is moving to a fully-producer funded model in the near future.
  - In Stewardship Ontario's proposed draft amended Blue Box Program Plan (BBPP), a 75% diversion target for all packaging and printed paper is proposed.[31] Though this plan is no longer being pursued, in order to approach a similar target, major changes to the current recycling system will be necessary.
  - When operational management of the Blue Box program is handed over to producers, producers will likely consider operational improvements that will increase efficiencies across jurisdictions. These efficiencies may result from elimination of duplicative capacity such as material recovery facilities (MRFs) and transfer stations. A DRS might be able to utilize some of these assets, as they can be repurposed as counting centres or redemption centres.
- Worldwide trends are moving toward higher recycling targets. Under the European Commission's *Single Use Plastics Directive*, there is a 90% separate collection target for plastic bottles by 2029 (77% by 2025).[32] This legislation is likely to set the standard for the world to follow. With Canada's participation in the G7 Ocean Plastics Charter, Canadian provinces are likely to begin to move toward targets more in line with those of Europe.[33]
- Strong public support – a 2016 survey found that a deposit return program for plastic bottles receives near universal support (91%) among Ontarians, with more than two thirds of Ontarians strongly in support of the program, even when asked without specifying an outcome, and with a signal of potential cost to consumers.[34]

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[31] "Blue Box Program Plan Draft for Consultation." December 2017 <http://stewardshipontario.ca/wp-content/uploads/2017/12/DRAFT-for-Consultation-Amended-Blue-Box-Program-Plan.pdf>

[32] European Commission Press Release. "Circular Economy: Commission welcomes European Parliament adoption of new rules on single–use plastics to reduce marine litter." March 27, 2019. <http://europa.eu/rapid/press-release_STATEMENT-19-1873_en.htm>

[33] DW. "G7 minus two: Leaders agree to ocean plastics charter." November 6, 2018. <https://www.dw.com/en/g7-minus-two-leaders-agree-to-ocean-plastics-charter/a-44107774>

[34] On behalf of Environmental Defence (ED), the Gandalf Group conducted a survey among 800 Ontarians to assess support for a Deposit Return Program for plastic bottles and programs to protect waterways from agricultural run-off. Online interviews were completed between March 4th and 7th, 2016. A probability sample of this size yields a margin of error of +/- 3.5%, 19 times out of 20. Data is weighted to represent the gender, age, and regional distribution of the province.

- Changing markets for recyclables - DRSs have the added benefit of producing a higher quality material than single stream curbside systems, which can warrant a higher market price and is more likely to be used by local manufacturers. This fact is especially important given the recent changes in the market for recycled material. In early 2018, China – then the largest market for post-consumer recycled material – announced that it would be imposing strict quality standards on the recyclable materials it would accept, through its National Sword policy.[35] Since the implementation of this policy, some recyclable material in Ontario has ended up in the landfill.[36] However, clean, well-sorted recyclables – like those emanating from a DRS program – will more easily find a market and ensure that the efforts of Ontarians to recycle are not wasted.
- Rising awareness and understanding of the impact of single-use plastics – Recent years have seen a growing awareness and knowledge of the impact that single use plastic items, including beverage containers, are having on our marine environment. A 2016 report by the World Economic Forum indicated that by 2050, plastic will outweigh fish in the sea.[37] While this is a troubling statistic, there are more local issues with marine litter that affect Ontarians. The Rochester Institute of Technology found that 10,000 tonnes of plastic enter the Great Lakes every year, with Toronto being one of the worst sources.[38] DRSs have been proven to reduce littering of beverage containers by up to 80%, based on a comparative review of the effect of DRSs on littering behaviour.[39]
- Prime Ministers announcement on June 10, 2019 to address harmful single use plastics[40].
- Growing problem of microplastics - microplastics are also found in marine animals, including those which humans consume as food. The Rochman Lab in the Department of Ecology & Evolutionary Biology at the University of Toronto has shown microplastics pose particular concern for human exposure in shellfish and other animals consumed

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[35] Seldman, Neil. "Recycling is Crashing? Far from It." *Governing*. August 20, 2018. <http://www.governing.com/gov-institute/voices/col-recycling-survival-china-restrictions.html>

[36]"Eastern Ontario Recycling Heading to Landfill." *CBC* News. March 31, 2018. <https://www.cbc.ca/news/canada/ottawa/north-glengarry-recyclng-crunch-china-rules-1.4599592>

[37] World Economic Forum. "The New Plastics Economy: Rethinking the future of plastics." January 2016. <http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf>

[38] Zukowski, Dan. "22 Million Pounds of Plastic Enters the Great Lakes Each Year." *Ecowatch*. December 20, 2016. <https://www.ecowatch.com/plastic-great-lakes-2157466316.html>

[39] Eunomia (2017) Impacts of a Deposit Refund System for One-way Beverage Packaging on Local Authority Waste Services, 11th October 2017

[40] https://pm.gc.ca/eng/news/2019/06/10/canada-ban-harmful-single-use-plastics-and-hold-companies-responsible-plastic-waste

whole.[41] Much is still unknown about how microplastics affect human health, but many of the chemicals contained in plastics appear to impair lab animals, even at levels some governments consider safe for humans.[42]

Designs Associated with High Recycling Rates

For beverage containers, DRSs complement curbside collection systems in order to achieve higher recycling rates than possible through curbside systems alone (see Figure 2-1). DRSs also decrease contamination levels and loss rates across the system. The design of a DRS, though, is key to its performance, with different designs delivering varying degrees of success (from a 51% return rate in Connecticut[43] to a 98% return rate in Germany[44]).

Among existing DRSs that consistently achieve high redemption rates (in excess of 80%) at low cost (somewhere between $0.01 and $0.02 per container sold), similar characteristics are often shared, including:

1) Governance: Legislation that is not overly prescriptive on process, with the focus on outcomes. Specifically:
    a. Setting and enforcing a recycling target;
    b. Establishing the need for continuous improvement, putting in place mechanisms to adjust the level of deposit if recycling targets are not being achieved for an agreed-upon number of consecutive years and ensuring that consumers can conveniently redeem containers; and
    c. Establishing the role of government as one of audit, oversight and enforcement.

    Within reason, and over and above the essentials, the fewer details that are enshrined in the legislation, the more flexibility producers have to react to factors that affect achievement of program goals.
2) Management: Those parties responsible for the supply and, in some cases, sale of beverages (essentially producers, distributors and grocers) are given the responsibility for meeting the requirements of the legislation through a collaborative administrative approach and market-driven operational delivery, ensuring cost effective compliance. This includes:
    a. Putting in place a PRO to oversee the system;

[41] Smith, Madeline; Love, David; Rochman, Chelsea; and Neff, Roni. "Microplastics in Seafood and the Implications for Human Health. "Current *Environmental Health Reports.* August 16, 2018. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6132564/>

[42] Royte, Elizabeth. "We Know Plastic Is Harming Marine Life. What About Us?" National Geographic. June 2018. <https://www.nationalgeographic.com/magazine/2018/06/plastic-planet-health-pollution-waste-microplastic>

[43] Container Recycling Institute (2018). <http://www.bottlebill.org/legislation/usa/connecticut.htm>

[44] CM Consulting & Reloop (2018) Deposit Systems for One-Way Beverage Containers: Global Overview 2018. <https://reloopplatform.eu/wp-content/uploads/2018/05/BOOK-Deposit-Global-27-APR2018.pdf>

    b. Procurement and commissioning of services that will:
        i. Deliver redemption infrastructure and options to ensure consumers can conveniently redeem;
        ii. Offer technology driven solutions that will drive efficiencies in respect to transport and provide transparent and accurate data;
        iii. Optimize costs through a market-driven, innovative approach to infrastructure and fee setting.
3) Delivery: Organizations appointed through the PRO, given the responsibility for operational delivery and required to report through Performance Management Indicators to demonstrate achievement of, and compliance with program financial, legal, environmental and social goals.

DRSs operated by producers, through a PRO, are typically operated on a non-profit basis and funded through a combination of:

- Material revenues;
- Unredeemed deposits; and
- Producer/administration fees.

Any PRO established for the collection and management of PPP under an RRCEA regulation would be a suitable PRO for a DRS system in Ontario.

Ontario's future waste management system needs to be economically viable and effective in its aims of diverting waste from the landfill as well as capturing marketable high-quality material to feed into the circular economy, helping to develop local employment opportunities. A joint Blue Box and DRS program may be the best way to achieve these ends. Complementing the existing programs with an optimized Blue Box system and a robust DRS for non-alcoholic beverage containers will allow Ontario to achieve high recycling rates for all beverage containers, maintain current high capture rates on paper, and maximize cost-effectiveness for producers, who will be responsible for covering 100% of the costs associated with reaching targeted recycling rates (such as the 75% recycling rate set out in the draft amended BBPP).

3.0 Context and Rationale

3.1.1 Product Stewardship for Residential Printed Paper and Packaging (PPP) in Ontario today

The *Waste Diversion Act* (WDA), passed in 2002, set up a structure for the Blue Box program to be partially funded by producers of PPP.[45] The WDA was the first step in moving Ontario toward an extended producer responsibility (EPR) model.[46] EPR describes the comprehensive responsibility that Ontario producers, importers and brand owners have to reduce the environmental impact of their products and packaging.[47] This responsibility extends across the entire product management lifecycle, encompassing waste reduction, recovery, recycling and reuse.

The WDA states:

> *"A waste diversion program developed under this Act for blue box waste shall not provide for payments to municipalities that total more than 50 per cent of the total net operating costs incurred by the municipalities in connection with the program."*[48]

The WDA established Waste Diversion Ontario (WDO) (now the Resource Productivity and Recovery Authority (RPRA), a non-crown agency, to implement and manage programs under the Act. The WDA also creates an Industry Funding Organization (IFO), Stewardship Ontario (a non-profit industry organization), to collect fees and data from the producers, or "stewards," and pay municipalities. Stewardship Ontario is maintained under the *Waste Diversion Transition Act 2016.*

Stewardship Ontario calculates the fees that producers are required to pay each year on a per kilogram basis, by material type.[49] The calculation uses information provided by municipalities on the costs of their Blue Box programs, the Stewardship Ontario budget, waste composition and activity-based cost allocation studies, and reports from producers.[50] The Pay-In Model

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45 Waste Diversion Act, 2002. <https://www.ontario.ca/laws/statute/02w06>
46 Waste Diversion Act, 2002. <https://www.ontario.ca/laws/statute/02w06>
47 Stewardship Ontario. "What is Extended Producer Responsibility" < http://stewardshipontario.ca/what-is-extended-producer-responsibility/>
48 Waste Diversion Act, 2002. <https://www.ontario.ca/laws/statute/02w06>
49 Stewardship Ontario. "2016 Fee Schedule." <http://stewardshipontario.ca/wp-content/uploads/2013/03/2016-Fee-Schedule.pdf>
50 Stewardship Ontario. "Fee-setting Methodology." < http://stewardshipontario.ca/stewards-bluebox/fees-and-payments/fee-setting-flow-chart/>

(PIM) is the result of calculations based on those inputs and is used to allocate costs to producers of the various PPP materials.

The Ontario Government has stated its intention to reform this shared responsibility model towards full producer responsibility. [51] The current system is not true EPR since producers only contribute to the funding of the recycling program and not to the costs of disposal or litter clean-up associated with their packaging. Full EPR should allow for producers to put in place operational systems that will ensure their packaging is managed at the end of life and that recycling targets are met.

3.1.2 Ontario Deposit Return Program (ODRP)

The Beer Store is a privately-owned beer retailer owned by brewers that until recently was the only retailer approved to sell beer for off-site consumption under the Ontario Liquor Control Act[52] (for recent changes, see Section 3.2). Since its founding in 1927, The Beer Store has been operating a private deposit program for the beverage packaging sold in its stores. Originally, The Beer Store sold beer in refillable bottles only, and the refundable deposit encouraged consumers to return their bottles for refilling. The program was expanded to single-use containers as they came into use.

Building off the success of The Beer Store's program, in 2007, the provincial government enacted the Ontario Deposit Return Program (ODRP), also known as "Bag it Back," which established a partnership between The Beer Store and the Liquor Control Board of Ontario (LCBO). The agreement allows for only The Beer Store, through its over 900 locations, to accept and refund deposits for all empty alcohol beverage containers which are sold exclusively in Ontario through LCBO and The Beer Store. The deposit for different container types are shown in Table 3-1.[53]

[51] General Manager, Solid Waste Management Services of Toronto. May 24, 2017. "Update on New Provincial Waste Management Framework Legislation - Bill 151: Waste-Free Ontario Act, 2016." https://www.toronto.ca/legdocs/mmis/2017/pw/bgrd/backgroundfile-104195.pdf

[52] Province of Ontario. "The Liquor Control Act R.S.O. 1990, c. L.18." <https://www.ontario.ca/laws/statute/90l18>

[53] http://www.bagitback.ca/en/residential/faq.shtml

Table 3-1: Ontario Deposit Return Program Deposit Levels

Glass bottles, plastic bottles (PET), Tetra Pak containers, bag-in-box:	**Aluminum and steel containers:**
Up to 630mL: $0.10	Up to 1L: $0.10
Over 630 mL: $0.20	Over 1L: $0.20

Source: The Beer Store

3.1.3 Expansion of Alcohol Sales

Ontario has traditionally only sold alcohol through The Beer Store and the LCBO retail locations. However, beginning in 2018, Ontario began to allow select grocers to sell beer, cider and/or wine, following an easing of licensing laws. By late 2018, 450 supermarkets were selling beer and cider, 70 of which also sold wine.[54] An announcement in March 2019 by Ontario's finance minister indicated that the government intends to further the sale of beer and wine into corner stores, big box stores and more grocery stores.[55]

The expansion of the outlets that sell these beverages could have significant impacts on the redemption of deposit containers under the ODRP, as consumers will no longer have to visit a redemption point (The Beer Store) in order to purchase beer. As the convenience for consumers to purchase these beverages increases, but the convenience of container redemption does not, it is likely that redemption rates will fall. This situation lends support to the idea for an enhanced and expanded infrastructure for deposit refunds, in order to ensure that even current rates of redemption are sustained.

3.2 Toward the Future

In March 2019, the Ontario Ministry of the Environment, Conservation and Parks released its discussion paper, *Reducing Litter and Waste in Our Communities* as part of its *A Made-in-Ontario Environment Plan*, Ontario's new plan to preserve and protect its environment for future generations. The province states that it is, "committed to make producers responsible for the waste generated from their products and packaging, and to outline actions to explore

[54] Province of Ontario website - "Beer, wine and cider sales in grocery stores." <https://www.ontario.ca/page/beer-wine-cider-sales-grocery-stores>
[55] Jeffords, Shawn. "Fedeli says Ontario to expand beer, wine to corner stores." *Global News*. March 28, 2019. <https://globalnews.ca/news/5108152/fedeli-ontario-beer-wine-corner-stores/>

how to recover the value of resources in waste, provide clear rules for compostable products and packaging, and support competitive and sustainable end-markets for Ontario's waste.[56]

The waste sector is responsible for 6% of Ontario's GHG emissions, 90% of which is from landfills.[57] Reducing the amount of material going to landfills is an essential step in embracing circular economy practices and reducing future emissions. The majority of beverage containers do not give rise to GHGs if disposed of in landfills, however the true environmental benefits result from recycled material displacing the use of virgin materials. This substitution delivers significant embodied energy savings resulting primarily from reduced resource extraction. As an example, metals make up approximately 5% of the waste stream but account for a third of carbon emissions when embodied energy is considered.[58] These benefits have not been calculated in this report so would be in addition to the environmental benefits calculated.

The *Waste-Free Ontario Act, 2016 (WFOA*), took significant measures to modernize the waste system in Ontario through two acts that replaced the WDA and crafted the framework for a new system designed to move Ontario toward a circular economy.

The *Resource Recovery and Circular Economy Act, 2016 (RRCEA)* established an outcomes-based producer responsibility regime and included three provisions:

1) Identified provincial interest in resource recovery and waste reduction to provide overarching government direction;
2) Established full financial and environmental responsibility for producers to collect and manage waste associated with their products and packaging (currently only tires are regulated under the RRCEA with a regulation for waste electronics and electrical equipment and batteries under way.); and
3) Established the Resource Productivity and Recovery Authority (RPRA) to effectively replace the WDO as the body overseeing the legacy program operating under the *Waste Diversion Transition Act, 2016 (WDTA)* and administering regulations under the RRCEA.

EPR for packaging and printed paper will eventually be regulated under the RRCEA. The current municipally delivered system under the WDTA (the second of the acts underneath the

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[56] Ontario Ministry of the Environment, Conservation, and Parks. "Reducing Litter and Waste in Our Communities: Discussion Paper." <https://prod-environmental-registry.s3.amazonaws.com/2019-03/Reducing%20Litter%20and%20Waste%20in%20Our%20Communities%20Discussion%20Paper_0.pdf>
[57] Government of Ontario. February 2017. "Strategy for a Waste-Free Ontario: Building the Circular Economy." <https://files.ontario.ca/finalstrategywastefreeont_eng_aoda1_final-pdf>

[58] Eunomia Report Carbon Recycling Index 2014/15. <https://www.eunomia.co.uk/reports-tools/recycling-carbon-index-201415/>

WFOA) will continue until full producer responsibility is regulated under the RRCEA and the responsibility for collecting and managing PPP transfers from municipalities to producers.

Once the transition to full producer responsibility is complete, Regulation 101/94 of the Environmental Protection Act will be revoked eliminating the directive to Ontario municipalities to run Blue Box programs.

The *Made-in-Ontario Environment Plan* states the provincial government's commitment to combat climate change, reduce waste and litter in communities, and other environmental measures. It also restates Ontario's commitment to EPR, stating that the province intends to "make producers responsible for the waste generated from their products and packaging." [59] More specifically it calls for moving Ontario's waste programs to an EPR model to "provide relief for taxpayers and make producers of packaging and products more efficient by better connecting them with the markets that recycle what they produce."[60]

This plan lends support to the idea that producers should have responsibility for a system that creates the best environment for Ontarians, is efficiently run, and diverts the most waste from the landfill.

The government's discussion paper *Reducing Litter and Waste in Our Communities* further calls for diverting waste from the landfill in Ontario and reducing litter through:

1) Reducing and diverting food and organic waste from households and businesses;
2) Reducing plastic waste;
3) Reducing litter in neighbourhoods and parks; and
4) Increasing opportunities for the people of Ontario to participate in waste reduction efforts.

DRSs are proven to be the best method for preventing litter. A DRS program will support points 2-4 of the above in addition to supporting curbside programs including source-separated food waste collection. Creating a comprehensive system for Ontario that allows for the best methods for reducing each type of waste is key. A well-designed DRS for non-alcoholic beverage containers will allow Ontario to meet its goals and move toward a cleaner, more prosperous future.

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[59] Ontario Ministry of the Environment, Conservation and Parks. "Preserving and Protecting our Environment for Future Generations, A Made-in-Ontario Environment Plan."2018. <https://prod-environmental-registry.s3.amazonaws.com/2018-11/EnvironmentPlan.pdf>

[60] ibid.

4.0 Proposed Program Design

As Ontario moves towards more circular models, there is a requirement not only to increase recycling rates, but also to ensure that material collected is of high quality. Increasing the quantity and quality of recyclable material has the added benefit of reducing GHGs, through the displacement of virgin material in new packaging with recycled content.

A correctly designed DRS can achieve 90% (and higher) redemption rates, which will bring Ontario above 70% in overall recycling.

The existing ODRP for beer and alcohol is an established system that consumers are familiar with and one that achieves a relatively high redemption rate at 87% it has been assumed in our analysis that the system will remain in place.

4.1 Legislative and Regulatory Authorities

While legislation is not needed to establish a DRS for non-alcoholic beverage containers, the framework for such legislation is already enacted under the broader regulation of printed paper and packaging (PPP) in the *RRCEA*. If the government of Ontario chose to formalize the program through legislation, this regulation would ideally contain the following key provisions:

1) A definition of beverage containers, as distinct from other PPP, which includes those supplied into Ontario's Industrial, Commercial and Institutional sector (IC&I);
2) A specific statutory performance target for the collection and recycling of beverage containers (i.e. 90% collection for recycling as adopted by the European Union for plastic beverage containers);
3) Penalties for failing to achieve performance targets;
4) Continuous improvement measures, such as mechanisms to adjust the deposit value if recycling targets are not being achieved for an agreed upon number of consecutive years; and
5) Audit, oversight and enforcement authority for the government to ensure that the program runs smoothly and that all provisions are being met.

There may also be a requirement to guarantee a minimum level of convenience for all users, for example through minimum geographic coverage of redemption options. However, if the return target is set sufficiently high (i.e. at least 90%) then coverage will be such to ensure the target is met.

4.2 Principles of Design

A set of design principles, based on successful existing programs, has been used to guide the design of the proposed DRS for non-alcoholic beverage containers. Examples of good and bad DRS designs are provided in Appendix A.1.0.

- **Targeted:** A 90% recycling rate for used beverage containers;
- **Engaging Incentive:** The deposit set at a level that will incentivise consumers to return, assessed as being $0.15 for non-alcoholic beverages in Ontario.
- **Convenient:** A return network that is sufficient in number and location to enable consumers to return empty containers as part of their every day activities. Redemption must be as easy as purchasing;
- **Comprehensive**: All beverage types to be included, preventing free riders and making the program simple for consumers to understand;
- **Accountable:** The latest information technology is deployed to ensure the accurate capture of return rates, to allow correct payments and to mitigate fraud;
- **Flexible:** Producers have the control to put in place the most cost-efficient system to meet the 90% target.

4.3 Design Overview

The sections below describe the design and operations of the proposed DRS, which has been designed to work alongside the existing ODRP and in partnership with a fully producer funded Blue Box system. The decision to model a DRS for non-alcoholic beverage containers alongside the current programs, rather than a combined alcoholic and non-alcoholic DRS and separate curbside system was made for a number of reasons:

- the ODRP program is well understood by users and is based on a specific return to The Beer Store redemption model;
- redemption infrastructure for non-alcoholic beverages needs to be convenient, so that it captures beverages consumed in the home, on-the-go and in food and beverage establishments;
- this report allows producers, who will be covering 100% of the costs of recycling their packaging in the future, as designated in the *RRCEA*, to compare costs of the current curbside program, which is the only existing program for non-alcoholic beverages in Ontario, against a joint DRS and curbside program on a cost per tonne recycled basis.

It is not uncommon for there to be separate programs for alcoholic and non-alcoholic beverages, as seen in British Columbia and Quebec. However, there are likely to be efficiencies if programs are combined, especially with the relaxation of alcohol sales in Ontario through *Reg. 232/16: Sale of Liquor in Government Stores*, which allows consumers to purchase alcohol in a growing number of establishments.

4.3.1 Governance

4.3.1.1 Producer Responsibility Organization

The RRCEA allows for the creation of Producer Responsibility Organizations (PRO) to undertake collection and management on behalf of the producers. The PRO's role is to provide oversight of the system, procurement and commissioning of services, ensure recycling targets are met and be responsible for cost efficiency and fraud mitigation. Administrative functions associated with maintaining the system, including the IT to support tracking and processing deposit flows, would likely be handled by a PRO.

The PRO handles the incoming revenue from sold material, all unclaimed deposits, and outflow of payments to any appointed operators of the system. The PRO is also responsible for compliance and fraud prevention. It determines the level of producer administration fee necessary to ensure cost coverage. The PRO also has the ability to set service standards for redemption centres, ensuring a consistent standard.

As the system administrator, the PRO has a hand in how the system is structured to meet the 90% redemption target at the lowest cost. The PRO is likely to procure part or all of the collection, counting and sorting activities. Given Ontario's large size, the PRO may choose to use a zoned procurement process. The PRO would likely set:

- the redemption targets; and
- technology specifications necessary to mitigate fraud and ensure transparent reporting.

Bidders propose the appropriate infrastructure to reach those targets and the cost for doing so, either as a per container price (in the form of a handling fee - see Section 5.2.2 for more information) or as an annual cost.

This system design also benefits the beverage agency by maximizing the collection of all eligible containers, reducing financial losses. Examples of good and bad DRS governance from around the world are found in Appendix A.1.1.

New South Wales, Australia used a zoned procurement process in its model, "Return and Earn." A network operator there, TOMRA Cleanaway, set up and runs a state-wide network of collection points; they develop and operate the collection points themselves, or contract other organizations to collect on their behalf.[61] Zoned models such as this allow the needs of different areas (e.g. rural vs. urban; low vs. high volume) to be best serviced and priced accordingly, which is not possible when there is a standard handling fee model.

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[61] New South Wales Environmental Protection Agency (2018). <https://www.epa.nsw.gov.au/your-environment/recycling-and-reuse/return-and-earn>

4.3.2 Scope

The proposed scope for the DRS includes all PET, aluminum, steel, glass, cartons, and film pouches of the following beverage container types:

- Carbonated soft drinks
- Sparkling water
- Non-sparkling water
- Sports drinks
- Energy drinks
- Fruit and vegetable beverages and juice
- Ready-to-drink tea and coffee

All containers less than 3L, except for milk and wellness beverages,[62] are included and are required to carry a deposit and be labelled as such. In addition, providing information to retailers and consumers, the deposit label allows the system to detect and prevent fraud, if the barcode is registered with the PRO and scanned by the RVM or at the counting centre. This allows Ontario to safeguard its program from fraudulent redemption from containers sold in Quebec, for example, where the deposit is lower.

A broad scope maximizes the potential impact in terms of recycling rates and litter reduction. This approach is arguably the fairest for all beverage producers, as no beverage or company gains an advantage from being included in, or excluded from, the scheme. It has the added benefit of simplicity for consumers, retailers and producers, and means consumers do not have to sort their containers.

4.3.3 Deposit Level

The deposit is the mechanism for incentivizing returns and needs to be set at a level to ensure consumers feel it is worth returning their containers. The most successful schemes – those with the highest return rates – tend to have higher deposits.

In order to ensure that Ontario achieves a 90% redemption rate, it is recommended that the deposit be set at $0.15 across all container sizes. A flat rate deposit such as this provides equal incentive to return all containers, ensures that the system is fair to all producers, and is simpler to administer.

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[62] Milk, dairy-alternatives, wellness and functional beverages are often excluded from DRS schemes, in Ontario, most milk is sold in bags and has been excluded from the modeling for these reasons. When designing a DRS for Ontario, the inclusion of these beverage may merit revisiting to conform with DRS program updates in Canada, like the program in Alberta, which includes containers of all beverage types. Wellness and functional beverages include infant formula, dietary supplements, etc.

A high deposit value is the best driver of redemption rates. Oregon increased its deposit from USD $0.05 (equivalent to CAD $0.07) to USD $0.10 (equivalent to CAD $0.13) in April 2017. This followed an amendment to the legislation requiring the deposit to be increased if the redemption rate was below 80% for two consecutive years.[63] This flexible approach recognizes the link between the deposit and return rates, and the need to keep the deposit value under review. The return rate during January – March 2017 was 59%.[64] Following the increase, Oregon hit 90% redemption in 2018.[65] Similarly, in 2008, Alberta raised the deposits on all beverage containers from $0.05 to $0.10 for containers 1L and under and from $0.20 to $0.25 for containers greater than 1L. The collection rate increased by approximately 13% just three years after implementation.[66]

4.3.4 Redemption Infrastructure

Focusing on the principles of convenience and flexibility, the proposed non-alcoholic beverage container DRS includes four channels for consumers to return their containers and redeem their deposit, described below. There are 8,045 retailers in Ontario that could potentially participate in the DRS.[67,68] Retail outlets were grouped into categories based on number of employees, and each category was assumed to operate using a certain redemption method. Hypermarkets (the largest retail outlets) are the location of bag drops and therefore do not need any in-store collections. In this model, other retailer types are assumed to accept containers through RVMs or manual takeback. The breakdown of retail outlets, by size, and assumptions by category, is given in Appendix A.3.3.[69] In practice, the PRO, retailers and market conditions will determine the distribution and number of redemption channels necessary to meet targets and geographical coverage requirements to make the system accessible to all Ontarians.

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[63] Oregon Legislative Assembly "House Bill 3145." 2011 Regular Session. <https://olis.leg.state.or.us/liz/2011R1/Downloads/MeasureDocument/HB3145>

[64] Oregon Beverage Recycling Cooperative. "2017 Annual Report," <https://www.obrc.com/Content/Reports/OBRC%20Annual%20Report%202017.PDF>

[65] Profita, Cassandra. "Oregon Bottle Deposit System Hits 90 Percent Redemption Rate." *NPR*. February 4, 2019. <https://www.npr.org/sections/thesalt/2019/02/04/688656261/oregon-bottle-deposit-system-hits-90-percent-redemption-rate>

[66] CM Consulting. "Who Pays What 2018." < https://www.cmconsultinginc.com/wp-content/uploads/2018/10/WPW-2018-FINAL-5OCT2018.pdf>

[67]As of December 2018, based on calculations from Statistics Canada - https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3310002501&pickMembers%5B0%5D=3.859

[68] The requirement to participate in the scheme is expected to extend to all supermarkets, groceries and convenience stores. However, where small retailers are located within a mall and the mall organized suitable provision it is assumed there would be an exemption. An estimate of 10% of small business may be exempted.

[69] Based on private communication with RVM distributors

The bag drop system design is based on the Bottle Drop Express program in Oregon (as seen in Figure 4-1), run by Oregon Beverage Recycling Cooperative (OBRC, an industry-appointed non-profit) or British Columbia's Return-It™ EXPRESS 'drop-and-go' service. Bag drops are stand-alone structures (typically repurposed shipping containers) that are located in the parking lots of the largest big box stores and hypermarkets, and in municipal depot drop-off facilities. Consumers purchase bags in which they place their empty containers.[70] It is assumed that each bag can hold approximately 100 glass bottles, 150 PET bottles or 250 cans.[71] Full bags are deposited at bag drop structures through a service hatch. Each consumer has an online account and when dropped-off bags are verified through the counting centre, the deposit refund is credited to the consumer's account. The consumer can then use the deposit credit to purchase goods at retailers or have the option to donate the money to a charity/school/etc. The bag drop facilities are not continuously staffed, but monitored periodically by mobile teams, making them especially cost-effective. Bag drops have also been modelled as being located at municipal drop-off centres.

Figure 4-1: Oregon Bottle Drop Express Outlet

Source: OBRC, https://www.bottledropcenters.com/Express

Redemption centres are assumed to be privately-owned and operated businesses that exist to collect deposit containers and are compensated through handling fees. Redemption centres thrive when volume is high, and it is assumed that the redemption centres in Ontario will be used primarily by high volume redeemers such as independent businesses redeeming containers from the hospitality sector.

The proposed infrastructure mix accommodates large versus small volume redeemers, and rural versus urban communities. A suburban town in the Greater Toronto Area will not need the same redemption infrastructure as a rural community in the north. Equally, retailers do

[70] Sacks are charged at equivalent of 27c in Oregon

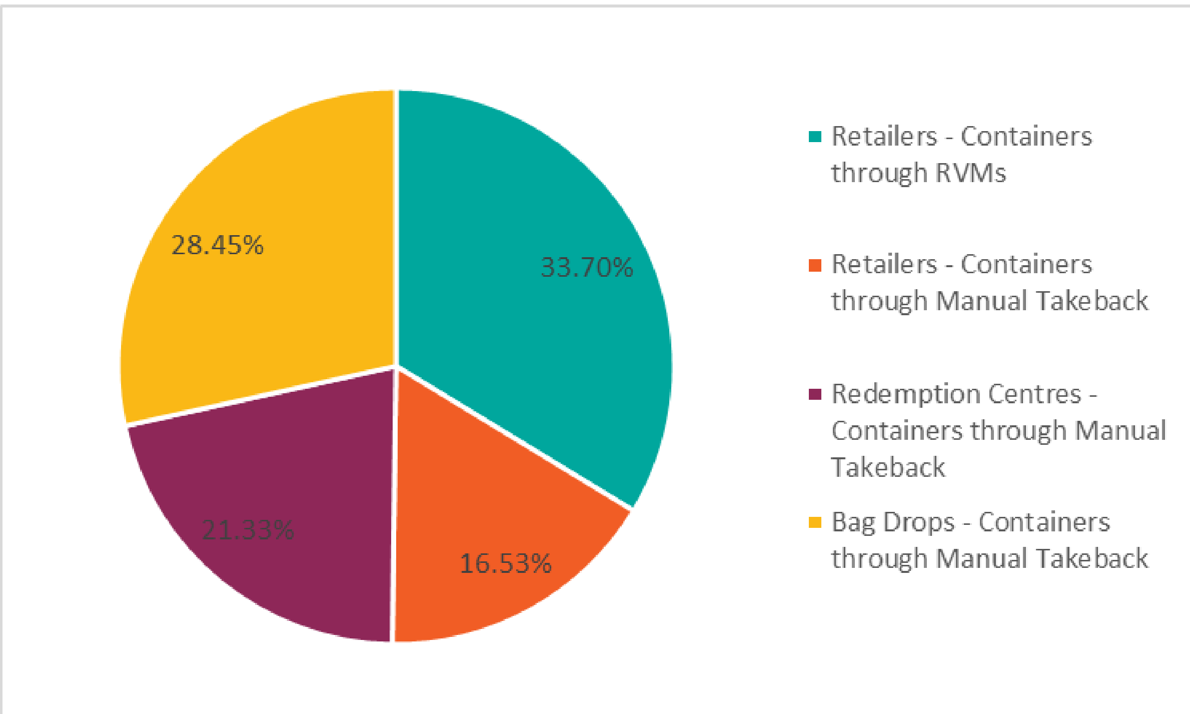
[71] TOMRA (2001), Zentrale Organization Einweg Pfand Deutschland: Business Model Development Guide

not have the space to accommodate large volume redeemers. Demographics and existing infrastructure have been used to model a system that allows consumers to have a simple, convenient system for return.

The proposed 2,895 redemption locations are significantly higher than the 218 redemption depots in Alberta[72] and 260 in British Columbia.[73] In these provinces, residents must make special trips to the depots, which may be quite far from their homes, to return their containers. The proposed redemption infrastructure for Ontario prioritizes convenience for every type of redeemer as a part of their daily activities and provides a dense network of redemption locations across the province, ensuring that no one will be too far from a place to reclaim their deposits.

Figure 4-2 details the percentage of containers that have been modelled to be redeemed through each redemption route.

Figure 4-2: Percentage of Containers Redeemed through Each Redemption Route



Source: Eunomia modelling.

[72] https://www.bcmb.ab.ca/uploads/source/Annual_Reports/BCMB_2017_Annual_Report_Final_Web.pdf
[73] https://www.return-it.ca/locations/?St=&Sv=express&Se=38&Se=40&Se=100

The ultimate design and mix of redemption options will be determined by the PRO or its appointed operators in conjunction with retailers based on the needs of the market to ensure that the 90% redemption target is met.

It may be possible for there to be some harmonization between the existing ODRP and the DRS for non-alcoholic beverages but this has not been modelled in this report.

4.3.4.1 DRS Redemption Infrastructure Summary

Table 4-1 summarizes the number of redemption locations by redemption method and the volume of material modelled to go through each.

Table 4-1: Ontario DRS Redemption Methods

Redemption Method	Number of locations	Total volume processed (tonnes/year)	Volume per location per year (units)
Retail stores, manual	1,356	30,678	963,127
Retail stores, reverse vending machines (RVMs)	1,241	49,086	657,534
Dedicated redemption centres	58	28,040	13,896,551
Bag drops	240	31,370	3,550,000
Total:	**2,895**	**139,174**	**15,517,212**

Source: Eunomia calculations

4.3.4.2 Blue Box

Consumers can continue to place their empty containers in their Blue Box bins, if this option is most convenient and they do not want to recover the deposit. An additional 3.5% of containers sold are assumed to be captured through the Blue Box program.

4.3.5 Transport and Transfer

Appointed contractors manage the collection from retailers, bag drop locations and redemption centres. RVM retailers and bag drop locations automatically feed data back to the collection contractor when collections are required. Regular collection routes are determined for redemption centres.

4.3.6 Counting and Processing

The model assumes the establishment of three regional counting centres across the province to count and verify all containers that are not redeemed through RVMs, as RVMs verify containers at the point of redemption. Counting centres also carry out some processing of material, such as baling. Counting and verifying all containers helps identify fraudulent activity and ensures payment is only made on eligible containers, reducing overall system cost. "Conditioners" in Quebec are certified by the industry non-profit and provide services that may include: counting, weighing, measuring, controlling, surveying and verifications according to the established guidelines.[74] This allows the industry to ensure that that all deposit reimbursements are accurate according to their certified partners.

Former municipal material recovery facilities (MRFs) may serve as possible locations for counting centres, if MRF infrastructure is consolidated as anticipated under the full EPR framework, where operational responsibility for the Blue Box program is transferred to producers (as referenced in the BBPP to "build scale efficiencies in handling…and to minimize logistic inefficiency.")[75]

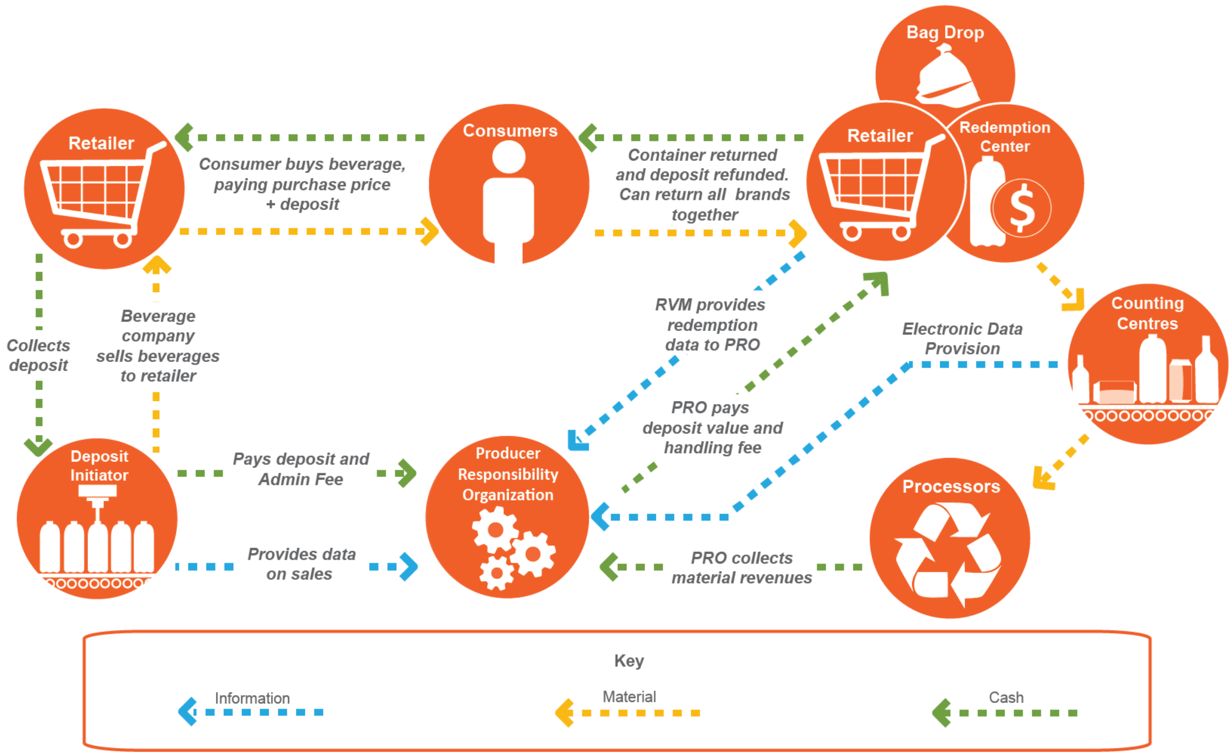
4.3.7 System Operation Summary

Figure 4-3 illustrates the money and material flows between the various stakeholders in the proposed DRS for non-alcoholic beverage containers, including the role of each stakeholder within the system.

[74] "Certified Conditioners." BGE Website. http://bge-quebec.com/en/about-us/#conditionneurs

[75] "Blue Box Program Plan Draft for Consultation." Page 26. December 2017 <http://stewardshipontario.ca/wp-content/uploads/2017/12/DRAFT-for-Consultation-Amended-Blue-Box-Program-Plan.pdf>

Figure 4-3: Proposed Non-alcohol Beverage Container DRS Map



Beverage Container Flow:

- **Full container:** The beverage manufacturer supplies full containers to the distributor, who supplies the retailer, who then supplies the consumer.
- **Empty container**: Consumers can return containers through one of four redemption methods to redeem the deposit.
  - Return to retail, manual takeback
  - Return to retail, RVMs
  - Redemption centre
  - Bag drop

  Containers are taken to the counting centres where units are verified, counted and baled, and sold to processors.

Information Flow:

- **Reporting to the PRO:** Counting centres and RVMs provide real time data electronically to the PRO. The deposit initiators also provide sales data. This information is used for payment of handling fees, calculation of producer fees, and calculation of recycling rates.

Monetary Flow:

- **Deposit**:
  - **Payment:** Deposit is initiated by the producer or distributor (deposit initiator). Deposit is paid by the retailers to the deposit initiator, and by the consumer to the retailer. The deposit is then passed to the deposit initiator and finally to the PRO.
  - **Recovery:** The deposit value is recovered when the consumer returns the container through one of the four redemption options. The redemption facility recovers the deposit value from the PRO once units have been verified through counting centres or RVM records. Unclaimed deposits remain with the PRO.
- **Handling Fee:**
  - The PRO pays the redemption facility a set handling fee as compensation for providing redemption infrastructure for the deposit containers. This may vary depending on redemption route as detailed in Section 5.2.2.
- **Material Value:**
  - Material is sold on behalf of the PRO and revenues offset the cost of operating the system.
- **Administration Fee:** Producers pay an administration fee to the various operators to cover the net cost of system operation (after material revenues and unclaimed deposits).

5.0 Impact Assessment

5.1 Collection Rate

This section outlines the performance of the current Blue Box program and considers the impact of operating a DRS for non-alcoholic beverage containers alongside the Blue Box program. The ODRP is excluded from this analysis, as the impact is the same in both scenarios.

5.1.1 Current System

5.1.1.1 Blue Box

In 2017, the overall collection rate for materials recovered through the Blue Box was 65.8%.[76] However, the rate of recycling by material varies. Printed paper and corrugated cardboard have been by far the materials most successfully recycled through the Blue Box, with rates consistently around 90%. The high rate for these materials helps to elevate the overall collection rate when compared to other materials.[77,78]

The capture rate for non-alcoholic beverage containers recycled through the curbside program is only approximately 43.1%,[79] as seen in Table 5-1 and Figure 5-1.

Table 5-1: Destination of Non-Alcoholic Beverage Containers under Current Program in Tonnes

	PET	Steel	Aluminum	Glass	Beverage Cartons	Total
Recycled	18,933	3,327	10,751	29,932	2,303	**65,245**
Residual Waste	21,411	1,048	13,649	35,476	4,134	**75,719**
Litter	2,473	471	1,826	5,418	177	**10,364**
Recycling Rate, %	44.2%	68.7%	41.0%	42.3%	34.8%	**43.1%**

[76] Stewardship Ontario (2019). "Blue Box Performance." <https://stewardshipontario.ca/blue-box-performance/>

[77] Stewardship Ontario. "Amended Blue Box Program Plan – Draft for Consultation." 2018. <https://stewardshipontario.ca/wp-content/uploads/2017/12/DRAFT-for-Consultation-Amended-Blue-Box-Program-Plan.pdf>

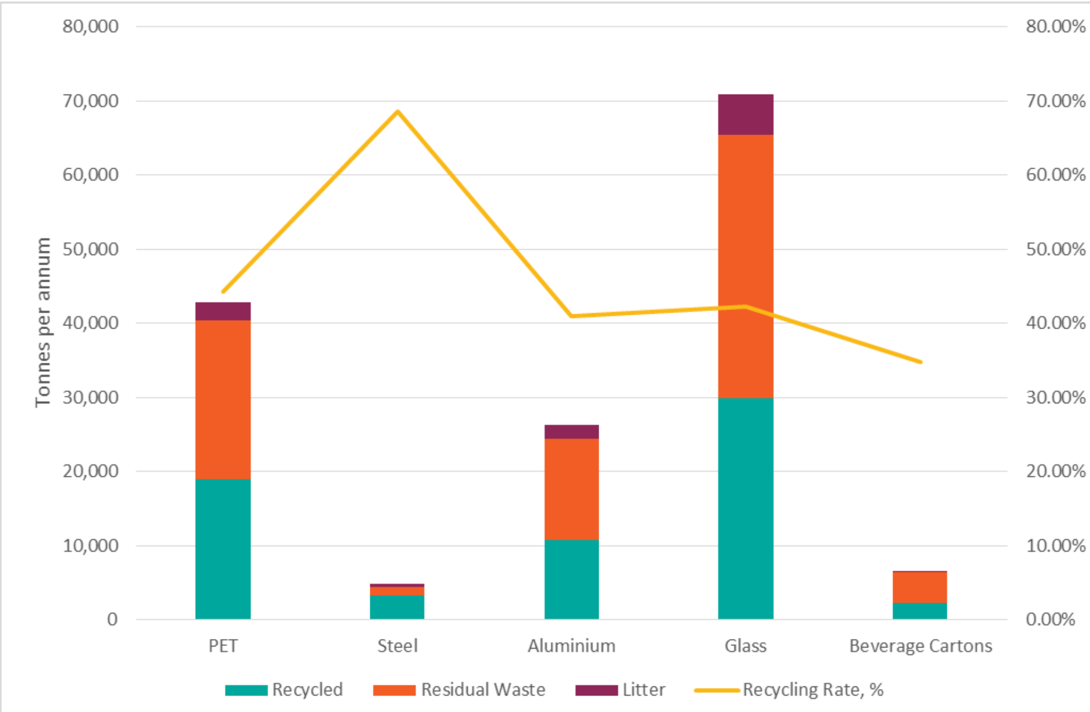
[78] 2016 PIM data, Stewardship Ontario.

[79] This percentage is based on tonnage collected plus a processing loss rate as set out in Appendix A.3.2.3.

1. *Some litter will be collected and therefore enter the waste management system*

Source: Eunomia Calculation using 2016 PIM data

Figure 5-1: Current Fate of Non-alcoholic Beverage Containers



Source: CM Consulting data, 2016 and Eunomia Calculations

The draft amended BBPP proposed an aggregate province-wide recycling target of 75%, with material specific targets as described in Table 5-2, with the shortfall from current and proposed performance predominately based on greater capture and recycling of plastics and metals.

Table 5-2: Material Specific Targets Proposed by Stewardship Ontario in the Amended Blue Box Program Plan

Material	Current Performance	Proposed Target for 2027	Necessary Improvement
Paper	94%	95%	+1.1%
Plastic	35%	50%	+42.9%
Metal	58%	65%	+12.1%

Material	Current Performance	Proposed Target for 2027	Necessary Improvement
Glass	73%	75%	+2.7%

Source: Figure 9, Draft Blue Box Program Plan, Draft for Consultation, December 2017

Currently, the high collection rate for glass, and especially paper, props up the overall recycling rate. The current plastic recycling performance needs to increase by 42.9% in order to meet the proposed targets in the draft amended BBPP, a large gap to overcome through education alone. This difference is substantial and there is no detailed mechanism described in the plan for changing consumer behaviour in order to achieve this target.

5.1.1.2 ODRP

In Ontario, the total recycling rate for alcohol deposit containers sold through The Beer Store was 87% in 2017.[80][81] Additionally, the ODRP captures 81% of non-refillable alcohol containers sold at LCBO outlets, illustrating that deposits are effective for single-use beverage containers, even those purchased from alternative locations from where they are redeemed.[82]

A strong program for non-refillable beverage containers is especially important as the use of refillables in Ontario has declined in recent years. From 2008 to 2016, the percentage of beer sold in refillable containers in Ontario dropped from 76% to 54%.[83]

Refillables have always been a strong area for deposits, and in 2015-2016, The Beer Store collected 95% of refillable beer bottles, reusing them an average of 15 times before recycling. As the percentage of refillables declines, it is pertinent that the loss in this area be compensated for in order to maintain Ontario's strong environmental standing.

5.1.2 Proposed Program

Through a convenient infrastructure and with a sufficient deposit value, a high redemption rate for beverage containers is achievable and not unprecedented.

Assuming a deposit of $0.15, the DRS in Ontario has been modelled to achieve a recycling rate of 90%. In order to achieve this target, recycling rates for all non-alcoholic beverage

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[80] Unlike for the Blue Box system, where not all recyclable material that is collected is actually recycled. The ODRP rate is considered a recycling rate as what is collected is actually recycled due to the high quality of the material.

[81] CM Consulting. "Who Pays What 2018." <https://www.cmconsultinginc.com/wp-content/uploads/2018/10/WPW-2018-FINAL-5OCT2018.pdf>

[82] https://www.ontario.ca/page/strategy-waste-free-ontario-building-circular-economy

[83] CM Consulting. "Who Pays What 2018." <https://www.cmconsultinginc.com/wp-content/uploads/2018/10/WPW-2018-FINAL-5OCT2018.pdf>

containers covered by a deposit need to increase from current rates. Setting the recycling target prior to the development of the infrastructure allows the market to determine the most efficient distribution of redemption methods across the province in order to capture the deposit material most effectively within varying geographic and demographic zones. The tonnage of material recycled and recycling rate for non-alcoholic beverage containers under a system with a DRS and Blue Box program is outlined in Table 5-3 and illustrated in

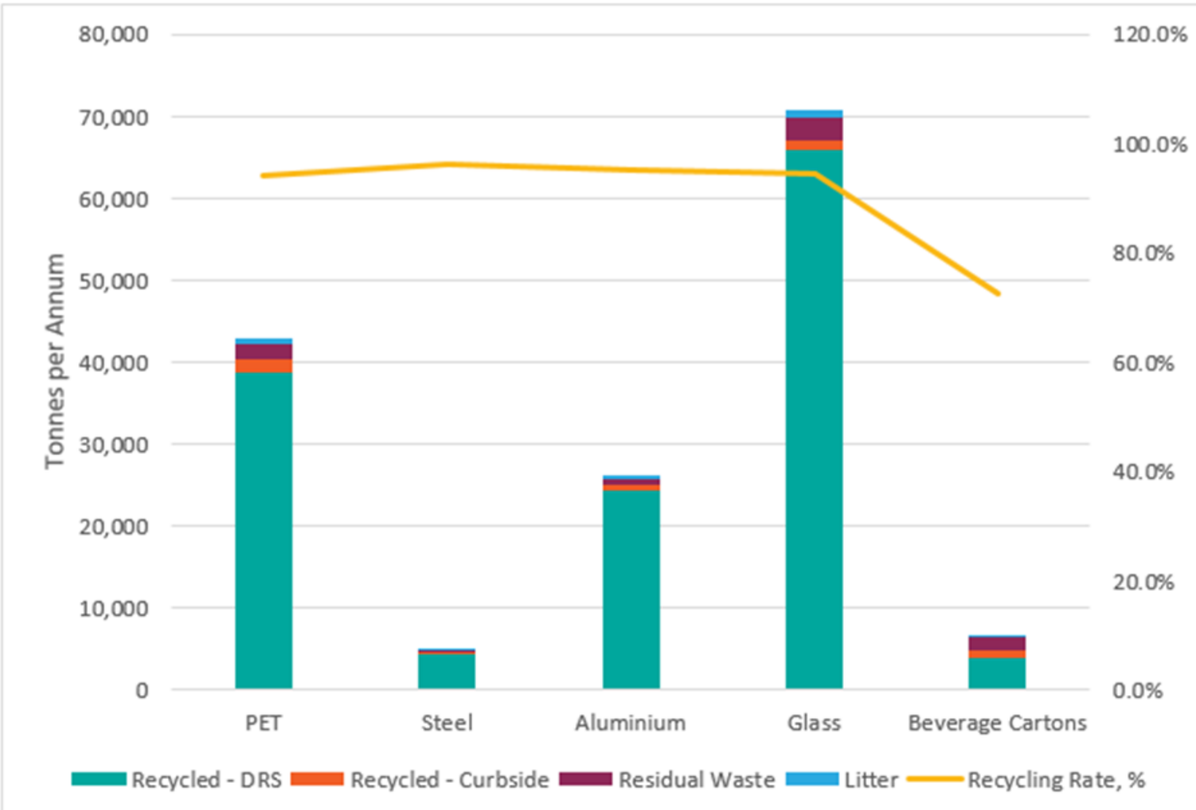
Figure 5-2.

Table 5-3: Destination of Non-Alcoholic Beverage Containers Under Proposed DRS and Blue Box Program

	PET	Steel	Aluminum	Glass	Beverage Cartons	Total
Recycled (Tonnes)	40,330	4,670	24,973	67,019	4,807	**141,799**
Residual Waste (Tonnes)	1,993	82	887	2,724	1,771	**7,456**
Litter (Tonnes)	495	94	365	1,084	35	**2,073**
Recycling Rate, %	94.2%	96.4%	95.2%	94.6%	72.7%	**93.7%**

1. *Some litter will be collected and therefore enter the waste management system*

Figure 5-2: Destination of Non-Alcoholic Beverage Containers Under Proposed DRS and Blue Box Program



Source: Eunomia calculations

The DRS delivers a recycling rate of 90% on non-alcoholic beverage containers, with a further 3.7% captured through the Blue Box program. In addition to significantly increasing the recycling rate, the DRS also reduces the volume of beverage container litter by up to 80% (see Section 5.4.4). The effect is to reduce waste disposed of by 18,330 tonnes.

5.1.3 Other Paper and Packaging Material

The Blue Box is an essential part of the recycling infrastructure in Ontario. Maintaining a robust Blue Box system helps maximize the diversion of all packaging types from the landfill. Introducing the new DRS for non-alcohol beverage containers diverts deposit containers from the Blue Box, as more consumers are incentivized to redeem their beverage containers in return for their deposits. Containers are also captured from the residual waste stream, reducing waste to landfill, which results in a reduction of GHGs, as described further in Section 5.4.5.

Removing the non-alcoholic beverage containers from the Blue Box creates space for packaging material that is not currently being captured. Table 5-4 describes the packaging materials that are expected to be captured as the proposed DRS moves non-alcoholic beverage containers out of the Blue Box and creates space for additional materials. Educational campaigns encouraging residents to return DRS material, and to maximize the effectiveness of their Blue Boxes by increasing recycling of all accepted materials, especially those that are currently recycled less effectively, helps ensure that modelled rates are achieved.

Table 5-4: Current and Future Capture Rates of Selected Materials in the Blue Box

Material	Aseptic Containers	Boxboard	HDPE	Steel Aerosols	Other Aluminum (not beverage cans)
Current	25.8%	51.7%	45.5%	43.9%	19%
Future	60%	80%	55%	55%	50%

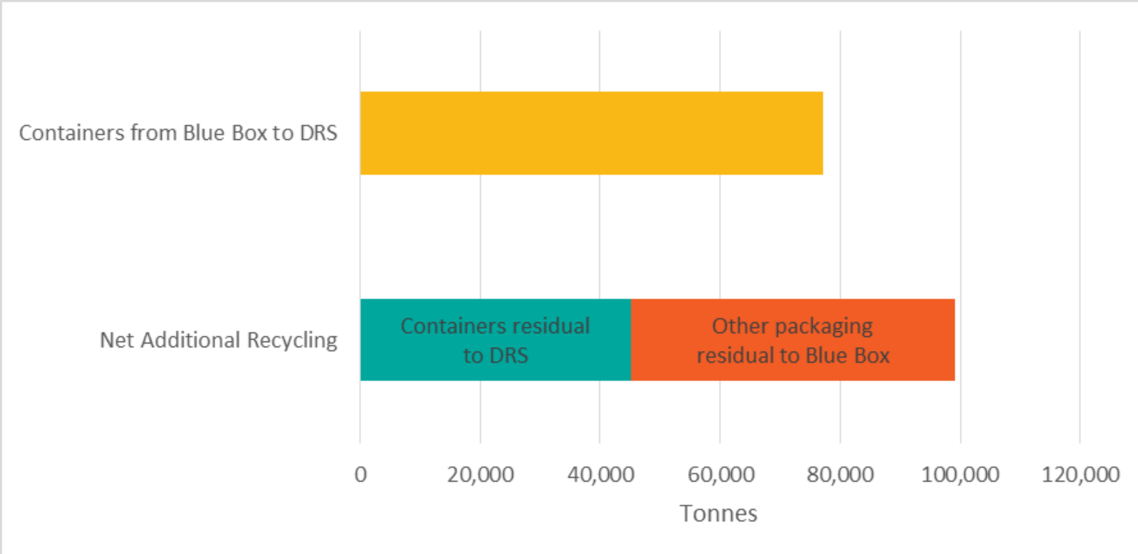
Source: 2016 PIM data and Eunomia assumptions.

The recycling rates assumed for HDPE, steel aerosols and other aluminum items in this model are less than the material-specific targets that were set out in the draft amended BBPP, seen in Table 5-2. The conservative capture rate for HDPE used in the model is offset by higher recycling rates delivered through the DRS for PET, which is the most common material for non-alcoholic beverage containers.

5.1.4 Whole System

Figure 5-3 summarizes the movement of material from the Blue Box and residual waste stream to the DRS as well as the additional movement of material from the residual waste stream to the Blue Box. With the movement of this material, the collection rate (of the Blue Box and proposed DRS) increases from 65.8% to 73.9%.

Figure 5-3: Additional Recycling Tonnage from Combined Blue Box and DRS



Source: Eunomia calculations

5.2 Costs and Revenues

5.2.1 Current System

5.2.1.1 Blue Box

The cost of the Blue Box program in 2016 was $252M, as described in Table 5-5. This cost was for recycling 836,227 tonnes of material.

Table 5-5: Cost for Blue Box Program 2016

Program Item	Total Cost ($)	Cost per Tonne ($)
Collection Costs	181,406,633	216.93
Processing Costs	113,615,059	135.87
Transfer and Depot Costs	26,619,844	31.83
Promotion and Education Costs	8,017,489	9.59
Interest on Municipal Capital	5,154,091	6.16
Administration Costs	12,186,689	14.57
Gross Costs	346,999,803	414.96
Revenue	- 95,056,481	-113.67
Net Costs	**251,943,322**	**301.29**

Source: Blue Box 2016

Half of this cost was covered by producers. Under a fully-funded EPR model, producers will cover 100% of these costs.

Municipalities currently cover the other 50% of Blue Box program costs. They also cover the total cost of collecting, transferring and disposing of PPP that ends up in the residual waste stream and is not recycled. The cost of this is approximately $55M. An estimate of the total cost to municipalities for managing PPP in 2016 is provided in Table 5-6. Please note that this table does not show any transfer or overhead costs, which are included in the Blue Box costs in Table 5-5.

Table 5-6: Cost to Municipalities for Managing Printed Paper and Packaging (PPP) (Recycled and Disposed)

Item	2016 Costs ($M)
Residual Waste Collection of PPP[84]	24.60
Residual Waste Disposal of PPP[85]	30.36
Cost of Blue Box Program (municipality-funded portion)	120.09
Total Cost to Municipalities for Collection, Treatment, Recycling and Disposal of PPP	148.25

Source: 2016 PIM data and 2014/15 Curbside Material Composition Study, Stewardship Ontario.

5.2.1.2 ODRP

For the fiscal year ending March 31, 2016, the service fees to The Beer Store totalled $41.0 million (including $4.7 million of HST).

5.2.2 Proposed Program

The proposed program modelled and presented in this section is for a DRS for non-alcoholic beverage containers, plus an optimized Blue Box program based on every other week collections (as proposed in the draft amended BBPP) and increased capture rates for the materials listed in Table 5-4.

5.2.2.1 DRS

The DRS operating costs include:

- Billing and system administration (provided by the PRO);

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[84] Based on 17% of residual being PPP, defined in 2014-2015-Curbside-Material-Composition-Study-March-22-16 – Single Family Property

[85] Based on 17% of residual being PPP, defined in 2014-2015-Curbside-Material-Composition-Study-March-22-16 – Single Family Property

- Handling fees paid to retailers and redemption centres to cover the cost of providing the redemption network;
- Transport from the redemption network to counting centres and from counting centres to third party processors; and
- Counting and minor processing.

These costs are offset by the following sources of revenue:

- Material revenue;
- Unredeemed deposits; and
- Producer administration fees which bridge the gap between the system operating costs and the above two revenue streams.

PRO Administrative Costs

The PRO, appointed by the beverage industry, oversees producers' obligations under the fully-funded EPR model. High-level costs for the administrative functions of the PRO have been estimated based on the experience of similar central operations in Oregon (U.S.) and Europe. Assumed annual costs are shown below in Table 5-7.

Table 5-7: Producer responsibility Organization Cost Summary

Costs	Cost ($M)	Note
Annualized Depreciation of Set Up	6.91	Includes IT database, office furniture and equipment, project management and communication estimated to be $40M
Staff	0.77	Budget for up to 11 staff across accounting/database and consumer service
Office Space	0.05	$12.1k per person per annum based on average Ontario rent[86] and an allowance of 30m^2 per staff member, plus a similar amount of associated office expenditure
Administration	1.0	Includes IT, finance, legal, staff expenses and utilities

[86] Toronto Real Estate Board, "GTA REALTORS® Release Commercial Market Statistics," *Globe* Newswire, May 3, 2017. <https://globenewswire.com/news-release/2017/05/03/978083/0/en/GTA-REALTORS-Release-Commercial-Market-Statistics.html>

Costs	Cost ($M)	Note
Marketing and Communication	1.0	Promoting and educating the public on the program including social media
Total	**9.73M**	

Source: Eunomia Calculations

Included within the set-up costs in the table above are staff, legal and capital costs associated with:

- Set-up of the PRO, including: the establishment of the organization, developing the counting centre model, and procuring financing;
- Constructing the system, including building the container database, clearinghouse and billing systems;
- Procuring logistics and transport providers;
- Stakeholder communication, enrollment and wider public advertising;
- Staff recruitment;
- Database population; and
- Legal and consultant fees.

The set-up costs have been depreciated over 10 years without interest.

Handling Fee

Handling fees vary by DRS. In Quebec, for example, retailers receive a flat $0.02 per unit handling fee, whereas in Alberta, handling fees differ according to material stream.[87] In this model, the proposed handling fee for Ontario was calculated using a 'bottom-up' approach based on considerations of the costs incurred. This enables an estimate of the 'correct' handling fee, which assumes that those running the redemption infrastructure are fully reimbursed for their costs.

Handling Fee to Retailer

Retailer costs associated with maintaining infrastructure and collecting containers are recovered through the handling fee. The cost to retailers operating RVMs is higher than the cost to retailers that choose manual, over the counter, redemption due to the costs of leasing and maintaining the RVMs, plus additional space and labour costs. However, RVMs reduce the costs of other parts of the system, such as through compacting containers, which reduces

[87] BCMB (2019). "Handling Commission." <https://www.bcmb.ab.ca/depot-owners-operators/depot-fees-handling-commissions/>

collection costs. RVMs can also verify container units at the point of redemption, which mitigates the need for the units to be verified at counting centres, further reducing costs. On this basis, the calculated flat rate handling fee for retailers in Ontario under this scenario has been calculated as $0.0441 for retailers with RVMs and $0.0073 for retailers that choose manual take-back. A differential handling fee model is designed to reward retailers that choose RVMs, which reduces overall system costs. The decision as to whether to have a flat rate handling fee or variable one is up to the PRO. The cost breakdown for each retailer type is summarized in Table 5-8.

Table 5-8: Retailer Handling Fee Calculations per Container

Cost Element	RVM (cents)	Manual (cents)
Space Costs	0.597[88]	0.264
Labour Costs (Pickup/unload, Emptying Bins, Cleaning Machines, Processing Receipts)	0.864	0.378
RVM and Maintenance Costs	2.866	-
Container Costs	0.084	0.084
Total	**4.41**	**0.73**

Source: Eunomia Calculations

Handling Fee to Redemption Centres

The handling fee is the only source of revenue for redemption centres. Redemption centres can cater to bulk redeemers, such as private operators collecting from hotels and restaurants, and operate at a lower cost than the return-to-retail network.

Table 5-9 contains a breakdown of costs used to calculate the per container handling fee.

Table 5-9: Redemption Centre Handling Fee Calculations per Container

Cost Element	Total Cost ($M)	Cost Per Container Redeemed (cents)
Space Costs	3.95	0.490
Labour Costs	11.62	1.489

[88] The RVM space cost is made up of two elements, RVM floorspace and storage space, whilst the manual space cost is only made up of storage space. Storage space is set to the same for both RVM and manual (1m2), but the RVM floorspace is considerably higher (10m2).

Cost Element	Total Cost ($M)	Cost Per Container Redeemed (cents)
Container Costs	0.68	0.083
Overhead Costs	3.32	0.412
Total	**19.57**	**2.48**

Source: Eunomia Calculations

Bag Drop Costs

Bag drops are standalone units that do not require full-time staff. Therefore, they incur minimal labour and maintenance costs, and much smaller initial set-up costs than either return to retail with RVM or redemption centres.

The operating costs of the bag drop system in Oregon (Bottle Drop Express) was used as the basis of the proposed system for Ontario. Table 5-10 summarizes the costs modelled. Further detail on how the costs were calculated can be found in Appendix A.3.3.5.

Table 5-10: Bag Drop System Cost Summary

	Total Cost ($M)	Cost Per Container Redeemed (cents)
Space Costs	3.95	0.368
Labour Costs	1.70	0.158
Container Costs	0.91	0.084
Overhead Costs	0.85	0.079
Total	**7.41**	**0.69**

Source: Eunomia Calculations

It is also worth noting that in Oregon's Bottle Drop program, consumers pay USD $0.20 (equivalent to CAD $0.27) to buy each bag that they fill, and also pay a USD $0.35 (equivalent to CAD $0.47) sorting fee per bag. These fees fund the bag drop system. We have not included these revenue streams in our analysis; if included they would generate an estimated revenue of $690k in bag sales and $1.2M in sorting fees per year.

Collection Costs

Factors impacting the cost of transporting containers from redemption locations to counting centres and/or processors include the number and volume of containers and whether containers are compacted or uncompacted.

These factors impact on the number and type of collection vehicles and the required pickup frequency. The assumptions around these calculations are detailed in Appendix A.2.0 and summarized in Table 5-11. RVMs help to bring down the average collection cost by compacting containers, so fewer trips are needed to collect a larger volume.

Table 5-11: Collection Cost Summary

	Total System Costs ($M)	Average Cost Per Container (cents)
Collection	**44.89**	**1.19**

Source: Eunomia Calculations

Counting Centre, Sorting and Processing Costs

Three regional counting centres have been modelled for the proposed DRS. All material collected manually through retailers, bag drop and redemption centres is processed through a counting centre so that the containers can be verified, sorted and in some cases baled.

Costs have also been included for the bulking of material at intermediary locations between regional depots and counting centres. It is assumed that much of the required infrastructure would already exist as depots used for municipal collections. Therefore, costs have been modelled on the assumption that the owners of the already existing infrastructure would be reimbursed for the space and labour costs required to handle the additional material. This is based on an assumption of four intermediary locations being required, assuming four employees per site. This totals an additional $643,951 in labour costs and an additional $274,134 in space costs.

The counting centre costs are summarized in Table 5-12.

Table 5-12: Counting Centre Cost Summary

	Total Costs ($M)	Average Cost Per Container (cents)
Counting Centre Operating Costs	7.46	
Annualized Investment Cost	1.73	
Total	9.18	0.36

Source: Eunomia Calculations

Although containers redeemed through RVMs do not need to go through counting centres, there is a further $3.24M associated cost to sort compacted mixed plastics and cans coming from RVMs.

Material Revenues

Table 5-13 summarizes the expected value from the sale of materials processed through the DRS, which is expected to total $63.36M per year. It should be noted that material collected through a DRS program typically attracts a higher value than the same material resulting from a single stream MRF.

Table 5-13: Material Revenues

Material	Revenue per Tonne ($)[89]	Total Revenue ($M)
Glass Bottles	-39	-2.62
Plastic Bottles	486	18.94
Steel Cans	326	1.48
Aluminum Cans	1,847	45.28
Beverage Cartons	72	0.28
Total		**63.36**

Source: Eunomia Calculations

Unclaimed Deposits

As in all DRSs, some containers will not be returned for a refund of the deposit. Some will be recycled through the Blue Box system, disposed of in the trash, or discarded as litter, leaving those deposits unclaimed. These unclaimed deposits are retained by the PRO. At a 90% redemption rate, approximately 421 million beverage containers per year across Ontario will not be redeemed, which will generate $45.87M of revenue.

Standalone Cost of the DRS for Non-Alcoholic Beverages

Table 5-14 summarizes the total costs and revenues of the modelled DRS for non-alcoholic beverage containers. The modelled producer cost is $0.0131 per unit redeemed.

[89] https://thecif.ca/wp-content/uploads/2018/09/2018-August-Price-Sheet.pdf

Table 5-14: Breakdown of Producer Administration Fee by Net System Costs for DRS

	Total Cost ($M)	Cost per Container Redeemed (cents)	Cost/Kg Redeemed (cents)	Cost/Kg Placed on the Market (cents)
PRO	9.73	0.26	0.70	0.64
Handling Fees - Retailers, Redemption Centres, Bag Drops	93.96	2.49	6.75	6.21
Transport Costs	44.89	1.19	3.23	2.97
Counting Centre Costs	12.38	0.33	0.89	0.82
Materials Income	-63.35	-1.68	-4.55	-4.19
Unclaimed Deposits	-68.81	-1.82	-4.94	-4.55
Fraudulently Claimed Deposits	5.67	0.15	0.41	0.37
Net Cost	**34.48**	**0.91**	**2.48**	**2.28**
Funded by Producer Administration Fee	**-34.48**	**-0.91**	**-2.48**	**-2.28**

Source: Eunomia Calculations

The $0.0091 modelled here shows that the already cost-efficient Ontario system fares even better with the addition of a DRS for non-alcoholic beverage containers. One of the factors that makes the proposed Ontario system cost efficient is the higher deposit. The unclaimed deposits, although only associated with less than 10% of total units sold, cover over 40% of the cost of the DRS. If the deposit was $0.10, the unredeemed deposits would only cover approximately 25% of costs.

Table 5-15 shows the total system costs, listed above, by material stream. Because of their high sales value, aluminum cans result in a negative cost to the system, which means that theoretically producers of beverages in aluminum cans would receive an income from the system. This is similar to the Norwegian approach, where producers pay for every container they place on the market, by material type.[90] The fee structure is additionally used to incentivize eco-design and ensure that producers who use materials with a lower value or that are less easily recycled pay for the additional costs of dealing with that material.

[90] Infinitum (2019). <https://infinitum.no/kostnadskalkulator >

Table 5-15: Breakdown of System Costs (Producer Administration Fee), by Material, Per Container and Per kg of Containers Redeemed.

	Total Cost ($M)				Cost per Container Redeemed (cents)				Cost/Kg Redeemed (cents)			
	PET	Metal	Glass	Beverage Cartons	PET	Metal	Glass	Beverage Cartons	PET	Metal	Glass	Beverage Cartons
Producer Responsibility Organization	3.42	4.83	0.72	0.77	0.25	0.25	0.24	0.39	8.78	16.63	1.06	19.75
Handling Fees - Retailers, Redemption Centres, Bag Drops	35.43	45.69	7.74	5.10	2.64	2.34	2.63	2.63	90.94	157.30	11.50	131.56
Transport Costs	26.40	12.35	3.97	2.17	1.96	0.63	1.35	1.12	67.75	42.50	5.90	56.08
Counting Centre Costs	4.35	6.15	0.91	0.97	0.32	0.32	0.31	0.50	11.17	21.16	1.35	25.13
Materials Income	-18.94	-46.76	2.62	-0.28	-1.41	-2.40	0.89	-0.14	-48.60	-160.98	3.90	-7.20
Unclaimed Deposits	-24.18	-34.15	-5.07	-5.42	-1.80	-1.75	-1.72	-2.79	-62.06	-117.57	-7.53	-139.65
Fraudulently Claimed Deposits	2.02	2.92	0.44	0.29	0.15	0.15	0.15	0.15	5.17	10.07	0.66	7.50
Net Cost	**28.50**	**-8.97**	**11.34**	**3.61**	**2.12**	**-0.46**	**3.86**	**1.86**	**73.14**	**-30.90**	**16.85**	93.17
Funded by Producer Administration Fee	**-28.50**	**8.97***	**-11.34**	**-3.61**	**-2.12**	**0.46**	**-3.86**	**-1.86**	**-73.14**	**30.90***	**-16.85**	-93.17

*Source: Eunomia Calculations. * possible payment to producers of aluminum containers*

The current costs of the Blue Box program per kilogram of glass, PET, aluminum is provided in Table 5-16. As a whole, the cost per kilogram of material placed on the market is less for the DRS than for the current Blue Box system, at $0.0228 as show in Table 5-14.

Table 5-16: Cost of Material in Blue Box Program

Material	Cost (cents/Kg)
Glass – Clear	7.54
Glass – Coloured	12.32
PET	31.94
Aluminum	6.66

Source: Stewardship Ontario, 2016 PIM data

5.2.2.2 Curbside Service

A DRS for non-alcoholic beverages removes material from both the Blue Box and the residual waste stream. This presents two main opportunities:

1) The potential to reduce curbside recycling and residual collection frequency;
2) The potential to capture additional quantities of other packaging material that currently have low capture rates, such as HDPE and boxboard.

Collection Costs

The collection method (single or multi-stream) and frequency (weekly or every other week) of curbside pickup varies across municipalities. Table 5-17 summarizes the number of households that have multi- or single-stream collections in urban and rural locations across Ontario and the frequency of those collections. Households in communities that do not receive a curbside service have access to drop-off facilities.

Table 5-17: Overview of Curbside Service Provision

Category	Stream	Frequency	Total Households	Curbside Households
Urban	Multi	52 (weekly)	1,756,504	1,751,816
Urban	Multi	26 (every other week)	249,417	249,417
Urban	Single	52	1,072,796	1,072,796
Urban	Single	26	921,911	921,911
Rural	Multi	52	493,914	435,159
Rural	Multi	26	133,076	108,048
Rural	Single	52	318,731	296,734
Rural	Single	26	119,879	119,879
Total			**5,066,228**	**4,955,760**

Source: Eunomia calculation using 2016 Blue Box Cost & Revenue Report and provided models

To ascertain the cost and resource impact on both curbside Blue Box and residual waste services, two scenarios were considered;

1) Savings from change in volume; and
2) Savings resulting from reduced pickup frequencies (those municipalities currently on weekly collection moving, where possible, to every other week collections), as proposed in the draft amended BBPP.

As discussed below, the savings from these changes are relatively high, but reflect the detailed data used to model the vehicle and labour costs associated with municipal waste collection for every municipality in Ontario.[91]

In Ontario, currently approximately 52% of municipalities[92] have a pay-as-you-throw (PAYT) system that charges for waste disposal based on the volume disposed – whether through different costs for different sized curbside collection bins, as in Toronto,[93] or by requiring residents to purchase special garbage bags for curbside pickup, as in Wellington County.[94] Changing the frequency of curbside collection may affect fees and charges for PAYT programs, and/or may have capital impacts on bin infrastructure in non-PAYT communities, as larger bins may be needed for less frequent collection. Further analysis on bin sizing is

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[91] Based on average Ontario residential collection costs, by municipality, established from confidential commercial information.
[92] Based on calculations from Stewardship Ontario data.
[93] City of Toronto. "Toronto Garbage Bin Sizes and Fees." < https://www.toronto.ca/services-payments/recycling-organics-garbage/houses/garbage-bin-sizes-fees/>
[94] Wellington County. "Garbage and Recycling – Curbside Collection." < https://www.wellington.ca/en/resident-services/SWSCurbside-Collection.aspx>

recommended in subsequent analysis. Additional costs or changes to fee structures have not been factored into this model.

Collection costs could be reduced further if route optimization was carried out based on removal of municipal boundaries, however these potential savings have not been included in the analysis. Additionally, Ontario's food waste diversion goals identified in the *Reducing Litter and Waste in Our Communities*: *Discussion Paper* and Ontario's *Climate Change Action Plan* will further reduce the volume of residual waste and reduce the necessary frequency of curbside waste collection as separate food waste collection programs become more common.[95] The discussion paper *Addressing Food and Organic Waste in Ontario* notes that approximately 70% on Ontario's population is covered by municipalities that offer curbside organic waste collection. Increasing the percentage of food waste that is collected through these programs, as well as expanding them to the rest of the province will be a large shift from current practices.[96] Adding the collection of food waste has also been proven to increase the overall sorting and proper recycling of dry materials as well, further reducing the volume of recyclable material in the residual trash stream.[97]

Collection Savings Resulting from Change in Material Volume

Table 5-18 summarizes the reduction in collection labour and resources and the associated savings resulting from the removal of DRS material from the curbside.

Table 5-18: Curbside Collection Savings Resulting from Reduced Volume

Category	Stream	Collection Frequency (Weeks per Annum)	Curbside Recycling		Residual Waste Curbside		Overall Savings (Vehicles and Labour) ($M)
			Baseline	Future DRS	Baseline	Future DRS	
			Vehicles	*Vehicles*	*Vehicles*	*Vehicles*	
Urban	Multi	52	460	446	392	376	4.1
Urban	Multi	26	45	45	40	39	0.19
Urban	Single	52	237	228	203	194	2.4
Urban	Single	26	318	314	128	122	1.4
Rural	Multi	52	136	132	135	129	1.4

[95] Government of Ontario. February 2017. "Strategy for a Waste-Free Ontario: Building the Circular Economy." <https://files.ontario.ca/finalstrategywastefreeont_eng_aoda1_final-pdf>

[96] Ontario Ministry of the Environment and Climate Change. "Addressing Food and Organic Waste in Ontario" <www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2017/013-0094_DiscussionPaper.pdf>

[97] European Commission. "Assessment of separate collection schemes in the 28 capitals of the EU." Page 29. November 13, 2015. <http://ec.europa.eu/environment/waste/studies/pdf/Separate%20collection_Final%20Report.pdf>

Category	Stream	Collection Frequency (Weeks per Annum)	Curbside Recycling		Residual Waste Curbside		Overall Savings (Vehicles and Labour) ($M)
			Baseline	Future DRS	Baseline	Future DRS	
			Vehicles	*Vehicles*	*Vehicles*	*Vehicles*	
Rural	Multi	26	34	33	34	33	0.22
Rural	Single	52	101	98	96	92	0.92
Rural	Single	26	34	33	33	32	0.31
			1,365	**1,329**	**1,061**	**1,016**	**10.9**
						Overall Savings:	**3%**

Source: Eunomia calculation using the 2016 RPRA Datacall and provided models

Collection Savings Resulting from Move to Every Other Week Collections Plus Change in Volume

Data on current collection systems and costs was used to calculate the number of households, in rural and urban areas, that could transition to 'every other week' curbside recycling and residual collections. Both vehicle capacity and proximity to tipping point were considered when determining the viability of every other week collections and ultimate pass rates. Savings from both reduced volume and a shift, where possible, to less frequent collections is set out in Table 5-19. This results in an 18% reduction in curbside collection costs for both recycling and residual waste, based on vehicle and labour cost reductions.

Table 5-19: Curbside Collection Savings Resulting in Reduced Volume and Move to Bi-weekly Collections

Category	Stream	Collection Frequency (Weeks per Annum)	Curbside Recycling		Curbside Residual Waste		Overall Savings (Vehicles and Labour) ($M)
			Baseline	Future DRS	Baseline	Future DRS	
			Vehicles	*Vehicles*	*Vehicles*	*Vehicles*	
Urban	Multi	52	460	331	392	281	32.7
Urban	Multi	26	45	45	40	39	0.19
Urban	Single	52	237	171	203	146	16.9
Urban	Single	26	318	314	128	122	1.4
Rural	Multi	52	136	129	135	125	2.3

Category	Stream	Collection Frequency (Weeks per Annum)	Curbside Recycling		Curbside Residual Waste		Overall Savings (Vehicles and Labour) ($M)
			Baseline	Future DRS	Baseline	Future DRS	
			Vehicles	*Vehicles*	*Vehicles*	*Vehicles*	
Rural	Multi	26	34	33	34	33	0.22
Rural	Single	52	101	95	96	89	1.6
Rural	Single	26	34	33	33	32	0.31
			1,365	**1,151**	**1,061**	**866**	**55.7**
					Overall Savings:		**18%**

Source: Eunomia calculation using 2016 RPRA Datacall and provided models

Blue Box and Residual Waste Cost Comparison

The impact of the change in material flow and reduced frequency of curbside collections is highlighted in Table 5-20. This does not include transfer costs or other system costs, such as administration and promotions related to residual waste collection, as this information was not available. Although there is a loss of revenue associated with the movement of beverage containers from the Blue Box to the DRS, this loss in revenue is offset by reduced collection, transfer and disposal costs.

5.2.2.3 Total Cost of Proposed New System

With both the DRS for non-alcoholic beverage containers and the modernized Blue Box system considered, Table 5-20 summarizes the operating costs of the current system (Blue Box only) versus that of operating the future proposed program (since the ODRP remains the same in both scenarios, costs are not included). Table 5-21 breaks down the cost per tonne of material recycled.

Table 5-20: Comparison of Operating Costs

Service Area	Activity	Cost of Current Service ($M)	Cost of Future Service (with move to every other week curbside collection) ($M)	Change ($M)
Curbside[98]	Cost of recycling collection	186.17	156.80	-29.36
	Cost of recycling treatment	115.41	112.55	-2.85
	Cost of transfer (recycling only)	27.02	26.35	-0.67
	Other costs (promotions, administration from BB cost revenue recycling only)	25.76	25.12	-0.64
	Material revenue	-96.37	-94.15	2.22
	Cost of residual collection (% of costs associated with PPP)	24.60	15.90	-8.70
	Cost of residual disposal (% of total cost associated with PPP)	30.36	23.01	-7.36
	Curbside Subtotal	312.94	265.59	-47.35
DRS – Non-Alcoholic Beverages	Producer responsibility organization	0	9.73	9.73
	Handling fees - retailers, redemption centres, bag drops	0	93.96	93.96
	Transport costs	0	44.89	44.89
	Counting Centre and Sorting Costs	0	12.38	12.38

[98] Excludes interest on capital that is included in Table 5-11: Collection Cost Summary

Service Area	Activity	Cost of Current Service ($M)	Cost of Future Service (with move to every other week curbside collection) ($M)	Change ($M)
	Materials Income	0	-63.35	-63.35
	Unclaimed Deposits	0	-68.81	-68.81
	Fraudulently Claimed Deposits	0	5.67	5.67
	DRS Subtotal	0	34.48	34.48
System Costs		312.94	300.07	-12.87

Source: Eunomia calculations

Table 5-21: Cost of Material Recycled

	Current ($)	Proposed DRS and Blue Box ($)
Total Cost of System	312.94M	300.07M
Tonnes Recycled (DRS and all Blue Box)	996,854	1,114,421
Cost per Tonne of Material Recycled	312.94	269.26
% of Total Packaging Recycled	**65.8%**	**73.9%**

Altogether, the cost of the new system is almost $12.9M per annum less than the current Blue Box program. This is a result of: a) savings delivered through moving from weekly to every other week curbside collections; and b) the cost of the deposit program being almost completely covered by material revenue and unredeemed deposits. The cost of recycling per tonne of packaging falls by 14%, and the overall recycling rate increases from 65.8% to 73.9%. In addition, revenue from the sale of bags for the bag drop program, not included here, would further reduce costs (Section 4.3.4).

There are additional environmental and socio-economic benefits to implementing a DRS that, when monetized, further support implementing a DRS for non-alcoholic beverage containers in Ontario. These benefits are summarized in Sections 5.3 and 5.4.

5.3 Socio-Economic Impacts

The potential employment impacts associated with the introduction of a DRS for non-alcoholic beverage containers were also calculated as part of the overall cost benefit analysis. While some jobs, such as those related to system administration, are full-time roles directly supported by the DRS, others, such as those within retailers, may only have a portion of their time associated with supporting the system. Therefore, the hours spent by individuals engaging with the system were used to calculate the number of full-time equivalent (FTE) jobs.

The number of FTE staff employed under the current municipal Blue Box recycling and residual waste programs is 7,105 direct FTE jobs.

Indirect jobs can be created through activity associated with the direct functioning of the system (e.g. a recycling plant purchasing container processing equipment). All indirect jobs calculated are those which occur within Ontario as a result of the current system.

Induced effects are changes in household consumption arising from changes in employment and associated income (which in turn results from direct and indirect effects) in Ontario. For example, these may include additional spending by workers at the recycling plant with their wages, as well as additional spending by equipment manufacturers with income received from sales to the recycling plant.

An economic impact multiplier can be used to determine indirect and induced effects from the initial direct jobs.[99] Altogether, there are 12,576 total direct, indirect and induced FTE jobs created by the current system in Ontario.

The total number of FTEs employed under the optimized Blue Box recycling program, residual waste curbside and new DRS for non-alcoholic beverages is 14,064 direct, indirect and induced FTE jobs, a 12% increase over the current system.

Table 5-22: Number of Direct, Indirect and Induced Jobs Resulting from the New System

Job Activity	Number of Jobs Created by Current System	Number of Jobs Created by Proposed System
Curbside		
Blue Box Collection	2,121	1,733
Residual Waste Collection	2,729	2,301
Sorting at MRF	423	426
Secondary Processing	-	-
Plastic	685	881

[99] In this study an economic impact multiplier of 1.77 is applied to estimate the indirect and induced effects.

Job Activity	Number of Jobs Created by Current System	Number of Jobs Created by Proposed System
Glass	257	348
Aluminum	117	284
Steel	166	184
Beverage Cartons	349	442
Paper	25	29
Landfill	217	209
Incineration	15	14
Subtotal Curbside	**7,105**	**6,851**
Non-Alcoholic DRS		
Retail	-	331
Redemption Centres	-	42
Bag Drops	-	286
Collection	-	221
Further Haulage	-	44
Producer Responsibility Organization	-	11
Counting Centres	-	161
Subtotal DRS	**-**	**1,095**
Total Direct	**7,105**	**7,946**
Total Indirect and Induced	**5,471**	**6,118**
Total Direct, Indirect and Induced	**12,576**	**14,064**

Source: Eunomia calculations

Gross Value Added (GVA) is a measure of the value of goods or services added in a sector of the economy. The model created for this study used the income approach to measuring GVA. The income approach to calculating GVA sums up all of the income earned by individuals or businesses involved in the production of goods and services. The main components of income-based GVA are:

- compensation of employees;
- gross operating surplus (includes gross trading profit and surplus, mixed income, non-market capital consumption, rental income, less holding gains); and
- taxes (less subsidies) on production (excludes taxes on products).

Income-based GVA is a common approach to measuring the contribution of a sector to the overall Gross Domestic Product of a region.

The GVA from the current program is $709.74M. Additionally, the government gains $58.84M in tax revenue.

In the new, combined system, the GVA to the economy is $800.54M, and total tax revenue is $66.60M.

In total, the new program yields a combined additional $90.80M to the economy over the current system and results in an additional 1,488 direct, indirect and induced FTE jobs.

Due to the increase in material throughput in the proposed DRS, there is less material going through the curbside system – both the residual waste and the Blue Box. The decrease in material throughput in the curbside system leads to the loss of some jobs from the collection of municipal waste and recycling at the curbside. However, with an increase of 1,488 FTE jobs over the current system, the proposed DRS more than compensates for the loss of jobs in the curbside system.

5.4 Environmental Impacts

Environmental impacts associated with the introduction of a DRS arise from the following processes:

1) Recycling of additional beverage containers;
2) Reduction in disposal of beverage containers;
3) Additional collection and transportation of containers to recyclers; and
4) Reduction in impact to personal amenity associated with litter.

Each of these processes is described in further detail in the Sections below.

The two main elements impacted by processes 1) to 3) and quantified in this model are GHG emissions and air quality impacts. The approach to valuing these two elements is described in Sections 5.4.1 through 5.4.3, with further detail in Appendix A.3.5.

An additional environmental consideration relates to the amenity impact associated with litter. There is a dearth of relevant studies detailing the process to value this benefit, but it is simply too important, in our view, to be assigned (implicitly) a zero value. Our approach to assigning a cost benefit for the reduction in litter associated with a DRS for non-alcoholic beverages is outlined in Section 5.4.4.

5.4.1 Recycling of Beverage Containers

GHG emissions factors for recyclables were taken from the Waste and Resources Assessment Tool for the Environment (WRATE), an environmental model that is used to assess the environmental impacts of waste management activities.[100] Whereas a number of studies have considered the climate change benefits of recycling, much less data are publicly available regarding the air quality impacts of recycling. A cost benefit analysis of landfill bans undertaken by Eunomia provides information on a limited number of pollutants, derived

[100] WRATE (2019). <http://www.wrate.co.uk/>

from the studies included within its review and other leading sources on life cycle analysis.[101, 102]

The resulting values used to calculate GHG and air quality damage costs are in Table 5-23.

Table 5-23: GHG and Air Emissions Impacts from Recycling

Material	Kg of emissions per tonne of recycled material						Total Monetized Impact ($/tonne)
	CO_2	PM2.5	SO_2	NO_x	NH_3	VOCs	
Plastic	-1,150	-0.11	0.005	-2.27	0.01	-3.51	-72
Glass	-169	-0.04	-0.03	-0.59	-0.15	-0.05	-14
Steel	-1,623	-0.78	-0.01	-2.70	-0.07	-0.25	-110
Aluminum	-10,721	-4.62	-0.01	-18.00	-0.15	-2.20	-715
Beverage Cartons*	-925	-0.28	0.00	-1.89	-0.01	-0.86	-61
* Note that beverage carton impacts are based on the following composition: 21% plastic, 4% aluminum, 75% paper.							

Sources: WRATE2 / Prognos / Environmental Resources Management / Ecoinvent; The Alliance for Beverage Cartons and the Environment (2014) What are Beverage Cartons? Accessed 5th December 2014, http://www.ace.be/beverage-cartons/what-are-beverage-cartons

5.4.2 Disposal of Beverage Containers

To determine the impact of reducing the amount of material sent to the landfill, emissions factors for landfilling were taken from the aforementioned landfill bans study. [103] Air quality damage costs were calculated using the values discussed in Section 5.4.1. The GHG and air quality impacts are given per tonne of waste landfilled in Table 5-24.

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[101] Eunomia (2010) *Landfill Bans Feasibility Research*, Final Report for WRAP <http://www.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Research.f5cf24f9.8796.pdf>

[102] The main source of information on the air quality impacts of recycling comes from life cycle databases such as Ecoinvent and life cycle inventory datasets for commonly recycled materials created by trade associations.

[103] Eunomia (2010) *Landfill Bans Feasibility Research*, Final Report for WRAP <http://www.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Research.f5cf24f9.8796.pdf>

Table 5-24: Landfill Impacts for GHGs and Air Emissions, per kg

Material	Kg of emissions per tonne of landfill						Total Monetized Impact ($/tonne)
	CO_2	PM2.5	SO_2	NO_x	NH_3	VOCs	
Plastic	4.3	0.004	0.008	0.17	5.0E-07	0.04	1.16
Glass	4.3	0.004	0.01	0.17	5.0E-07	0.04	1.16
Steel	4.3	0.004	0.01	0.17	5.0E-07	0.04	1.16
Aluminum	4.3	0.004	0.01	0.17	5.0E-07	0.04	1.16
Beverage Cartons*	819	0.004	0.02	0.15	0.62	0.01	49
* Note that beverage carton impacts are based on the following composition: 21% plastic, 4% aluminum, 75% paper.							

Source: Eunomia (2010) Landfill Bans Feasibility Research, Final Report for WRAP, http://www.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Research.f5cf24f9.8796.pdf; The Alliance for Beverage Cartons and the Environment (2014) What are Beverage Cartons? Accessed 5th December 2014, http://www.ace.be/beverage-cartons/what-are-beverage-cartons

GHG emissions for beverage cartons are significantly higher than for other beverage packaging types. This is due to the fact that the bulk of beverage cartons are made of paper, which partially biodegrades in landfills and releases GHGs.

Our modelling assumes a 20% gas capture rate, the standard Intergovernmental Panel on Climate Change (IPCC) capture rate. Plastics, glass and aluminum are all inert materials, so they do not biodegrade in landfills and therefore do not release GHGs. For these materials, the per unit landfill impacts are low, as they only relate to transport and operating emissions at the landfill site.

5.4.3 Collection of Beverage Containers

As part of the recycling process, beverage containers are collected and transported large distances to reach processing facilities using trucks and other vehicles. These vehicles emit GHGs and a number of other compounds and particles, which cause damage to the environment.

Emissions were modelled for three vehicle types: Semi-trailers (tractor-trailer trucks), 12 tonne curtain-side trucks, and passenger cars. Air quality emissions factors (grams per km) for heavy-duty trucks were based on emissions standards adopted by Environment and

Climate Change Canada and the most recent heavy-duty vehicle exhaust emission standards were used.[104] For passenger cars, NO_x emissions were based on the Canadian fleet average in 2008 (and PM emissions based on the same emissions year). 2008 data was used as the average age of passenger cars in Canada is 10 years.[105,106] Emissions factors for passenger cars (grams per km) are based on Euro Class 3 standards (2000).[107]

GHG emissions factors for diesel and gasoline fuel were sourced from the US EPA.[108] These were converted into emissions per mile travelled, based on average fuel consumptions for each vehicle: 45 litres per 100 km (Semis); 27 litres per 100 km (12 tonne curtain-side truck); and 9 litres per 100 km (passenger car).[109,110,111]

For consumer journeys, we assume that half of the journeys taken to redeem containers at redemption centres are conducted purely for the purpose of redeeming containers, and attribute emissions accordingly, with an average round trip distance of 40 km. For retailers, we assume that 10% of containers deposited are by consumers who would not otherwise make that journey, with an average round trip journey length of 15 km. For bag drops, we assume 30% of journeys are conducted only for the purpose of redeeming containers, with an average round trip journey length of 25 km.

5.4.4 Amenity Impact of Litter

Beverage containers are often consumed on the go (and are significantly larger than frequently-littered items such as cigarette butts or chewing gum). It is estimated that they account for approximately 40% of litter by volume.[112]

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[104] TransportPolicy (2018) *Canada: Heavy-duty: Emissions*, <https://www.transportpolicy.net/standard/canada-heavy-duty-emissions/>

[105] Ibid.

[106] Statista (2018) *Average age of vehicles on roads in Canada from 1990 to 2016*, <https://www.statista.com/statistics/641410/age-of-motor-vehicles-in-canada/>

[107] Dieselnet (2018) *EU: Cars and Light Trucks*, Accessed 3rd July 2018, <https://www.dieselnet.com/standards/eu/ld.php>

[108] U.S. Environmental Protection Agency (2015) *Emissions Factors for Greenhouse Gas Inventories*, 19th November 2015, <https://www.epa.gov/sites/production/files/2015-11/documents/emission-factors_nov_2015.pdf>

[109] Geotab (2018) *The State of Fuel Economy in Trucking*, <https://www.geotab.com/truck-mpg-benchmark/>

[110] Global Fuel Economy Initiative (2014) *Fuel Economy State of the World 2014*, Report for FIA Foundation, <https://www.fiafoundation.org/media/44209/gfei-annual-report-2014.pdf>

[111] Miller, G. & Spoolman, S. (2011) Living in the Environment: Principles, Connections, and Solutions, 1st January 2011

[112] Eunomia (2017) Impacts of a Deposit Refund System for One-way Beverage Packaging on Local Authority Waste Services. 11th October 2017

According to the 2016 Toronto Litter Audit, PET beverage bottles accounted for 15.4% of all the large litter surveyed around the city.[113] The proposed DRS for non-alcoholic beverage containers imparts a value to these containers, which significantly lowers the overall litter rate.

Our approach to estimating the impact of litter on level of amenity in Ontario is based on a study recently conducted by Eunomia for DG Environment of the European Commission. A literature review found no studies relating to litter amenity impact specifically in Canada.

The Eunomia study reviewed available literature on the litter amenity impact. This is the 'welfare loss' - i.e. the extent to which citizens are negatively impacted – from the existence of littered items in their local neighbourhood. Typically, a monetary value is placed on this amenity impact through determining the amount that respondents are willing to pay for a for a reduction in the levels of litter.

Based on the literature review, litter damage costs (in terms of dollars per tonne) were calculated based on data for Europe. These were scaled to Ontario on per capita GDP adjusted by purchasing power parity (see Appendix A.3.5.6 for further details).

This study assumes an 80% reduction in litter following implementation of the DRS. This is a conservative estimate based on a comparative review of the effect of DRSs on littering behaviour around the world.[114] The damage costs for both terrestrial and marine litter were then used to calculate the monetized environmental benefit gained through reducing littering. The total estimated benefit in the amenity from a reduction of litter resulting from the implementation of a DRS for non-alcoholic beverage containers is presented in Table 5-25.

Table 5-25: Amenity Benefit Associated with Reduction in Litter

Litter Component	Amenity Benefit (Cost Reduction) ($M)
Terrestrial Litter	-1,037
Marine Litter	-992
Total	-2,029

Source: Eunomia Calculation

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[113] AET Group, Inc. "2016 Toronto Litter Audit." October 27, 2016. < https://www.toronto.ca/wp-content/uploads/2017/10/8ed5-Toronto-Litter-2016-Final-Report_App_Final.pdf>

[114] Eunomia (2017) Impacts of a Deposit Refund System for One-way Beverage Packaging on Local Authority Waste Services, 11th October 2017

5.4.5 Overall Environmental Benefit

Using the methodology described above, the overall environmental benefit was calculated. Operating curbside services alongside a DRS for non-alcoholic beverage containers delivers a reduction of 48.5K tonnes of CO_2e GHG emissions and monetized benefits of $2.033B, the vast majority of which, $2.029B, is attributed to the reduction in terrestrial and marine litter. These savings are detailed in Table 5-26.

Table 5-26: Overall Environmental Benefit

Service	Environmental Impact	Monetized Environmental Impact ($M)
Curbside Blue Box		
Reduced travel, km	-1,031,474	-
Air quality	-	-0.002
GHG, CO2e tonnes	-741	-0.037
Curbside residual		
Reduced travel, km	-1,071,187	-
Air quality	-	-0.002
GHG, CO2e tonnes	-770	-0.038
Recycling		
Recycling increase, tonnes	117,567	-
Air Quality	-	-2.224
GHG, CO2e tonnes	-127,779	-6.300
Landfill		
Disposal reduction, tonnes	-85,333	-
Air Quality	-	-0.092
GHG, CO2e tonnes	-1,612	-0.079
Incineration		
Disposal reduction, tonnes	-5,957	-
Air Quality	-	-0.012
GHG, CO2e tonnes	-125	-0.015
Additional vehicle movements associated with DRS		
Additional travel, km	217,726,937	-
Air Quality	-	0.085
GHG, CO2e tonnes	82,529	4.069
Subtotal		-4.647
Litter reduction – amenity impact		
Amenity impact, tonnes	-8,291	-2,029
Total Cost Benefit	-	**-2,033**

Source: Eunomia Calculations

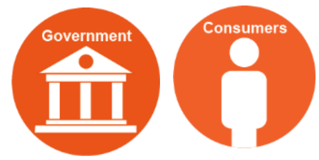
5.5 Stakeholder Impacts

All stakeholders in Ontario associated with beverage production, consumption and container disposal will be impacted by a shift toward an optimized Blue Box system

and non-alcoholic beverage container DRS. Table 5-27 summarizes the impacts on each of the key stakeholders.

Table 5-27: Stakeholder Benefit Summary

Benefit	Description	Stakeholders Benefitting
Financial	• Ability for producers to fully control the redemption infrastructure through the PRO to ensure targets are met • Reduction in average cost per kg of packaging placed on the market from \$0.31 to \$0.27 • Reduction in cost per tonne recycled from \$313.93 to \$269.26. • \$63.3M in material revenue • Potential increase in consumer visits to retailers • Tax revenue of \$66.60M under proposed program • \$800.54M GVA under proposed DRS • Undetermined reduction in street cleaning costs associated with 80% reduction in litter • Overall reduction in system costs of \$12.87M	
Environmental	• Recycling rate increases from 65.8% to 73.9% • 117,565 additional tonnes of material recycled, replacing virgin material on the market and feeding into the circular economy • 48,498 tonnes of CO_2e GHG emissions saved • Reduction in terrestrial and marine litter • Monetized environmental savings of \$2.03B	

Benefit	Description	Stakeholders Benefitting
	• 80% reduction litter of beverage containers	
Social	• 14,064 FTE jobs associated with the proposed system, 1,488 more than the current system • $2.029B amenity benefit associated with reduction in beverage container litter	

Source: Eunomia Calculations

5.5.1 Province

The province's role under the proposed DRS is one of legislative oversight, and as such, its costs will be low. The benefits to the province include:

- Additional 117,565 tonnes recycled contributing to Ontario's circular economy and waste reduction goals as described in the *Reducing Litter and Waste in Our Communities: Discussion Paper*;
- Reduction of 48,498 tonnes of CO_2e GHG emissions;
- Monetized environmental benefits of $2.03B;
- Creation of an additional 1,488 jobs, resulting in 14,101 total FTE under the proposed program;
- A 12% increase in GVA over the current system resulting in a total of $800.54M from the combined Blue Box and DRS program (excluding the ODRP);
- Generation of $66.60M in tax revenue, an additional $7.8M over the current system.

5.5.2 Municipalities

When the Blue Box program moves to being fully-funded by the producers, the primary cost that is retained by municipalities is the collection and disposal of residual waste. As more material is recycled, additional savings are possible by reducing the volume of material in the waste stream. The DRS allows for additional space in the Blue Box that can be filled with currently under-recycled materials, reducing the volume in the residual waste stream. The proposed program results in the following cost reductions:

- $46.68M from a reduction in residual waste collected and a move to every other week collections;
- An 85,333-tonne reduction in the amount of waste landfilled and 5,957 tonne reduction in waste incinerated; and
- Undetermined reduced street cleaning costs associated with an 80% reduction in beverage container litter.

With the move toward producer operation of the Blue Box program, there is the possibility of stranded assets (e.g. MRFs that are no longer required as a result of cross-jurisdiction collections and regional sorting). The draft amended BBPP recognized that municipalities would need the "opportunity to divest, lease out or repurpose public facilities."[115] There is the potential for some municipally owned assets to be used as counting centres, redemption facilities or transfer stations under the proposed program.

5.5.3 Retailers

The proposed DRS for non-alcoholic beverage containers requires retailers to play a role in collecting the beverage containers that they sell to consumers. This might be through the placing of a bag drop in their parking lot, or by offering RVM or manual redemption. However, we assume in our model that they are compensated for the role they play in this regard through the payment of handling fees. Retailers may also benefit from increased foot traffic and sales as redeemers use their reclaimed deposits for in-store purchases.

For retailers that are already selling alcoholic beverages, which are subject to a deposit under the ODRP, expanding to a non-alcoholic DRS ought to be a natural extension. The redemption infrastructure has been designed so that large redeemers such as restaurants use redemption centres or bag drops, while redemption at retailers is intended for individuals/consumers.

5.5.4 Producers

The proposed DRS program passes responsibility and control for the achievement of the recycling targets to producers, which is aligned with a fully funded Blue Box program. The producers discharge their obligation through a non-profit PRO, similar to Stewardship Ontario (or one and the same). This full control mechanism enables producers to design a cost-optimized system that meets the recycling target via a free market approach to service delivery.

Coming together as one, producers can put in place mechanisms that mitigate fraud, such as province specific labelling and ensure there is accountability through technology driven systems based on utilizing RVMs in retail stores and counting centres for verification of manually redeemed containers. Technology can also be used to provide consumers with easier ways to spend their redeemed deposits at retailers or even donate their $0.15 to charities or schools.

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[115] "Blue Box Program Plan Draft for Consultation." Page 29. December 2017 <http://stewardshipontario.ca/wp-content/uploads/2017/12/DRAFT-for-Consultation-Amended-Blue-Box-Program-Plan.pdf>

Stewardship Ontario's proposed draft amended BBPP sets a 75% diversion target for all packaging and printed paper.[116] The BBPP sought to meet this target through expanding collection to multifamily households, standardizing the list of materials collected, and education.

It is uncertain if education alone would enable Ontario's curbside program to achieve a 75% recycling rate for paper and packaging, as British Columbia's program is only just touching this rate.

The proposed combined Blue Box and non-alcoholic DRS delivers the following benefits to producers:

- Increase overall paper and packaging recycling rate 65.8% to 73.9%;
- Reduction in cost per tonne of recycling from $313.93 to $269.26;
- Reduction in cost per kg of packaging placed on the market from $0.31 to $0.27;
- Additional 117,567 tonnes of material recycled that can be used in the manufacture of their products, helping achieve minimum recycled content goals; and
- 8,291 tonnes reduction in litter reducing impact on land and marine environment, providing an elevation of brand image as it contributes to a clean environment.

5.5.5 Consumers

The proposed system allows for more consistency and flexibility from a consumer perspective.

The multi-channel return infrastructure for the non-alcoholic beverage DRS will ensure that consumers have convenient locations to redeem beverages. The bag drop sites, in particular, enable the return of deposit containers quickly and without hassle. By providing consumers with convenient options, this facilitates a higher return rate and therefore, the collection of higher quality materials, through the DRS.

Ontarians almost universally support a deposit system for plastic beverage containers, according to a survey by Environmental Defence,[117] and with good reason. A DRS enables consumers to feel good about doing their part to contribute to a better environment. The DRS contributes to reduced litter, lowering of GHG emissions, and better air quality, all of which directly benefit Ontario residents. Furthermore, the addition of nearly 1,500 new jobs

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[116] "Blue Box Program Plan Draft for Consultation." December 2017 <http://stewardshipontario.ca/wp-content/uploads/2017/12/DRAFT-for-Consultation-Amended-Blue-Box-Program-Plan.pdf>

[117] On behalf of Environmental Defence (ED), the Gandalf Group conducted a survey among 800 Ontarians to assess support for a Deposit Return Program for plastic bottles and programs to protect waterways from agricultural run-off. Online interviews were completed between March 4th and 7th, 2016. A probability sample of this size yields a margin of error of +/- 3.5%, 19 times out of 20. Data is weighted to represent the gender, age, and regional distribution of the province.

directly as a result of the changes modelled creates a more prosperous economy for all Ontarians.

In addition, the redemption network caters to businesses collecting from the hospitality sector by allowing for large-volume redemption. These containers are often not captured in DRS programs.

6.0 Conclusions

In the *Waste Free Ontario Act*, *2016*, the provincial government indicates a desire to move toward a circular economy and has set ambitious goals related to waste diversion. Recycling rates in Ontario will need to substantially increase to align with other Canadian provinces and global trends.

Furthermore, current changes such as the loosening of licensing laws for alcohol sales indicate a shift toward greater distribution, which will reduce the ODRP's effectiveness in collecting all current deposit containers, as consumers visit a wider array of retailers to purchase their alcoholic beverages. This indicates that the current recycling rate is actually at risk of declining.

If Ontario is serious about its commitment to furthering waste reduction and moving toward a circular economy, it should consider implementing a proven system that guarantees the collection of high-quality material alongside the curbside program.

DRSs have consistently proven to be the most effective systems at collecting for recycling beverage containers and reducing litter. In the *Reducing Litter and Waste in Our Communities: Discussion Paper*, the option of a DRS is highlighted as a way to reduce litter and waste in communities. This option should be pursued.

The Blue Box program and a complementary DRS for non-alcoholic beverage containers can increase the recycling rate for paper and packaging as a whole to 73.9% from the current 65.8%. The DRS modelled in this study is capable of achieving a 90% redemption rate, similar to those in Oregon and Norway, through good design, including:

- A deposit value of $0.15; and
- A convenient redemption network that accommodates consumers who are likely to want to redeem prior to shopping, as well as larger volume redeemers, such as those servicing the hospitality sector.

The PRO operating on behalf of producers will be able to ensure the correct redemption infrastructure is in place to achieve the targets at the lowest cost and to mitigate fraud through a technology driven approach (reverse vending machines and counting centres). The comparative costs and performance of the current program and the proposed system are set out in Table 6-1.

Table 6-1: Current vs. Proposed system

	Current Program	Proposed Program
Operating Costs (DRS, Blue Box + % Residual associated with PPP and DRS)	$312.94M	$300.06M
Tonnes Recycled (DRS and Blue Box)	996,854	1,114,421
Cost per Tonne Packaging Recycled	$313.93	$269.26
Cost per kg of Packaging Recycled	$0.31	$0.27
Total Direct FTE Jobs	7,105	7,946
Total Direct, Indirect and Induced FTE Jobs	12,576	14,064
GVA	$709.74M	$800.54M
Tax Revenue	$58.84M	$66.60M

Source: Eunomia Calculations

The full conversion to the proposed combined curbside Blue Box and DRS for non-alcoholic beverage containers saves approximately $12.87M and recycles an additional 118K tonnes of material. In terms of the cost per container, the cost of the proposed DRS is only $0.0091 per unit.

It is also worth noting that in Oregon's Bottle Drop program, consumers pay USD $0.20 (equivalent to CAD $0.27) to buy each bag that they fill, and also pay a USD $0.35 (equivalent to CAD $0.47) sorting fee per bag. These fees are estimated to generate an additional revenue of $690k in bag sales and $1.2M in sorting fees per year to help offset the cost of the DRS. This is another avenue for Ontario to explore in order to fund the system.

Aside from costs, the proposed program has the added benefits of:

- Reducing litter by 80%;
- Diverting 85,333 tonnes of waste from landfill;
- Reducing 48,498 tonnes of CO_2e GHG emissions; and
- Public amenity benefit of litter reduction equating to $2.029B

Currently, Ontario falls short of its peers in terms of recycling. British Columbia is achieving a 75% recovery rate through a combination of DRS collections and RecycleBC's curbside program[118] and Alberta has had a return rate over 85% for the past three years.[119] A DRS for non-alcoholic beverages significantly increases the recycling rate of beverage containers in Ontario to put it on equal footing with that of other provinces in Canada.

6.1 Next Steps

Once factors such as environmental, employment and stakeholder benefits are considered, the rationale for the introduction of a DRS for non-alcoholic beverage containers, especially alongside shifts in the collection frequencies for different material streams, becomes clear. Adding the proposed DRS will increase the effectiveness of the Blue Box as well, freeing up volume for less-well-recycled materials to be added. Through this model, the loss of revenue associated with the movement of beverage containers from the Blue Box to the DRS is offset by reduced collection, transfer and disposal costs and there is additional space in the Blue Boxes to recyclable material that is currently ending up in the landfill.

The majority of Ontarians are in favour of an expanded deposit program in Ontario.[120] Designing an integrated system where a DRS is extended to non-alcoholic beverage containers, and the Blue Box program is further optimized, potentially in the light of considerations as to how other streams, such as food waste, should be targeted for separate collection, is the next logical step for Ontario in the move toward zero waste and a more sustainable future.

Setting up a multi-stakeholder working group to discuss how to utilize the analysis and results within this report would be a logical next step. This report does not model a potential harmonization of the existing alcoholic container return system operated through The Beer Store with a system for non-alcoholic beverages but this might also want to be investigated to understand potentially further efficiencies.

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[118] Recycle BC. "Annual Report 2017." <https://recyclebc.ca/wp-content/uploads/2018/07/RecycleBCAR2017-June292018.pdf>

[119] Beverage Container Management Board. "2017 Annual Report." <https://www.bcmb.ab.ca/uploads/source/Annual_Reports/BCMB_2017_Annual_Report_Final_Web.pdf>

[120] On behalf of Environmental Defence (ED), the Gandalf Group conducted a survey among 800 Ontarians to assess support for a Deposit Return Program for plastic bottles and programs to protect waterways from agricultural run-off. Online interviews were completed between March 4th and 7th, 2016. A probability sample of this size yields a margin of error of +/- 3.5%, 19 times out of 20. Data is weighted to represent the gender, age, and regional distribution of the province.

APPENDICES

A.1.0 Examples of Good and Bad DRS Design

A.1.1 Governance

A.1.1.1 Examples of Good Practice

Norway

The Norwegian system was established by the beverage industry after the government introduced a beverage container tax. The level of the tax reduces as recycling rates increase from 25%, and container types that have a recycling rate of at least 95% are exempt. The beverage industry concluded that a DRS was the most effective mechanism to achieve the 95% target and minimize their tax liability.

Infinitum is a not-for-profit organization that owns and runs the DRS on behalf of the industry. The 95% target – combined with the tax if it is missed – means Infinitum is accountable for the system's success and is committed to maximizing return rates. The fact that the Infinitum board comprises representatives of the beverage and retail industries means that they are driven to achieve these targets as cost effectively as possible, that they are accountable to the companies funding the system, and all interests are taken into account. Infinitum publishes an annual report, including details of its revenue, costs and results. This report includes the number of containers sold with a deposit, which can help producers detect any free-riding.

A system that is owned and operated by the industry is fully in line with producer responsibility principles and means the industry can use its experience and expertise to design the best system.

Infinitum reports that it has worked continuously to improve the efficiency of its system – aiming to reduce costs while increasing the number of containers collected. They invest in advertising campaigns to promote the system and raise awareness amongst consumers. They set fees per container placed on the market on an annual basis, so producers can estimate their costs in advance. Infinitum also monitors fraud and determines the most cost-effective fraud prevention measures – balancing the costs of these against the potential losses from fraud.

In 2016, Norway collected 1,012,190,533 containers (95% of deposit-bearing containers sold). Their operating costs that year were €41,497,365 (CAD $62,597,446.37), translating into a cost per container of €0.04 (equivalent to $0.04 CAD).[121] As discussed in Section 5.7, producers do not pay anything for aluminum cans, and pay €0.019 for PET bottles.

Sweden

Sweden similarly has a centralized, not for profit system, but includes slightly more state involvement. It is run by Returpack, which is owned by Swedish brewers and retailers, and regulated by the Swedish Board of Agriculture.[122] The Government has specified recycling targets (90%) in a regulation on producer responsibility for packaging. As such, Returpack is held responsible by the industry for its operation, and by the Swedish Government for its results.

Like the Norwegian system, there is a single entity responsible for determining the scheme's design, for collecting containers, liaising with retailers, marketing the system, reporting, setting fees and preventing fraud. This minimizes producers' workload and administrative responsibilities associated with the DRS, as they can delegate their responsibilities to the system operator.

In 2017, the Swedish DRS achieved an 85% recycling rate, recycling 1,850,000,000 containers[123]

A.1.1.2 Weaknesses of Alternatives

Connecticut, USA

As a decentralized system, there is no single entity responsible for the system's operation or success. Legislation requires producers and retailers to participate in the scheme, and the logistics are the producers' responsibility. There are, however, no targets to meet and limited compliance efforts to verify that a deposit is initiated for every container placed on the market.

A lack of transparency can generate mistrust amongst key stakeholders – not least those funding the system. The lack of accountability may also contribute to Connecticut's low return rate (around 50% in recent years).

In Connecticut's DRS, producers' costs are based on the number of units returned, not the number of units sold, so producers cannot predict their costs and have to pay more as the recycling rate increases. They not only pay the full collection costs, but also the full handling fee to retailers for every container returned. This means producers' costs in Connecticut are

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[121] Infinitum (2017) *Annual Report 2016.* < https://infinitum.no/arsmelding-vis/22/06d586916b14fecacb6580135fd2b7f7/ENG_Infinitum_a%CC%8Arsrapport_WEB.pdf>
[122] Pantamera (2018). <http://pantamera.nu/om-oss/returpack-in-english/about-returpack/>
[123] Pantamera (2018). <https://pantamera.nu/pantsystem/statistik/pantstatistik/>

higher than they would be in a centralized system where the costs are distributed across all containers placed on the market and where they are offset by unredeemed deposits and material revenues.

Whereas in Norway and Sweden the system operator has the flexibility to design the optimum system and to improve and adapt it over time, the specific details – such as the deposit value, the handling fee and the scope of the system – of Connecticut's DRS are fixed in legislation. This prevents the system from evolving and adapting with inflation or consumer trends. It also means that amending the system is a lengthy legislative process, through which legislators are subject to political lobbying.

As producers are responsible for collecting their own containers from retailers, consumers and retailers are required to sort their used beverage containers by brand. This necessitates more collection vehicles as the containers are transported separately by brand.

Hawaii, USA

The Hawaiian system is unusual in the USA, as it is centralized. Unlike European systems, however, it is state-run so does not support producer responsibility principles and more costs fall on general taxpayers. Producers contribute little to the system's administrative or financial requirements. The system is funded by the state government, unredeemed deposits, and a non-refundable container fee that consumers pay along with the deposit. This means producers have no control over what happens to their used beverage containers, or the fee that is added to the price of their beverages.

Systems that allow the government to keep the unredeemed deposits do not necessarily achieve the highest return rates, as these often represent a valuable revenue stream that is diverted to other services. There are also few mechanisms to hold the government to account for the success of the system.

In 2016/17, Hawaii's return rate was 65%.[124]

A.1.2 Deposit Level

A.1.2.1 Examples of Good Practice

Norway

Norway achieves a return rate of 95%; while this cannot be solely attributed to the deposit value, it is likely to be a contributing factor. It is a relatively simple deposit structure of NOK

[124] Container Recycling Institute (2018). "Hawaii <http://www.bottlebill.org/legislation/usa/hawaii.htm>

2 (CAD $0.31) for plastic and metal containers ≤ 0.5 litre and NOK 3 ($0.46USD) for plastic and metal containers > 0.5 litre. This offers clarity and consistency, while recognizing the higher purchase price of larger beverages and ensuring the deposit value is proportionate. The deposit value has also been kept under review, as it will depreciate with inflation and was increased in 2018 to support a higher return rate. [125]

Lithuania

The Lithuanian system has a single, flat-rate deposit of €0.10 (CAD $0.15). This value is appropriate for the Lithuanian economy and cost of living and provides an equal incentive for consumers to return all containers. In 2017, Lithuania achieved a return rate of 92%.[126]

Oregon

Oregon increased its deposit from USD $0.05 (CAD $0.07) to USD $0.10 (CAD $0.13) in April 2017. This followed an amendment to the legislation requiring the deposit to be increased if the redemption rate was below 80% for two consecutive years.[127] This flexible approach recognizes the link between the deposit and return rates, and the need to keep the deposit value under review. The return rate during January – March 2017 was 59%. Following the increase, Oregon achieved 82% between April and December.[128]

A.1.2.2 Weaknesses of Alternatives

Connecticut; Massachusetts; New York, USA

In these states, the deposit is enshrined in legislation at USD $0.05 (CAD $0.07) and has not changed since the Bottle Bills were passed in the 1970s and 1980s. While the beverage industry and retailers prefer to keep the deposit low due to the impact on their cash-flow and the perceived price for consumers (although deposits should be listed separately to the price), with inflation, the deposit has lost value in real terms and this contributes to low return rates (51% in Connecticut; 57% in Massachusetts; and 66% in New York).

Germany

At €0.25 (CAD $0.38), the German deposit is higher than most. In its favour, it is linked to an impressive reported return rate of 97%. However, the high deposit, combined with Germany's long borders with countries that do not have a DRS and freedom of movement

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[125] The deposits were previously NOK1.00 (€0.11) and NOK2.50 (€0.26) but were increased by the Norwegian Environment Ministry in 2018. <https://infinitum.no/aktuelt/nye-pantesatser>

[126] CM Consulting & Reloop (2018) Deposit Systems for One-Way Beverage Containers: Global Overview 2018.

[127] Oregon Legislative Assembly "House Bill 3145." 2011 Regular Session. <https://olis.leg.state.or.us/liz/2011R1/Downloads/MeasureDocument/HB3145>

[128] Oregon Beverage Recycling Cooperative. "2017 Annual Report," <https://www.obrc.co House Bill 3145 m/Content/Reports/OBRC%20Annual%20Report%202017.PDF>

within the EU, means there is high risk of fraud. As a result, the German system relies on more expensive fraud prevention measures than other systems, with an associated cost for beverage producers.

Newfoundland, Canada

There are two deposit rates: CAD $0.08 for non-alcoholic beverages and CAD $0.20 for alcoholic beverages. While this reflects the higher purchase price of the latter, there can be more opportunities for fraud with alcoholic drinks due to the higher proportion of imports. A significant disparity in the deposit value could exacerbate the fraud risk.

Finland

Finland has four different deposit values. While these are associated with high return rates (87-94%)[129], we would suggest that multiple deposit values could add an unnecessary level of complexity, particularly for a new system. The differentiation for plastic bottles will take account of the increasing price for larger volumes of beverages, but it is important to avoid unequal incentives between different types of material.

- Plastic < 0.35 litre: €0.10 (CAD $0.15)
- Plastic 0.35 – 1 litre: €0.20 (CAD $0.30)
- Plastic > 1 litre: €0.40 (CAD $0.60)
- Metal: €0.15 (CAD $0.23)

A.1.3 Redemption Infrastructure

A.1.3.1 Examples of Good Practice

Norway

Norway uses the return to retail model with a mix of RVMs and manual services, depending on whether the retailer chooses to provide an RVM. Containers can be returned to 15,000 shops, kiosks and petrol stations, meaning consumers do not have to travel far, undertake a special journey to redeem their deposit or sort their containers and return to a number of shops with different brands. [130]

While there are 15,000 return locations, there are only 3,700 RVMs in Norway.[131] Despite this, 93% of containers are returned to an RVM; this enables Infinitum to make the logistics

[129] Palpa (2019). <https://www.palpa.fi/juomapakkausten-kierratys/pantillinen-jarjestelma/>
[130] Infinitum (2017) *Annual Report 2016.* < https://infinitum.no/arsmelding-vis/22/06d586916b14fecacb6580135fd2b7f7/ENG_Infinitum_a%CC%8Arsrapport_WEB.pdf>
[131] Infinitum (2019). <https://infinitum.no/om-infinitum>

operation as efficient as possible as the RVMs compact the containers and provide data for predicting return patterns and determining collection schedules.

As the system relies on the co-operation of retailers, they are represented on the Infinitum board by members of the Co-Op and grocery chain Rema 1000.

In response to the growth in online shopping, Norway (like Germany) has made provision for people to return their empty drinks containers via a home delivery service provided by retailers. Consumers can buy Infinitum bags from their online retailer, which are barcoded and embedded with a code to track the bag and its contents.[132] This means all retailers are treated fairly and people who do not have the time, or capacity due to health issues, to visit a shop can still return their containers for a refund. In Norway approximately 1% of returns are via home delivery.

Lithuania

Like Norway, Lithuania's DRS is based on the return to retail model. Here, however, the system operator has leased all the RVMs and provides these to retailers, free of charge. While there are arguments for leaving retailers responsible for buying or leasing the RVMs, Lithuania's approach ensures that all RVMs are compatible with their IT requirements. It also saves retailers time and may allow them to agree to more favourable terms with the RVM manufacturer due to the number of RVMs needed for the whole country.

A.1.3.2 Weaknesses of Alternatives

Connecticut, USA

In this state, retailers are only required to take back the brands they sell. This requires consumers to sort their containers by brand and may mean they have to visit several return points to redeem their deposit. This potentially increases the distance they have to travel and discourages consumers from returning their containers, especially as the deposit is a low value, having remained at the USD $0.05 (CAD $0.07) set in 1978.

Connecticut's redemption centres have also been closing because they are not economically viable; this partly highlights the need for handling fees to be set at an appropriate level, but also indicates the draw-backs of establishing and relying on depots that need to be able to make a profit from the DRS alone.

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132 Kolonial (2018). <https://kolonial.no/sok/?q=infinitum>

Northern Territory, Australia

This system only uses depots, so consumers have to make special journeys to claim their refund. This not only undermines the convenience of the system and consequently the return rate, but may also increase the costs and GHG emissions associated with the DRS. The redemption rate in Northern Territory is 48%.[133]

Vermont, USA

Like most US states, Vermont uses both retailers and redemption centres. Retailers, however, are allowed to opt out if there is a nearby redemption centre. This means not all retailers are treated equally. It also leads to potential uncertainty and confusion for consumers, who may be less likely to return their containers if they have to check where they can do so, or if they are turned away by a store.

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[133] Northern Territory Environmental Protection Authority. “Environment Protection (Beverage Containers and Plastic Bags) Act,” 2016-2017. <https://ntepa.nt.gov.au/__data/assets/pdf_file/0006/463983/2016_2017_CDS_annual_report.pdf >

A.2.0 Curbside Waste Flow and Resource Modelling

In addition to modelling the waste flows and resources required for Ontario's new DRS system, Eunomia carried out separate modelling to project the impact on curbside collection. The introduction of DRS implies changes in waste flows in both recycling and residual waste curbside collections. This raises the potential of reductions in the resources required to collect the remaining curbside waste.

A.2.1 Methodology

Eunomia used the waste flow and resourcing data provided[134] to create a baseline of each municipality within Ontario. This baseline included the tonnage of Blue Box recyclables, other recyclables, organic waste and residual waste, as well as the vehicles needed to collect this waste. Due to the large number of participating municipalities, municipalities were then separated into 8 larger groups, based on their rurality, recycling collection system, and collection frequency (Table A 1).

Table A 1: Municipal Groupings Used in Resource Modelling

Municipal Group	Rurality	Blue Box System	Collection Frequency
Group 1	Urban	Multi	Bi-weekly
Group 2	Urban	Multi	Weekly
Group 3	Urban	Single	Bi-weekly
Group 4	Urban	Single	Weekly
Group 5	Rural	Multi	Bi-weekly
Group 6	Rural	Multi	Weekly

[134] Based on average Ontario residential collection data established from confidential commercial information.

Group 7	Rural	Single	Bi-weekly
Group 8	Rural	Single	Weekly

These households, tonnages and vehicles were then summed up across the broader groups, creating 8 separate baselines (Table A 2).

Table A 2: Households and Waste Stream Tonnages by Municipal Grouping

Municipal Group	Curbside Households	Blue Box Tonnes	Other Recycling Tonnes	Organic Tonnes	Residual Tonnes
Group 1	1,751,816	345,893	55,169	343,128	854,633
Group 2	249,417	39,847	1,136	26,328	159,759
Group 3	1,072,796	249,255	33,850	316,641	515,210
Group 4	921,911	155,906	2,666	219,796	403,317
Group 5	435,159	70,668	11,320	30,387	191,767
Group 6	108,048	14,739	799	11,494	71,219
Group 7	296,734	56,462	5,173	19,091	144,898
Group 8	119,879	21,350	2,482	17,282	62,708

The tonnages in these municipalities were then converted into kg per household per year, along with the modelled changes from DRS introduction. This allows the impact of DRS on curbside collections to be measured, producing a waste flow for before and after the modelled changes (Table A 3).

Table A 3: Example Annual Waste Flows Before and After DRS Introduction

Material	Baseline (kg/household)	Future (kg/household)
Printed Paper	97	97
OCC/OBB	42	51
Mixed Paper	3	4
Polycoat	2	1
PET	12	7

Material	Baseline (kg/household)	Future (kg/household)
HDPE	4	4
Plastic Film	2	2
Tubs and Lids	0	0
Polystyrene	0	0
Mixed Plastic	6	6
Steel	6	6
Aluminum	2.15	0
Flint Glass	16	10
Coloured Glass	5	3
Other Recycled Material (e.g. C&D, scrap metals, textiles, wood)	31	31
Contamination	23	22
Mixed Organics	196	196
Residual Waste	488	468
Total	**936**	**909**
Amount going to Blue Box	**220**	**214**

These waste flows are based on the tonnages diverted to the DRS as well as assumed increases in capture of other materials after DRS is introduced. Overall the change in waste flows is relatively small, as shown in Table A 4.

Table A 4: Changes in Waste Flows Before and After DRS Introduction

		Baseline	After DRS	DRS Reduction	Subsequent Increase	Total Change
Blue Box Tonnes	**Printed Paper**	488,629	488,629			
	OCC/OBB	185,722	231,921		46,199	-46,199
	Mixed Paper	13,251	15,361		2,111	-2,111
	Polycoat	7,932	6,196	1,737		1,737
	PET	55,982	31,414	24,568		24,568
	HDPE	18,500	21,257		2,758	-2,758
	Plastic Film	11,392	11,392			
	Tubs and Lids	683	683			
	Polystyrene	273	273			
	Mixed Plastic	28,507	28,507			

		Baseline	After DRS	DRS Reduction	Subsequent Increase	Total Change
	Steel	27,955	26,410	1,545	1,706	-161
	Aluminum	10,587	1,555	9,032	1,279	7,754
	Flint Glass	78,480	47,417	31,063		31,063
	Coloured Glass	23,223	14,031	9,192		9,192
	Blue Box Total	951,116	925,047	77,136	54,052	23,084
Other Recycled Material Tonnes		111,956	111,956			
Organic Tonnes		982,497	982,497			
Disposed Tonnes	**EfW Tonnes**	142,204	136,354	2,655		2,655
	Landfill Tonnes	2,062,309	1,977,467	38,498		38,498
	Hazardous Waste Tonnes	212,868	204,111	3,974		3,974
	Total	**4,462,949**	**4,337,431**	**122,262**	**54,052**	**68,210**
						2%

The financial implications of this change in waste flows in terms of treatment costs is set out in Table A 5, based on an assumption of $93.10/tonne for sorting of single stream recyclables, $12.20/tonne for multi-stream recyclables, and $71/tonne for disposal of residual waste. These costs were based on the supplied system costs for waste collection, after removing the costs of collection.

Table A 5: Financial Impact of Waste Flow Changes on Process and Treatment Costs Only

Category	Stream	Collection Frequency (Weeks/Annum)	Recycling Processing Savings ($)	Residual Processing Savings ($)	Overall Savings ($)
Urban	Multi	52	142,994	2,529,754	2,672,748
Urban	Multi	26	1,299	360,177	361,476
Urban	Single	52	943,838	1,549,198	2,493,036
Urban	Single	26	213,959	1,331,309	1,545,268
Rural	Multi	52	26,305	628,402	654,707
Rural	Multi	26	3,444	156,029	159,473

Category	Stream	Collection Frequency (Weeks/Annum)	Recycling Processing Savings ($)	Residual Processing Savings ($)	Overall Savings ($)
Rural	Single	52	159,128	428,506	587,634
Rural	Single	26	64,840	173,114	237,954
		Total	**1,555,807**	**7,156,489**	**8,712,296**
				Overall Savings:	4%

A.2.1.1 Resource Requirements

Based on the waste flow modelling and predicted changes from DRS introduction, collection resource models were produced for both the waste stream models before and after the new system. Where collection frequency was maintained, these models assumed no change in collection efficiency. The resource requirements post-DRS introduction, whilst maintaining collection frequency, are shown in Table A 6.

Table A 6: Change in Vehicle Numbers and Vehicle and Labour Cost Savings, Baseline Scenario (No change in Frequency)

			Baseline	Future DRS	Baseline	Future DRS	Overall Savings ($)
Category	**Stream**	**Collection Frequency (Weeks/ Annum)**	*Vehicles*	*Vehicles*	*Vehicles*	*Vehicles*	
Urban	Multi	52	460	446	392	376	4,134,832
Urban	Multi	26	45	45	40	39	188,165
Urban	Single	52	237	228	203	194	2,353,477
Urban	Single	26	318	314	128	122	1,392,166
Rural	Multi	52	136	132	135	129	1,357,210
Rural	Multi	26	34	33	34	33	223,490
Rural	Single	52	101	98	96	92	916,777
Rural	Single	26	34	33	33	32	311,132
			1,365	**1,329**	**1,061**	**1,016**	**10,877,247**
						Overall Savings:	(3%)

The baseline results show a small reduction in resource requirements for both residual waste and curbside recycling collections. This stems from reduced yields per household meaning more waste can be collected before tipping, increasing property collection rates. This leads to a similarly small reduction in the costs of collecting materials, which covers the vehicles and labour required for collection.

Models were also developed to examine the potential impact of a move to every other week (bi-weekly) collection of recycling and residual waste across Ontario. This modelling assumes a reduction in pass rates in areas which previously used weekly collections, as reduced collection frequency leads to higher set out rates and higher yields per collection. The resource requirements post-DRS introduction, whilst changing all areas to a bi-weekly collection schedule, are shown in Table A 7.

Table A 7: Change in Vehicle Numbers and Vehicle and Labour Cost Savings, Bi-weekly Scenario (Reduced Frequency)

			Baseline	Future DRS	Baseline	Future DRS	Overall Savings ($)
Category	**Stream**	**Collection Frequency (Weeks/ Annum**	*Vehicles*	*Vehicles*	*Vehicles*	*Vehicles*	
Urban	Multi	52	460	331	392	281	32,710,192
Urban	Multi	26	45	45	40	39	188,165
Urban	Single	52	237	171	203	146	16,853,071
Urban	Single	26	318	314	128	122	1,392,166
Rural	Multi	52	136	129	135	125	2,345,785
Rural	Multi	26	34	33	34	33	223,490
Rural	Single	52	101	95	96	89	1,632,333
Rural	Single	26	34	33	33	32	311,132
			1,365	1,151	1,061	866	55,656,334
						Overall Savings:	(18%)

Initial indications are that significant savings can be found by transferring to a bi-weekly collection schedule after introducing DRS. However, it is important to note that the savings in the bi-weekly scenario are not solely due to DRS introduction, but also stem from the change to bi-weekly collections in itself. This element of the savings is modelled only at a very high level across Ontario, and detailed analysis of the resource needs in each municipality would be necessary to arrive at a firm conclusion of the true scale of possible savings.

A.2.1.2 Key Assumptions

A number of key assumptions underpin the collection resource modelling, variations to which could significantly change the results:

- it is assumed that both curbside collection and depot collection properties have the same yield and composition of waste. Whilst this may not be correct, there was not enough evidence to determine whether there were differences between properties, and whether these varied based on rurality (and so distance between households and depots);

- similarly, it was assumed that DRS reductions in waste flows would occur evenly across all households. In practice, there may be variations in this due to the relative sparsity of collection points in rural areas compared to urban areas;
- it was assumed that a number of key waste streams would see an increase in curbside recycling after the introduction of a DRS system. This is due to more space being available in boxes, as well as greater awareness of recycling with the introduction of a new scheme. The increase in recycling by material is shown in Table A 8.

Table A 8: Increase in Recyclables Post-DRS Introduction

Scenario/Stream	Aseptic	Boxboard	HDPE	Other Steel	Other Aluminum
Recycling Rate Before	26%	52%	46%	33%	19%
Recycling Rate After	60%	80%	55%	55%	50%
Tonnes Before	1,658	87,887	13,754	2,599	816
Tonnes After	3,856	135,995	16,626	4,375	2,147

- residual collection systems were assumed to mirror the provided recycling frequency; that is, municipalities with weekly recycling collections also operate weekly residual waste collections, and the same for bi-weekly collections;
- for bi-weekly collections, the number of tips per vehicle was maintained for areas that are limited by time (as increasing the number of tips potentially significantly increases the amount of time used). This has the effect of reducing pass rates in areas switching from weekly to bi-weekly collections, especially in rural areas. This can be partially explained by the increase in pass rates, but it is possible that an in-depth study of the consequences of switching to a bi-weekly system would find more savings in these rural areas;
- No assumptions were made about efficiency savings which could be realized by harmonizing all municipalities on a bi-weekly system – for example by operating collections across municipal borders or sharing vehicles.

A.3.0 Modelling of Proposed DRS for Ontario

A.3.1 Introduction

Contained in this section of the document are the assumptions and methodology used to:

- Develop the material mass flows for the system (section A.3.2);
- Model the DRS, performance and cost benefit of the modernized system (Section A.3.3);
- Calculate the employment impact of the system in Ontario (Section A.3.4); and
- Calculate the overall environmental cost benefit of the system (Section A.3.5).

A.3.2 Material Mass Flows

A.3.2.1 Overview

The first step in a cost benefit analysis of the introduction of a DRS in Ontario was to consider the current material flows in the province, specifically how many beverages are sold, and how the empty containers are currently managed through the waste stream once those beverages have been consumed.

One important factor to consider when looking at the potential impacts introducing a DRS is the assumption about when the analysis takes place. It is very difficult to predict future changes in other assumptions, such as beverage consumption, material values, labour costs etc., and therefore it was appropriate to consider the costs over one year only.

Before conducting the modelling, stakeholders were consulted to identify existing relevant data sources. Wherever possible we have used sources specific to Ontario, supported by data from our work with other DRSs, including in Connecticut, Quebec, Oregon and Europe.

A.3.2.2 Beverage Container Sales / Waste Arisings

The figures for total beverage container sales are taken from 2016 data published by CM Consulting. We have used the following categories in our analysis:

- Fibre-based packaging – gabletop, aseptic;
- Plastic beverage packaging – PET bottles, HDPE bottles;
- Steel beverage packaging – beverage;
- Aluminum beverage packaging – beverage; and
- Glass beverage packaging.

Table A 9: Total Beverage Container Sales in Ontario for which a Deposit is Applied and/or Proposed (2016), Million Containers

	Units sold	Units recycled	Recycling rate
Fibre based packaging - Gabletop	82,699,048	51,081,905	62%
Fibre based packaging - Aseptic	247,968,182	64,059,091	26%
Plastic beverage packaging – PET Bottles	1,476,475,000	652,862,438	44%
Plastic beverage packaging – HDPE Bottles	53,822,172	24,488,741	45%
Steel beverage packaging – Food/beverage	325,212,195	223,260,553	69%
Aluminum beverage packaging – Food/beverage	1,760,083,075	721,511,304	41%
Glass beverage packaging – Food/beverage	309,284,908	130,709,153	42%
Total	**4,255,544,579**	**1,867,973,185**	**44%**

Source: CM Consulting data, 2016.

The average weights of beverage containers were taken from a variety of sources used in previous DRS work, as shown in Table A 10: Average Weight per Container Type

Table A 10: Average Weight per Container Type

Material	Average Weight (g)	Source
Glass bottle	229	Taken from Connecticut data, 2018
PET bottle	29	Taken from Connecticut data, 2018
Steel can	15	http://recycleusainc.com/category/aluminum-cans/
Aluminum can	15	http://recycleusainc.com/category/aluminum-cans/
Beverage carton	20	Taken from Kosovo data, 2016

Source: See table

A.3.2.3 Waste Collected

Waste is assumed to be collected via three distinct pathways:

- **Deposit Return Scheme (DRS) collection** - Retail outlets, reverse vending machines, bag drops and redemption centres that accept deposit beverage containers from the public;
- **Curbside/commercial recycling collection** - Private- or public-sector establishments that use collection vehicles to pick up recyclables at the curb from residences and businesses; and
- **Waste collection** - Private- or public-sector establishments that collect residual waste from residences and businesses at the curbside.

Other more minor collection routes are excluded from our analysis.

A.3.2.4 Container Deposit Return System

Return Rates & Return Destinations

The objective of a DRS is to get consumers to return their containers for recycling. In other jurisdictions operating DRS, return rates above 90% are not uncommon. In particular, higher return rates are associated with a higher deposit level. The deposit rate is set to $0.15 with an assumed overall return rate of 90%, with material-specific return rates varying. Table A 11: Scenario Assumptions for DRS Return Rate

shows these assumptions and the return rates assumed.

Table A 11: Scenario Assumptions for DRS Return Rate

	Plastic (PET, HDPE)	Glass	Aluminum	Steel	Beverage Cartons
Return Rate	91%	95%	93%	93%	59%

Source: Data from British Columbia system return rates

Four main redemption methods were modelled:

- Retail stores, manual - any dealer that sells a deposit-initiated beverage may also collect empty containers and return the deposit to the consumer;
- Retail stores, reverse vending machines (RVMs) – most larger retail stores have installed RVM to automate the process of redeeming containers;

- Dedicated redemption centres – these centres, often situated in retail stores or warehouses on the outskirts of a town, are privately owned businesses established solely for redeeming beverage containers subject to a deposit;
- Bag drops – shipping containers adapted to include hatches for consumers to deposit bags of containers, located in parking lots of large retailers or on patches of unused land.

For each material, assumptions have been made about return rates to each destination based on either data taken from the Connecticut system (redemption centres) or communication with OBRC, who run the bag drop system in Oregon. These assumptions are presented in Table A 12: Assumptions for Destination of Containers Collected in the DRS.

Table A 12: Assumptions for Destination of Containers Collected in the DRS

	Plastic (PET, HDPE)	Glass	Aluminum	Steel	Beverage Cartons
Redemption Centres	27%	17%	18%	18%	3%
Bag Drops	23%	23%	34%	34%	3%
Retail – Manual Takeback	17%	20%	16%	16%	18%
Retail - RVM	34%	41%	32%	32%	37%

Source: Eunomia assumptions based on previous work

A.3.2.5 Curbside Recycling Collection

Containers are also collected via curbside recycling services. This is one of the two major routes for recycling modelled in this study, along with container deposit return collections. Table A 13: Curbside Collections, Baseline, Tonnes shows the baseline for curbside collections, whilst Table A 14: Curbside Collections, DRS, Tonnes shows how these flows change with the implementation of DRS. It should be noted that Table A 13: Curbside Collections, Baseline, Tonnes and Table A 14: Curbside Collections, DRS, Tonnes show volumes collected before loss rates are applied, so do not constitute a recycling rate. This is instead shown in Section A.3.2.6.

Table A 13: Curbside Collections, Baseline, Tonnes

	Plastic (PET, HDPE)	Glass	Aluminum	Steel	Beverage Cartons	Total
Separate Recycling Collections	27,925	3,558	11,498	43,068	3,112	**89,161**
Separate Residual Waste Collections	12,145	764	12,699	21,738	3,305	**50,652**
Littered	2,748	523	2,028	6,020	196	**11,516**
Total	**42,818**	**4,846**	**26,225**	**70,826**	**6,613**	**151,328**

Source: Ontario 2016 Sales Data; Resource Recycling (2012) A Common Theme, February 2012, http://www.container-recycling.org/assets/pdfs/ACommonTheme.pdf; Eunomia assumptions based on previous work

Table A 14: Curbside Collections, DRS, Tonnes

	Plastic (PET, HDPE)	Glass	Aluminum	Steel	Beverage Cartons	Total
DRS Collections	38,964	4,530	24,517	67,285	3,878	**139,174**
Separate Recycling Collections	2,303	174	619	1,553	1,308	**5,956**
Separate Residual Waste Collections	1,001	37	683	784	1,389	**3,895**
Littered	550	105	406	1,204	39	**2,303**
Total	**42,818**	**4,846**	**26,225**	**70,826**	**6,613**	**151,328**

Source: Eunomia (2017) Impacts of a Deposit Refund System for One-way Beverage Packaging on Local Authority Waste Services, 11th October 2017

After collection, mixed recyclables are sent to MRFs for sorting into separate material streams before being sent to material recyclers. Material losses occur at both the sorting and reprocessing stages, and these were included in our mass flow model to calculate the total quantity of material that is actually recycled (i.e. the final output from the material recycler). The loss rates used for this study, presented in Table A 15: Material Loss Rate Assumptions

, were sourced from a 2012 publication by Resource Recycling.

Table A 15: Material Loss Rate Assumptions

	PET	Glass	Aluminum
Material Loss Rate	32.2%	30.5%[1]	6.5%[2]

Notes:

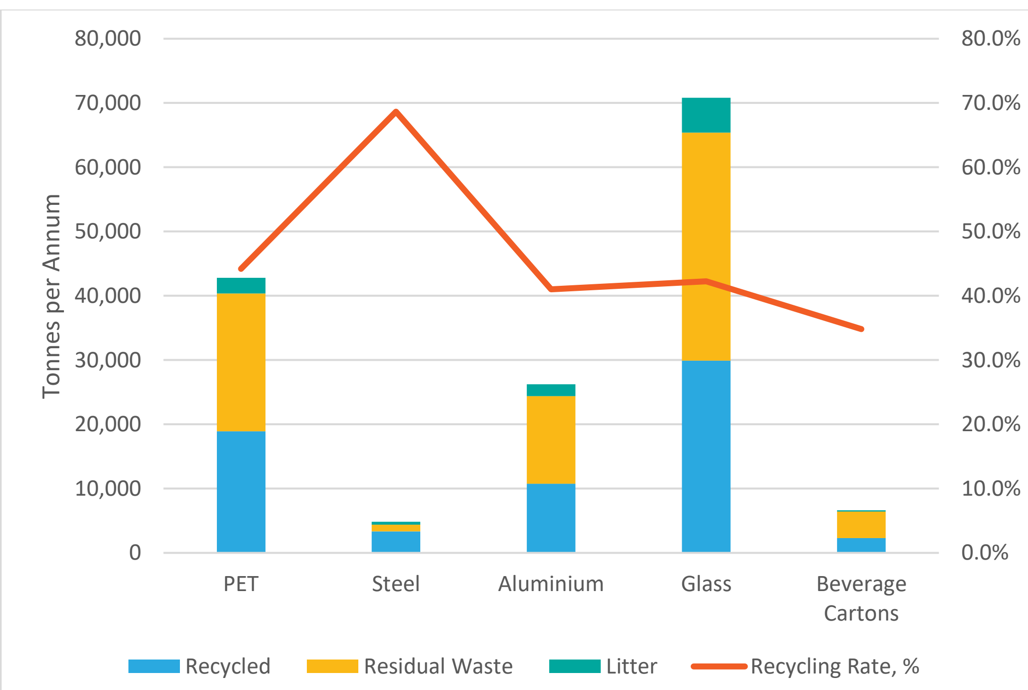
1. *Average of range (21% to 40%)*
2. *Average of range (2% to 11%)*

Source: Resource Recycling (2012) A Common Theme, February 2012, http://www.container-recycling.org/assets/pdfs/ACommonTheme.pdf

A.3.2.6 Final Destinations

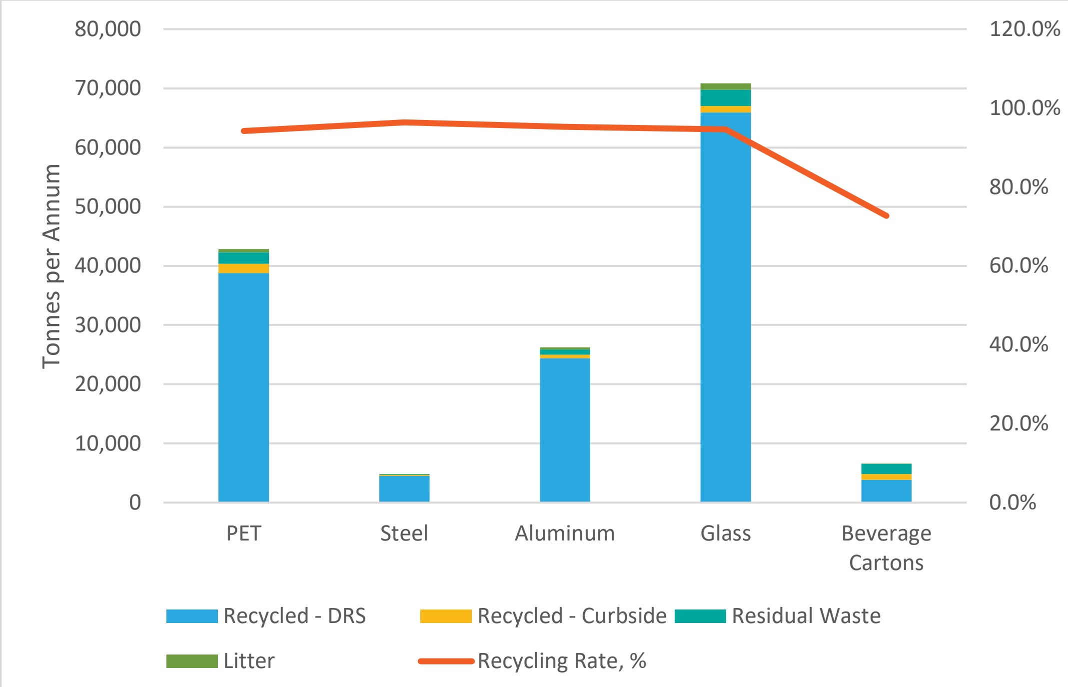
The final destinations of waste for the baseline scenario, based on the assumptions set out above are shown in Figure A 1. The final destinations of waste for the DRS are shown in Figure A 2.

Figure A 1: Final Destinations of Waste Generated, Baseline



Source: Eunomia calculations

Figure A 2: Final Destinations of Waste Generated, DRS



Source: Eunomia calculations

A.3.3 DRS System Return Network

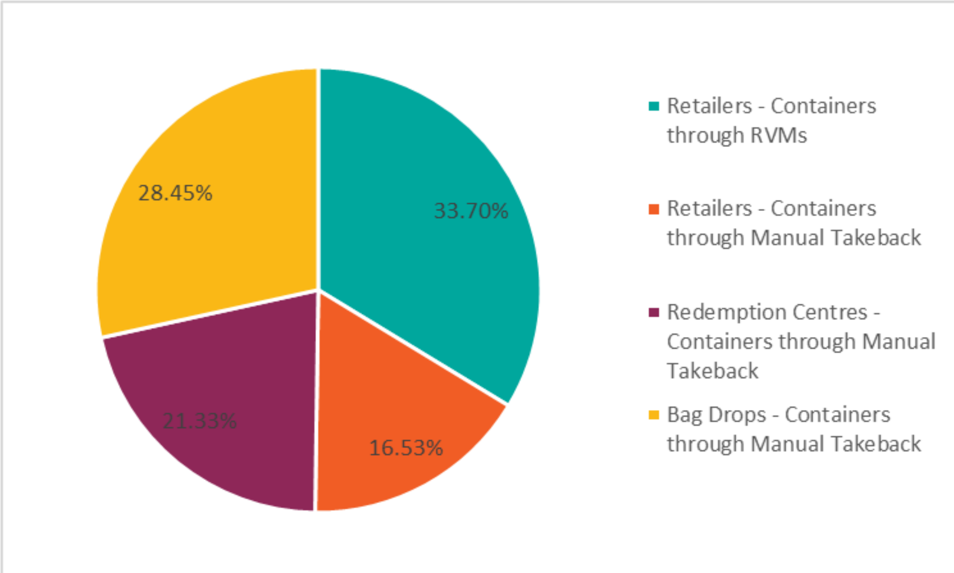
A.3.3.1 Return Points: Retail, Redemption Centres and Bag Drops

In the system modelled, containers can be returned to participating retailers, to bag drop locations or to privately-run redemption centres set up for the purposes of redeeming containers. A handling fee is included in DRSs to compensate redemption locations for the additional cost realized through having to handle returned beverage containers.

For this analysis we assume that the producer responsibility organization has the flexibility to provide for a network of redemption centres to meet consumer demand. We have also assumed that bag drops will be located at the largest retailers and so will negate the need for these retailers to also include RVMs, meaning that most of the throughput from RVMs will be seen at medium sized and smaller retailers, with the smallest retailers likely to choose manual takeback, in areas where it is needed. Geographic coverage is key to ensure ease of access for all Ontarians.

The number of units and tonnage of material that will flow through each redemption route is set out in Figure A 3 and Table A.16.

Figure A 3: Container Redemption by Unit Throughput, %



Source: Eunomia calculations

Table A 16: Volume of Material through Each Redemption Route

Redemption Method	Description	Number of Locations	Percent of Redemption Volume	Rationale
Retail Stores (Manual)	Any dealer that sells a deposit-initiated beverage may also accept empty containers and return the deposit to the consumer	1,372	16.53%	Approximately 80% of small grocery and convenience stores that will have enough throughput to require collection are assumed to not have enough volume for an RVM, and approximately 20% of supermarkets and large grocery stores are assumed to choose manual collections.
Retail Stores (Reverse Vending Machines (RVMs))	Most larger retail stores have installed RVMs to automate the process of redeeming containers	1,241	33.70%	Most supermarkets and medium/large grocery stores and around 20% of small grocery and convenience stores are assumed to have enough throughput to install RVMs.
Dedicated Redemption Centres	These centres, often situated in retail spaces or warehouses on the outskirts of a town, are privately owned businesses established solely for redeeming beverage containers subject to a deposit	58	21.33%	806 million containers are modelled to be redeemed at redemption centres. Each centre is assumed to process approximately 14 million containers per year.

Redemption Method	Description	Number of Locations	Percent of Redemption Volume	Rationale
Bag Drops	Shipping containers adapted to include hatches for consumers to deposit bags of containers, located in parking lots of large retailers or on patches of unused land	240	28.45%	it has been assumed that all hypermarkets and 12% of supermarkets will install a bag drop over RVMs

Source: Eunomia assumptions based on previous work

A.3.3.2 Retail Landscape and System Design

The types and total number of retail outlets in Ontario participating in the DRS were based on data from Statistics Canada.[135]This data was divided by employee numbers, with each category being attributed to a store size, with a normalization applied for sensible distribution. In total it was determined that there are 8,045 retailers that could accept containers.

The next assumption to consider was which retailers have RVMs and the average number of RVMs per retailer, based on discussions with and estimates provided by RVM distributors.[136]

The retailer assumptions described above are presented in Table A 17: Modelling Assumptions for Ontario Retailers.

Table A 17: Modelling Assumptions for Ontario Retailers

Categories for Model	No.	No. Requiring Collection	No. with RVMs	RVMS (%)	RVMs per retailer
Hypermarkets	81	81	0	0%	0
Supermarkets	885	885	566	95%	3
Medium / Large Groceries	602	602	482	80%	1.5

135 Statistics Canada (2018). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3310002501&pickMembers%5B0%5D=3.859>

136 Private communication with RVM distributors

Categories for Model	No.	No. Requiring Collection	No. with RVMs	RVMS (%)	RVMs per retailer
Small Groceries	999	150	30	20%	1
Convenience Stores	5,478	822	164	20%	1
Total	**8,045**	**2,540**	**1,241**		**2,854**

Source: Eunomia assumptions based on previous work

Due to the varying sizes of retailers that fall within the supermarket category, three RVMs is an average that gives a sensible container throughput across the category, meaning that the machines are as efficient as possible. However, in practice the number of RVMs installed is likely to vary from store to store, with some of the largest stores likely to require up to 8 machines. Hypermarkets (a big-box store combining a supermarket and a department store) have zero machines because they are serviced by a bag drop system.

Participation in the scheme is expected to extend to the majority of supermarkets, groceries and convenience stores, in order to ensure adequate geographic coverage. However, with small retailers, especially those located within a strip mall or where several retailers are located in close proximity, it is unlikely that these retailers will used aw redemption points, when more convenient options are available.

The proportion of glass bottles, plastic bottles, beverage cartons and cans returned to each type of retailer was also estimated in Table A.18. In lieu of sales data broken down by retailer type, figures from Connecticut, which is of similar geographic situation, were used with reference to other data from Quebec and Europe to give a sensible assumption.

Table A 18: Collection Point for Redemption of DRS Containers (% of Total Containers Redeemed at Retailers)

Type of Retailer	Glass Bottles	Plastics Bottles	Aluminum Cans	Beverage Cartons
Hypermarkets (all through bag drop)	0.00%	0.00%	0.00%	0.00%
Supermarkets	63.85%	64.10%	63.67%	63.67%
Medium / Large Grocery Stores	31.78%	31.90%	31.69%	31.69%
Small Grocery Stores	1.68%	1.78%	1.89%	1.89%

Type of Retailer	Glass Bottles	Plastics Bottles	Aluminum Cans	Beverage Cartons
Convenience Stores	2.69%	2.22%	2.75%	2.75%
Total	**100%**	**100%**	**100%**	**100%**

Source: Eunomia assumptions based on previous work

Note that these are estimates that are then aggregated back up for the purposes of modelling collections. Small changes in distribution per material type will have no significant impact on modelled costs.

RVMs in the System

Where possible, the DRS needs to integrate the collection of HDPE bottles and cartons. How these materials are integrated into the system would depend on:

- The space retailers have to store additional machines/compartments/bags; and
- The technological capability of the RVMs to both receive and separate out HDPE and carton fractions.

It is suggested that the RVM network in a modernized system in Ontario:

- Focuses on segregated materials to minimize sorting costs and maximize material revenue – prioritizing, where space and throughput allows, modern technology that provides single deposit interfaces to separate out multiple streams (e.g. clear from coloured PET, and amber/green glass);
- Increases the use of compacting RVMs to minimize transport costs (the biggest savings are in glass);
- Takes advantage of throughput leases that require minimal capital outlay from retailers.

Small stores with single multi-stream RVMs may not be able to receive HDPE and cartons separately. The number of plastic bottles coming through stores using single multi-sort RVMs is not expected to exceed 5% of the total RVM volume. This would mean that up to 5% of the collected RVM plastic tonnage (approximately 1.4ktpa) may need processing through an initial HDPE/PET[137] sorting line at the counting centre prior to secondary processing.

[137] HDPE containers for beverages excluding milk products so very small number.

Retailers not expecting any significant volume of HDPE and cartons to be returned might choose to manually store containers of HDPE and cartons for collection alongside the RVM bags, which would avoid the additional sorting cost.

A.3.3.3 Retailer Costs and Handling Fee

The cost of collecting and sorting containers at retail outlets is borne by the retailers themselves, and is reimbursed through handling fees.

For this study it was deemed appropriate to calculate the handling fee using a 'bottom-up' approach based on some rational considerations of the costs incurred. This enables an estimate of the 'correct' handling fee, which assumes that retailers are fully reimbursed for their costs.

In determining the handling fee, the key considerations centre on the collection of returned beverage containers, for example, where the containers are returned and how they are transferred back to the retailer during the redemption of the deposit. Both these aspects affect the nature of the collection logistics required. It is therefore important to understand the retail landscape prior to determining the system specification. This is described in the first of the sections below, along with the outline design of the container take back and collection system. The assumptions are based on conservative figures thus the collection, handling and processing costs should be a relatively good estimate of what they would be in practice.

The retailer cost overview on a cost per container basis is shown below in Table A 19. The assumptions behind these costs are detailed in Section A.3.3.2, below. It is worth noting that although the costs to the retailer for having an RVM is higher than having manual redemption, RVMs reduce other costs in the system, most significantly transport costs through the compaction of material. Overall a system operating with RVMs is less expensive than a system with manual redemption.

Table A 19: Retailer Costs, Cents Per Redeemed Container

Retailer	RVM (cents)	Manual (cents)
Space Costs	0.597	0.264
Labour Costs (Pickup/Unload, Emptying Bins, Cleaning Machines, Processing Receipts)	0.864	0.378
RVM and Maintenance Costs	2.866	-
Container Costs	0.084	0.084
Total	**4.41**	**0.73**

Source: Eunomia calculations

3.3.3.1 Space Costs

Space is required for all retailers who take back containers, regardless of whether there is RVM or manual redemption. This is an added cost for retailers, and as such should be compensated for by the central system. Table A 20 shows the costs for RVM usage and Table A21 shows the costs for manual redemption.

The costs for retailers who install RVMs are based on the actual cost to lease the floor space in the sales area. It should be noted that many supermarkets will use outside space to house RVMs and therefore calculations are on the conservative side. All retailers require storage space at the back of the store for redeemed containers awaiting collection. We have assumed that each cubic meter of material will on average require 2m^2 of storage space. A rental value of $1.64 per square foot per annum was used for retail cost calculations.[138]

Table A 20: RVM Space Requirement and Costs

RVM Storage	Number of RVMs	Floorspace Required (m^2)	Total Floorspace Required (m^2)	Total Cost ($M)
RVM Storage	2,331	10	23,305	4.92

Source: Eunomia assumptions based on previous work

Table A 21: Storage Space Requirement and Costs for Manual Redemption

	Number of Retailers	Average Pickup Volume (m3)	Floorspace Required per m3 Pickup Volume	Total Floorspace Required (m^2)	Total Cost ($M)
Retailer	1,241	6.0	1.0	7,474	1.57

Source: Eunomia assumptions based on previous work

Labour Costs

The additional handling and collection of containers from retail outlets and redemption centres demands labour time, and therefore additional costs are incurred. The two main activities requiring additional labour are:

1) Take back of containers from consumers, paying the deposit and placing the containers in storage locations; and

[138] Toronto Real Estate Board, "GTA REALTORS® Release Commercial Market Statistics," *Globe* Newswire, May 3, 2017. <https://globenewswire.com/news-release/2017/05/03/978083/0/en/GTA-REALTORS-Release-Commercial-Market-Statistics.html>

2) Facilitating pickup of containers from the contracted logistics company.

The calculation of these cost elements is described below.

Labour Costs for Consumer Take Back via RVMs

Labour costs for retailers with RVMs are based upon the following assumptions:

- Each consumer returns 30 containers in one visit to RVMS at retailers;[139]
- RVMs have an average storage capacity of 500 glass, 800 plastic, 3,500 metal or 900 carton containers;
- It takes 5 minutes to empty the RVM and store the containers at the back of the store;
- It takes 12 minutes per day to clean each RVM; and
- RVM receipts are processed alongside retail purchases, which adds three seconds to each transaction.

Labour Costs for Manual Consumer Take Back

For retail stores and redemption centres with manual takeback, the labour costs for redemption are associated with the additional time to collect the containers from the consumer, pay the deposit, and place the containers in the designated storage area.

For retailers, the time taken for the store attendant to accept an average of 80 containers and move them to the storage area is estimated at three minutes.[140]

For bag drops, minimal labour costs are required and so a small amount of maintenance time is assumed (1 hour per day per bag drop) to account for cleaning and ensuring that the bag drop is sufficiently operational.

Labour costs assume that staff are unskilled and paid an hourly rate of $19.39 per hour (plus 25% on costs).[141]

Transport Labour Costs for Container Collection

These labour costs are for the time spent by retailers and redemption centres in setting out containers for collection. We assume a labour cost of 30 minutes per container pickup for larger retailers and 10 minutes for smaller stores. Estimates for the number of pickups required per week for each retail category and redemption centre were also made.

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[139] Private communication with system administrators in other jurisdictions

[140] Private communication with system administrators in other jurisdictions

[141] <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410020401&pickMembers%5B0%5D=1.7&pickMembers%5B1%5D=2.1&pickMembers%5B2%5D=3.1>

Table A 22: Labour Hours Required at Retail Stores

Labour	Total Time (Hours)
Emptying Bins	257,997
Cleaning Machines	145,891
Processing RVM Receipts	29,561
Manual Takeback	176,352
Total	**609,801**
Cost per Container Redeemed (cents)	**0.557**

Source: Eunomia assumptions based on previous work

Reverse Vending Machine (RVM) Costs

We have modelled RVM costs based on a throughput contract pricing system. These are full service RVM contracts that are either totally or partially funded by the handling fee and the consumer volume through the RVM. Terms of throughput contracts are generally 5 years, but can vary anywhere from 3-7 years, and ownership of the RVM is always retained by the RVM supplier. We have assumed that all RVMs are compacting and a total cost to the retailer of $0.28 per container based on the average price quoted by RVM manufacturers.[142]

Table A 23: RVM Cost Summary Table

Cost Element	Value
RVM Lease/Container*	$0.028
Containers Through Retail RVMs	1,064M
Average RVM Throughput/Month	25,720
Monthly Cost per RVM	$518
Total RVM Cost	$29.9M
***Only lease and service costs – labour costs are included separately above.**	

Source: Eunomia calculations

[142] Personal communications with RVM manufacturers.

Container Costs

We also modelled the costs of the containment systems for the transportation of containers. We have assumed that:

- All plastic and cans, compacted and uncompacted, are transported in plastic bags;
- All compacted glass is collected in bags;
- All manually collected glass is transported in crates.

The number of bags required per year is estimated from the total number of containers requiring collection and the number of containers that can be transported in each bag. Each bag is assumed to take approximately 100 glass bottles, 150 PET bottles or 250 cans.[143] Where containers are compacted containers, each bag is assumed to take more based on the difference in bulk densities between compacted and uncompacted containers. The cost of a bag is modelled at $0.20, equating to $0.009 per container. This cost could go down if bags are reused, or the purchasing power of the central system comes into play, and all 17.6 million bags (per annum) are ordered in bulk and distributed to retailers accordingly. Glass bottle bins are assumed to have a 240L capacity, cost $19.50, and last three years (if used once per week).

A.3.3.4 Redemption Centre Network

The approach taken to model the cost of the redemption centre network is different from that of estimating the costs to retailers since:

- the receipt of handling fees is the primary income source to redemption centres, and so the handling fee given to each redemption centre needs to cover its full costs in order to avoid centres closing;
- full cost operation (rather than partial accounting for hours spent on individual tasks) is available in a way that it is not for the retail environment.

Redemption centre costs vary widely depending on a number of factors, including the scale of the operation, the nature of the enterprise, and the rental costs paid for the site. Redemption centre cost estimates sourced from conversations with sector experts range from as low as $0.011 per container in Oregon (with very high centre throughputs in excess of 4 million monthly) to as high as $0.044 per container (the cost of a manual redemption centre operation reported by RSS in 2013).[144]

Redemption centres have the potential to cater to bulk redeemers and take some of the volume from retailers at a lower cost than the return to retail network. The system operator

[143] TOMRA (2001), Zentrale Organization Einweg Pfand Deutschland: Business Model Development Guide
[144] RSS (2013), Container Redemption System Optimization Study

would decide on the optimal distribution and coverage of redemption centres based on consumer demand, but our central cost estimation for Ontario is based on 58 redemption centres, calculated based on container throughputs from Connecticut data.

Costs are likely to vary on a site-by-site basis. If the system operator is empowered to license redemption centres, then it could tender specific opportunities based on the handling fee that operators are prepared to accept. This would give it the flexibility to provide for both edge-of-town mass-redemption centres as well as smaller community locations and to expand or retract coverage to best meet demand and manage costs.

We suggest that the system operator start with a target redemption centre handling fee cost of $0.0248 per container.

We have also created a bottom-up cost model to approximate redemption centre service costs:

- Rent is assumed at an average of $69k per centre, calculated from an average floor space of 956 m^2. Rent is likely to be between $6.83 and $19.63 per square foot per annum based on the average rental cost of industrial and retail space in Ontario.[145]
- Labour costs:
    - At redemption centres, we assume that an average of 250 containers are redeemed per consumer, and that the total staff time required for this process is 4 minutes.[146]
    - We assume a labour time of 2.5 hours per pickup for redemption centres. An estimate for the number of pickups required per week for redemption centres was also made.
    - We also assume one full time centre supervisor.
- Management overheads are estimated at 15% of operational costs, and a profit margin is estimated at 10%.

Table A 24 shows the assumptions used to calculate the costs of redemption centres under the proposed system.

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[145] Toronto Real Estate Board, "GTA REALTORS® Release Commercial Market Statistics," *Globe* Newswire, May 3, 2017. <https://globenewswire.com/news-release/2017/05/03/978083/0/en/GTA-REALTORS-Release-Commercial-Market-Statistics.html>

[146] Private communication with New Britain, Central CT Redemption Centre

Table A 24: Redemption Centre Cost Summary

	Total Cost ($M)	Cost Per Container Redeemed (cents)
Space Costs	3.95	0.490
Labour Costs	11.62	1.489
Container Costs	0.68	0.084
Overhead Costs	3.32	0.412
Total	**19.57**	**2.48**

Source: Eunomia calculations

A.3.3.5 Bag Drop Network

The approach taken to model the costs of the bag drop network is again different to both the approach for retailers and for redemption centres. This is because bag drops are a fundamentally different operation that requires minimal labour and maintenance costs, and much smaller initial set up costs.

Many of the cost assumptions used in the bag drop model were from communications with OBRC, the company that runs the Bottle Drop scheme in Oregon. These conversations also informed how this part of the model was designed as insight was given to the operations and logistics of how a bag drop system is run.

The main cost elements for bag drops are:

- Infrastructure costs – this includes the costs for ongoing space requirements, electricity, and the upfront capital expenditure on the units.
- Labour costs – this is assumed to be 1 hour of retail staff time per bag drop per day to account for cleaning and general maintenance. As bag drops are assumed to be sited predominantly in retail parking lots staff time is assumed to come from existing retail staff.
- Overhead costs – 15% was applied to the total system cost to account for overheads, which includes central administration costs and setup and ongoing IT costs.

It is also worth noting that in Oregon's Bottle Drop program, consumers pay USD $0.20 (equivalent to CAD $0.27) to buy each bag that they fill, and also pay a USD $0.35 (equivalent to CAD $0.47) sorting fee per bag. This is for the convenience it gives over redeeming at a redemption centre or retailer, which helps to fund the bag drop system. Whilst we have not modelled these charges in this analysis, it is worth considering as a pricing structure that works elsewhere. On this basis, it would generate an estimated additional revenue of $690k in bag sales and $1.2M in sorting fees per year.

Table A 25: Bag Drop System Costs

	Total Cost ($M)	Cost Per Container Redeemed (cents)
Space Costs	3.95	0.368
Labour Costs	1.70	0.158
Container Costs	0.91	0.084
Overhead Costs	0.85	0.079
Total	**7.41**	**0.69**

Source: Eunomia calculations

A.3.3.6 Collection Costs

This section sets out our transport assumptions for containers that are collected from retailers, bag drops and redemption centres. Our analysis estimates the costs of transport from retailers, bag drops and redemption centres to the first onward destination, whether this is a transport station or a material processor.

We assume that at both retail and redemption centre locations, non-compacted aluminum cans and plastic bottles are contained in bags, glass bottles in crates, and compacted containers are transported on pallets. We have modelled two separate rounds; a large shop round with a truck collecting large quantities from fewer shops, and a small shop round with a 12-tonne collection vehicle collecting smaller quantities from a larger number of shops.

A simple collection model was developed to estimate the number of vehicle days required per annum to collect the containers, and the cost of operation per vehicle. The key assumptions are listed below:

- Bulk densities of the containers:[147]
    - Glass bottles – 557 kg/m^3 compacted and 200 kg/m^3 un-compacted;
    - Plastic bottles – 36 kg/m^3 compacted and 20 kg/m^3 un-compacted;
    - Cans – 80 kg/m^3 compacted and 30 kg/m^3 un-compacted; and
    - Beverage cartons – 100 kg/m^3 compacted and 20 kg/m^3 un-compacted.

[147] Private communication with collection agents

- Vehicles will be filled to no greater than 90% of capacity (90% of 3,465 cu ft);[148]
- Drivers work a 7.5-hour day and 5-day week;
- Retailers and redemption centres are located an average drive time of 0.5 hours from the vehicle depot and it takes 15 minutes to travel between pick up points;
- It takes an average of 14 minutes to pick up containers from a retailer, 16 minutes from bag drops and 45 minutes from redemption centres;
- The vehicle costs are calculated based on the following assumptions:
    - $205,000 capital costs for large round vehicles and $140,000 capital costs for small round vehicles, with a 7-year depreciation period;
    - The tractor is leased under a full-service contract at $20,500k per annum;
    - Drivers earn $32.09 per hour;
    - 0.37 litres/km fuel consumption;
    - A fuel price of $1.27 per gallon ($0.34 per litre) of diesel.

The total number of pickups per week for each type of retailer and for redemption centres is another key assumption for our modelling. We are informed that collection vehicles usually collect from 8 retail stores or 2-3 redemption centres during a 10-hour shift. This information was used to guide our pickup assumptions, as was the typical number of containers redeemed per week at each store type. Our assumptions are presented in Table A 26.

Table A 26: Number of Pickups per Week for Participating Retailers, Redemption Centres, and Bag Drops

Type of Redemption Location	Number of Pickups per Week
Hypermarkets	(Bag Drop collection)
Supermarkets	2.0
Medium / Large Grocery Stores	2.0
Small Grocery Stores	1.5
Convenience Stores	1.5
Bag Drops	8.0
Redemption Centres	9.0

[148] Cerasis (2015) *Trailer Guide – Standard Freight Trailer*, http://cerasis.com/wp-content/uploads/2015/08/2015TrailerGuide.pdf

Source: Eunomia assumptions based on previous work

A.3.3.7 Sorting

Sorting costs and material revenues are primarily based on conversations and data from sorting equipment manufacturers: [149]

- The cost of unloading and preparing collected material for processing is estimated at $133/tonne.
- 65% of plastic bottle material from RVMs is shredded, which sells for a lower price (and/or requires additional processing).
- A mix of amber, green and clear glass is assumed. If this is unable to be colour-separated at source, this will negatively impact the gate fee. It is assumed that at most 20% of the glass is collected mixed from retailers.

A.3.3.8 Material Revenue

The system operator would fund the processing cost through producer administration fees and pass all material revenues on to distributors (Table A 27).

Table A 27: Material Revenues

Material	Revenue per Tonne ($)[150]	Total Revenue ($M)
Glass Bottles	-39	-2.62
Plastic Bottles	486	18.94
Steel Cans	326	1.48
Aluminum Cans	1,847	45.28
Beverage Cartons	72	0.28

Source: Eunomia calculations

[149] Communication with sorting equipment manufacturers.
[150] Continuous Improvement Fund (2018), “Price Sheet – August 2018.” <https://thecif.ca/wp-content/uploads/2018/09/2018-August-Price-Sheet.pdf>

A.3.3.9 Unclaimed Deposits

A total of 421 million beverage containers will not be redeemed which will generate $45.87M of revenue when system losses are accounted for.

A.3.3.10 Producer Responsibility Organization Administrative Costs

Administrative functions associated with maintaining the IT systems to support tracking and processing deposit flows around the system would be handled by the PRO. High-level costs for these functions have been estimated based on experience of costs of similar central operations in Oregon, Connecticut, and Europe. Assumed annual costs are shown below in A 28.

Table A 28: Producer Responsibility Organization Annual Costs

	Cost ($M)	Note
Annualized Depreciation of Set Up Costs	6.91	Includes IT database, office furniture and equipment, project management and communication
Staff Costs	0.77	Budget for up to 11 staff across accounting/database and consumer services
Office Space Costs	0.05	$12.1k per person per annum based on average Ontario rent[151] and an allowance of $30m^2$ per staff member, plus a similar amount of associated office expenditure
Administration Costs	1.0	Includes IT, finance, legal, staff expenses and utilities
Marketing Costs	1.0	
Total	**9.73**	

Source: Eunomia assumptions based on previous work

Included within the annual PRO costs above are staff, legal and capital costs associated with:

[151] Toronto Real Estate Board, “GTA REALTORS® Release Commercial Market Statistics,” *Globe* Newswire, May 3, 2017. <https://globenewswire.com/news-release/2017/05/03/978083/0/en/GTA-REALTORS-Release-Commercial-Market-Statistics.html>

- Set-up of the PRO, including the establishment of the organization, developing the clearinghouse model, and procuring financing;
- Constructing the system, including building the container database, clearinghouse and billing systems;
- Procuring logistics and transport providers;
- Stakeholder communication, enrolment and wider public advertising;
- Staff recruitment;
- Database population; and
- Legal and consultancy fees.

Table A 29 gives an overview of the total system net cost which would be funded by the producer administration fee. The table breaks this down into high level cost items, and shows the costs on a per unit and per kg redeemed basis, as well as per kg placed on the market.

Table A 29: Breakdown of Producer Administration Fee by Net System Costs

	Total Cost ($M)	Cost per Container Redeemed (cents)	Cost/Kg Redeemed (cents)	Cost/Kg POM (cents)
Producer Responsibility Organization	9.73	0.26	0.23	0.64
Handling Fees - Retailers, Redemption Centres, Bag Drops	93.96	2.49	2.24	6.21
Transport Costs	44.89	1.19	1.07	2.97
Counting Centre Costs	12.38	0.33	0.29	0.82
Materials Income	-63.35	-1.68	-1.51	-4.19
Unclaimed Deposits	-68.81	-1.82	-1.64	-4.55
Fraudulently Claimed Deposits	5.67	0.15	0.13	0.37
Net Cost	**34.48**	**0.91**	**0.82**	**2.28**
Funded by Producer Administration Fee	**-34.5**	**-0.91**	**-0.82**	**-2.28**

Source: Eunomia calculations

Table A 30 breaks down the total costs, listed above, by material stream. Aluminum cans, primarily due to their high sales value, result in a negative cost to the system. This means that, theoretically, producers of beverages in aluminum cans would receive an income from the system; this is similar to the approach taken in Norway, where producers pay for every container they place on the market, by material type. The fee structure is additionally used to incentivize eco-design and ensure that producers pay for the additional costs that result from using materials that are less easily recycled, have unnecessary packaging (e.g. film wraps around bottles), or have a lower value.

Table A 30: Breakdown of Producer Administration Fee by Material Stream

	Total Cost ($M)				Cost per Container Redeemed (cents)				Cost/Kg Redeemed (cents)			
	PET	Metal	Glass	Beverage Cartons	PET	Metal	Glass	Beverage Cartons	PET	Metal	Glass	Beverage Cartons
Producer Responsibility Organization	3.42	4.83	0.72	0.77	0.25	0.25	0.24	0.39	8.78	16.63	1.06	19.75
Handling Fees - Retailers, Redemption Centres, Bag Drops	35.43	45.69	7.74	5.10	2.64	2.34	2.63	2.63	90.94	157.30	11.50	131.56
Transport Costs	26.40	12.35	3.97	2.17	1.96	0.63	1.35	1.12	67.75	42.50	5.90	56.08
Counting Centre Costs	4.35	6.15	0.91	0.97	0.32	0.32	0.31	0.50	11.17	21.16	1.35	25.13
Materials Income	-18.94	-46.76	2.62	-0.28	-1.41	-2.40	0.89	-0.14	-48.60	-160.98	3.90	-7.20
Unclaimed Deposits	-24.18	-34.15	-5.07	-5.42	-1.80	-1.75	-1.72	-2.79	-62.06	-117.57	-7.53	-139.65
Fraudulently Claimed Deposits	2.02	2.92	0.44	0.29	0.15	0.15	0.15	0.15	5.17	10.07	0.66	7.50
Net Cost	**28.50**	**-8.97**	**11.34**	**3.61**	**2.12**	**-0.46**	**3.86**	**1.86**	**73.14**	**-30.90**	**16.85**	**93.17**
Funded by Producer Administration Fee	**-28.50**	**0.00**	**-11.34**	**-3.61**	**-2.12**	**0.00**	**-3.86**	**-1.86**	**-73.14**	**0.00**	**-16.85**	**-93.17**

Source: Eunomia calculations

Table A 31: Breakdown of Handling Fees by Redemption Method breaks down the costs shown in Table A 32 further into how the costs are distributed by material streams. Overall, metals come out with a negative net cost, meaning that the costs associated with this stream are balanced in favour of the system.

Table A 31: Breakdown of Handling Fees by Redemption Method

	Total Cost ($M)	Cost per Container Redeemed (cents)	Cost/Kg Redeemed (cents)
Handling Fees - Retailers (RVMs, Labour and Space)	56.2	4.41	10.96
Handling Fees - Retailers (Manual Collection, Labour and Space)	4.54	0.73	1.80
Handling Fees - Redemption Centres	25.8	3.2	9.2
Handling Fees - Bag Drops	7.4	0.69	2.14

Source: Eunomia calculations

Table A 32: Breakdown of Handling Fees by Redemption Method and Material Stream

	Total Cost ($M)				Cost per Container Redeemed (cents)				Cost/Kg Redeemed (cents)			
	PET	Metal	Glass	Beverage Cartons	PET	Metal	Glass	Beverage Cartons	PET	Metal	Glass	Beverage Cartons
Handling Fees - Retailers (RVMs, Labour and Space)	20.1	27.65	5.26	3.18	4.41	4.41	4.41	4.41	5.16	9.52	0.78	8.19
Handling Fees - Retailers (Manual Collection, Labour and Space)	1.61	2.25	0.42	0.26	0.73	0.73	0.73	0.73	0.41	0.77	0.06	0.67
Handling Fees - Redemption Centres	11.61	11.23	1.60	1.37	3.20	3.20	3.20	3.20	2.98	3.87	0.24	3.52
Handling Fees - Bag Drops	2.09	4.57	0.46	0.30	0.69	0.69	0.69	0.69	0.54	1.57	0.07	0.78

Source: Eunomia calculations

A.3.4 Employment Impacts

The potential employment impacts associated with the introduction of a DRS were also calculated as part of our overall cost benefit analysis.

The impacts on employment for sorting and reprocessing were calculated using our best estimates of the number of jobs required per tonne of waste throughput.[152] These were derived from a recent review of studies on employment in the waste management sector. The employment assumptions used are shown in Table A 33: Employment Assumptions for Non-DRS Waste Management in Canada.

Table A 33: Employment Assumptions for Non-DRS Waste Management in Canada

Employment Type		Average Jobs per 1,000 Tonnes Throughput
Sorting at Materials Recovery Facilities		1.1
Processors (Domestic)	Plastic	10.3
	Glass	2.9
	Aluminum	11.0
	Steel	6.0
	Beverage Cartons	2.0
	Paper	2.0
Landfill		0.1
Incineration		0.1

Note: *Reprocessor employment impacts were only calculated for materials where there is a change in mass flows between the current and proposed system and therefore a change in employment.*

[152] The studies reviewed are summarized in: Eunomia (2016) *A Resourceful Future – Expanding the UK Economy: Technical Appendix*, Report for SUEZ Recycling and Recovery UK, September 2016

Source: See footnote 17

For the DRS system, employment impacts are taken directly from the DRS model that calculates the number of staff required for each part of the system. This includes the staff used in collections of DRS material and further haulage as well as any additional retailer/redemption centre jobs required to receive containers brought for redemption (for manually returned containers only) and assisting with collections of DRS material from the retailer, redemption centre and bag drops. Employment impacts for the change in employment associated with curbside collections are taken directly from collections modelling.

A.3.4.1 Current System

The number of FTE jobs created under the current Blue Box recycling program and residual waste curbside and drop off programs is as set out in Table A 34: Number of Direct, Indirect and Induced Jobs Resulting from Current Program. A multiplier of 1.77 was applied to the number of direct jobs to calculate the indirect and induced jobs resulting from the program.

Table A 34: Number of Direct, Indirect and Induced Jobs Resulting from Current Program

Job Activity	Number of FTE Jobs Created by Current Program
Blue Box Collection	2,121
Residual Waste Collection	2,729
Sorting at MRF	423
Secondary Processing	-
Plastic	685
Glass	257
Aluminum	117
Steel	166
Beverage Cartons	349
Paper	25
Landfill	217
Incineration	15
Total Direct	**7,105**
Total Indirect and Induced	**5,471**
Total Direct, Indirect and Induced	**12,576**

Source: Eunomia calculations, excluded those employed by Stewardship Ontario

Gross Value Add to the economy from the current program is $709.74M, and total tax revenue is $58.84M.

A.3.4.2 Proposed System – Blue Box plus Non-Alcoholic Beverage DRS

The number of FTE jobs created as a result of the new system, which combines the current Blue Box recycling program, residual waste curbside collection, and DRS program for non-alcoholic beverage containers, is outlined in Table A 35.

Table A 35: Number of Direct, Indirect and Induced Jobs Resulting from the New System

Job Activity	Number of FTE Jobs Created by Proposed Program
Curbside	
Blue Box Collection	1,733
Residual Waste Collection	2,301
Sorting at MRF	426
Secondary Processing	-
Plastic	881
Glass	348
Aluminum	284
Steel	184
Beverage Cartons	442
Paper	29
Landfill	209
Incineration	14
Subtotal Curbside	**6,851**
Non-Alcoholic DRS	
Retail	331
Redemption Centres	286
Bag Drops	42
Collection	221
Further Haulage	44
Producer Responsibility Organization	11
Counting Centres	161
Subtotal DRS	**1,095**
Total Direct	**7,946**
Total Indirect and Induced	**6,118**
Total Direct, Indirect and Induced	**14,064**

Source: Eunomia calculations

Gross Value Add to the economy from the combined program is $800.54M, and total tax revenue is $66.60M. In total the new program would bring in a combined extra $74.50M to the economy.

A.3.5 Environmental Impacts

Environmental impacts associated with the introduction of a DRS for non-alcoholic beverage containers will occur from the following processes:

1) Recycling of additional beverage containers;
2) Reduction in disposal of beverage containers;
3) Additional collection and transportation of containers to recyclers; and
4) Reduction in impact to personal amenity associated with litter.

Each of these processes is described in further detail in the Sections below.

The two main elements considered for processes 1) to 3) are greenhouse gas (GHG) emissions and air quality impacts. The approach to valuing these two elements is set out in Sections A.3.5.1 and A.3.5.2. However, there is also an environmental impact to be considered. This is related to the amenity impact associated with litter. There is a dearth of relevant studies allowing the valuation of this, but it is simply too important, in our view, to be assigned (implicitly) a zero value. Our approach is set out in Section 5.4.4.

A.3.5.1 Greenhouse Gas (GHG) Valuation

GHG valuation is based on estimates of the damage cost of carbon used by Environment and Climate Change Canada (ECCC) to value the climate impacts of regulatory interventions. The damage cost is a measure, in dollars, of the long-term damage done by a tonne of carbon dioxide or equivalent (CO_2e) emissions in a given year. This dollar figure also represents the value of damages avoided for a small emission reduction (i.e., the benefit of a CO_2 reduction).

The approach used in this study is the same as that used in the cost benefit analysis of landfill bans undertaken by Eunomia; full details of the calculations used can be found in the appendices of this document.[153]

Estimates of the damage cost of GHGs increase over time because future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change, and because GDP is growing over time and many damage categories are modelled as proportional to gross GDP.

Given that the benefits associated with GHG emissions reductions are anticipated to increase in the future, the year in which the modelling is set will impact the overall

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[153] Eunomia (2010) *Landfill Bans Feasibility Research*, Final Report for WRAP <http://www.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Research.f5cf24f9.8796.pdf>

monetized value of emissions. Ideally, we would model waste flows over time, apply the correct value year-by-year, and calculate the net present value of the total benefits. Given that the study is forward looking, it seems sensible to choose a year that is not too close but also not too far in the future. The value for 2020 has thus been used in the calculation of GHG associated damage costs. We have used the official ECCC value of $49.30 per tonne of CO_2e (converted to 2018 prices).[154]

A.3.5.2 Air Quality Valuation

We have considered the impacts on air quality that are expected to result from the treatment processes, including both direct and indirect impacts (the latter relating to avoided impacts associated with energy generation and the recycling of materials).

Our approach is to apply external damage costs to emissions of a range of air pollutants, allowing for the quantification of impacts in monetary terms.

The analysis that follows is focussed on emissions to air. Whilst waste treatment processes may also in some cases affect soil and water quality, data regarding the precise nature of these impacts is less robust, and valuation data is scarcer still.

An in-depth review of the literature found no publicly available datasets for air damage costs for Canada. Our approach to estimating damage costs is therefore based on European data. The damage costs used in this study are sourced from the European Reference Model on Municipal Waste Management, with the methodology based on previous work conducted by the European Environment Agency.[155,156]

The factors that have the greatest influence on the rate of damage costs are average wage, population density, and the specific geographical location (e.g. if neighbouring countries are heavy polluters and thus have an impact on air quality). Of all the European countries, Sweden is the most similar to Canada in terms of these factors. We have therefore assumed that Canada's damage costs, if they were to be calculated, would be roughly similar to those for Sweden (Table A 36: Air Damage Cost Assumptions). It should be noted that while there is only a minor (~10%) difference between monthly wages and population density in Sweden, it is still around 50% higher than in Canada. These damage cost estimates may therefore be somewhat high compared to the real values.

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[154] Environment and Climate Change Canada (2017) *Canada's Approach on the Social Cost of Greenhouse Gases*, <https://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_180944.pdf>

[155] Eunomia (2016) *Support to the Waste Targets Review*, Report for DH Environment

[156] The methodology used is summarized in: European Environment Agency (2011) Revealing the Costs of Air Pollution from Industrial Facilities in Europe, EEA Technical Report No 15/2011

Table A 36: Air Damage Cost Assumptions

Compound	Damage Cost ($/Tonne) (2018 Prices)
NH_3	12,443
PM2.5	22,001
SO_2	6,119
NOx	4,526
VOCs	728

Source: Waste Model – Sweden (2018 prices)

A.3.5.3 Recycling of Beverage Containers

GHG emissions factors for recyclables were taken from WRATE, an environmental model which is used to assess the environmental impacts of waste management activities. Whereas a number of authors have considered the climate change benefits of recycling, much less data is publicly available regarding the air quality impacts of recycling. A cost benefit analysis of landfill bans undertaken by Eunomia provides some information on a limited number of pollutants taken from some of the studies included within its review.[157] Otherwise, the main source of information in this respect is life cycle databases such as Ecoinvent, although some trades associations have also created life cycle inventory datasets for some of the commonly recycled materials.

GHG and air quality damage costs are calculated using the values discussed in the section above and shown in Table A 37.

Table A 37: Recycling Impacts for GHGs and Air Emissions

Material	Emissions per Tonne of Recyclables (Kg)						Total Monetised Impact ($/Tonne)
	CO_2	PM2.5	SO_2	NO_x	NH_3	VOCs	
Plastic	-1,150	-0.11	0.005	-2.27	0.01	-3.51	-72
Glass	-169	-0.04	-0.03	-0.59	-0.15	-0.05	-14

[157] Eunomia (2010) *Landfill Bans Feasibility Research*, Final Report for WRAP, <http://www.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Research.f5cf24f9.8796.pdf>

Material	Emissions per Tonne of Recyclables (Kg)						Total Monetised Impact ($/Tonne)
	CO_2	PM2.5	SO_2	NO_x	NH_3	VOCs	
Steel	-1,623	-0.78	-0.01	-2.70	-0.07	-0.25	-110
Aluminum	-10,721	-4.62	-0.01	-18.00	-0.15	-2.20	-715
Beverage Cartons*	-925	-0.28	-0.005	-1.89	-0.01	-0.86	-61
Paper	-340	-0.10	-0.01	-0.92	-0.01	-0.04	-23
* Note that beverage carton impacts are based on the following composition: 21% plastic, 4% aluminum, 75% paper.							

Sources: WRATE2 / Prognos / Environmental Resources Management / Ecoinvent; The Alliance for Beverage Cartons and the Environment (2014) What are Beverage Cartons?, Accessed 5th December 2014, http://www.ace.be/beverage-cartons/what-are-beverage-cartons

A.3.5.4 Disposal of Beverage Containers

Emissions factors for landfill were taken from the landfill bans study and air quality damage costs are calculated using the values discussed in the section above. The GHG and air quality impacts are shown in Table A 37.

Table A 38: Landfill Impacts for GHGs and Air Emissions, per kg

Material	Emissions per Tonne of Landfilled Waste (Kg)						Total Monetised Impact ($/Tonne)
	CO_2	PM2.5	SO_2	NO_x	NH_3	VOCs	
Plastic	4.3	0.004	0.008	0.17	5.0E-07	0.04	1.16
Glass	4.3	0.004	0.01	0.17	5.0E-07	0.04	1.16
Steel	4.3	0.004	0.01	0.17	5.0E-07	0.04	1.16
Aluminum	4.3	0.004	0.01	0.17	5.0E-07	0.04	1.16
Beverage Cartons*	819	0.004	0.02	0.15	0.62	0.01	49
Paper	1090	0.003	0.02	0.15	0.82	0.004	65
* Note that beverage carton impacts are based on the following composition: 21% plastic, 4% aluminum, 75% paper.							

Source: Eunomia (2010) Landfill Bans Feasibility Research, Final Report for WRAP, <http://www.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Research.f5cf24f9.8796.pdf>; The Alliance for Beverage Cartons and the Environment (2014) What are Beverage Cartons? Accessed 5th December 2014, <http://www.ace.be/beverage-cartons/what-are-beverage-cartons>

GHG emissions for beverage cartons are significantly higher than for other packaging types. This is because the bulk of the composition of beverage cartons is paper, which is biodegradable in landfill and releases GHGs. Our model assumes a 20% gas capture rate which is the standard IPCC rate for countries with less developed waste management systems. Plastics, glass and aluminum are all inert materials and so do not biodegrade and release GHGs. For these materials, the landfill impacts are low as they only relate to transport and operating emissions at the landfill site(s).

A.3.5.5 Collection of Beverage Containers

Beverage containers are collected and transported large distances to reach reprocessing facilities using trucks and other vehicles. These vehicles emit GHGs, and a number of other compounds and particles, which cause damage to the environment. It is important to include these impacts in the cost benefit analysis.

Emissions were modelled for three vehicle types: Semi-trailers (tractor-trailers), 12 tonne curtain-side trucks and passenger cars. Air quality emissions factors (grams per km) for heavy-duty trucks were based on emissions standards adopted by Environment and Climate Change Canada (ECCC). For passenger cars, NO_x emissions were based on the Canadian fleet average in 2008 (and PM emissions based on the same emissions year). 2008 data was used as the average age of passenger cars in Canada is 10 years.[158,159] For trucks, the most recent heavy-duty vehicle exhaust emission standards were used.[160] For passenger vehicles, emissions factors (grams per km) are based on Euro Class 3 standards (2000).[161]

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[158] TransportPolicy (2018) *Canada: Light-Duty: Emissions*, Accessed 22nd November 2018, <https://www.transportpolicy.net/standard/canada-light-duty-emissions/>

[159] Statista (2018) *Average age of vehicles on roads in Canada from 1990 to 2016*, <https://www.statista.com/statistics/641410/age-of-motor-vehicles-in-canada/>

[160] TransportPolicy (2018) *Canada: Heavy-duty: Emissions*, Accessed 22nd November 2018, <https://www.transportpolicy.net/standard/canada-heavy-duty-emissions/>

[161] Dieselnet (2018) *EU: Cars and Light Trucks*, Accessed 3rd July 2018, <https://www.dieselnet.com/standards/eu/ld.php>

GHG emissions factors for diesel and gasoline fuel were sourced from the US EPA.[162] These were converted into emissions per mile travelled based on average fuel consumptions for each vehicle, these are: 45 litres per 100km (Semis); 27 litres per 100 km (12 tonne curtain-side truck); 9 litres per 100km (passenger car).[163,164,165]

For consumer journeys, we assume that half of the journeys taken to redeem containers at redemption centres are conducted purely for the purpose of redeeming containers, with an average round trip distance of 40 km. For retailers, we assume that 10% of containers deposited are by consumers who would not otherwise make that journey, with an average journey length of 15 km (round trip). For bag drops, we assume a journey length of 25 km, and 30% of journeys conducted only for the purpose of redeeming containers.

A.3.5.6 Amenity Impact of Litter

A number of studies have sought to quantify, in monetary terms, the 'welfare loss' - i.e. the extent to which citizens are negatively impacted – from the existence of littered items in their local neighbourhood. This welfare loss is often referred to as the 'amenity impact ' arising from litter – much of which is considered attributable to the 'visual amenity impact ', which is understandable given that litter can transform the look and feel of a place.[166] The studies have typically sought to place a monetary value on this amenity impact through determining the amount that respondents would be willing to pay for a marginal improvement from the current situation, in terms of a proportional reduction in the levels of litter.

While it is possible to measure litter by weight, number of items, and volume, it is likely that visual amenity impact is most closely related to the overall volume of litter, which depends both on the number and volume of littered items, rather than the weight, or only the number. While litter is composed of a number of different materials and items, of which

[162] U.S. Environmental Protection Agency (2015) *Emissions Factors for Greenhouse Gas Inventories*, 19th November 2015, <https://www.epa.gov/sites/production/files/2015-11/documents/emission-factors_nov_2015.pdf>

[163] Geotab (2018) *The State of Fuel Economy in Trucking*, Accessed 22nd November 2018, <https://www.geotab.com/truck-mpg-benchmark/>

[164] Global Fuel Economy Initiative (2014) *Fuel Economy State of the World 2014*, Report for FIA Foundation, <https://www.fiafoundation.org/media/44209/gfei-annual-report-2014.pdf>

[165] Miller, G. & Spoolman, S. (2011) Living in the Environment: Principles, Connections, and Solutions

[166] The association between a littered environment and perception of public safety / fear of crime is an example.

single use plastics will comprise a proportion, there is no research available, to the best of our knowledge, on how the impact varies by material and item type.

Our approach to estimating the litter amenity impact for Ontario is based on a study recently conducted by Eunomia for DG Environment of the European Commission. A review of the literature found no studies relating to litter amenity impact in Canada. We have therefore referred to European data which, while sparse, provides a basis for estimating the amenity impact associated with litter. Eunomia's approach to calculating the overall willingness to pay for reduced litter on land is described in the following paragraphs.

Drawing on what we consider to be the best available study[167] to establish the overall amenity impact associated with local land-based litter across the EU, we first take the unweighted average of a 'to best' improvement across the area types (inner-city, suburban, rural).[168] A 'to best' improvement is an improvement that brings the level of cleanliness to be litter free. This equates to $24.87 per adult per month in 2011. Inflated to 2018 values, this is equivalent to $28.07 per month, or $368 per adult per year.[169] We then scale this figure to Ontario on per capita GDP basis adjusted by purchasing power parity (PPP). Ideally, we would have detailed analyses of litter composition and prevalence to use in scaling the amenity values. However, there are very few composition analyses and those available are not readily comparable. Accordingly, it is appropriate to simply scale by PPP-adjusted GDP, noting that the figure may lead to a slight overestimate in some less-littered locations, and an under-estimate in other more-heavily littered locations.

It is important to note that the calculated amenity impacts relate only to neighbourhood amenity, and do not cover the impact of litter that might be found on journeys to areas beyond one's neighbourhood, such as on walking excursions. Therefore, these estimates do not provide a complete picture of the total land-based amenity impact associated with littered items. Indeed, in terms of neighbourhood litter, citizens may start to see this as somewhat 'normal' (while still having a strong preference for it not to be there). However, for litter encountered on a walking trip in a beautiful area, for example, the sense of upset and potentially anger might be proportionally higher than when it is seen in a day-to-day context.

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[167] Mark Wardman, Abigail Bristow, Jeremy Shires, Phani Chintakayala and John Nellthorp (2013) Estimating the Value of a Range of Local Environmental Impacts, Report for Dept. for Environment, Food and Rural Affairs, 1 April 2011, <http://randd.defra.gov.uk/Document.aspx?Document=9854_LEQFinal.pdf.

[168] *Ibid.*

[169] UK GDP deflators at market prices, and money GDP December 2017 <https://www.gov.uk/government/statistics/gdp-deflators-at-market-prices-and-money-gdp-december-2017-quarterly-national-accounts>

Proportional reductions in amenity impact will be calculated linearly based on anticipated reductions in volume. In respect of land-based litter, to assume a linear reduction (given the argument of diminishing returns) could well be to underestimate the benefit of such reductions – especially given that they will be of beverage containers. However, we take this approach in order to derive a conservative estimate.

Based on this approach a litter amenity of $167,000 per tonne for litter that remains in the terrestrial environment and $479,000 per tonne for marine litter was calculated.

An 80% reduction in litter is also assumed following implementation of the DRS. This is a conservative estimate based on a comparative review of the effect of DRSs on littering behaviour.[170]

A.3.5.7 Overall Environmental Benefit

Operating curbside services alongside a DRS for non-alcoholic containers delivers the following environmental impacts, resulting in a reduction of 48,498 tonnes of CO_2e GHG emissions and monetized benefits to a saving of $2.03B. These savings are shown in Table A 39.

Table A 39: Overall Environmental Benefit

Service	Environmental Impact	Monetized Environmental Impact ($M)
Curbside Blue Box		
Reduced travel, km	-1,031,474	-
Air Quality	-	-0.002
GHG, CO2e tonnes	-741	-0.037
Curbside Residual		
Reduced travel, km	-1,071,187	-
Air Quality	-	-0.002
GHG, CO2e tonnes	-770	-0.038
Recycling		
Recycling increase, tonnes	117,567	-
Air Quality	-	-2.224
GHG, CO2e tonnes	-127,779	-6.300
Landfill		
Disposal reduction, tonnes	-85,333	-
Air Quality	-	-0.092

[170] Eunomia (2017) Impacts of a Deposit Refund System for One-way Beverage Packaging on Local Authority Waste Services, 11th October 2017

Service	Environmental Impact	Monetized Environmental Impact ($M)
GHG, CO2e tonnes	-1,612	-0.079
Incineration		
Disposal reduction, tonnes	-5,957	-
Air Quality	-	-0.012
GHG, CO2e tonnes	-125	-0.015
Additional Vehicle Movements Associated with DRS		
Additional travel, km	217,726,937	-
Air Quality	-	0.085
GHG, CO2e tonnes	82,529	4.069
Subtotal		-4.647
Litter Reduction – Amenity impact		
Amenity impact, tonnes	-8,291	-2,029
Total Cost Benefit	-	-2,033

Source: Eunomia calculations

A.3.6 Total System Costs Benefit

A.3.6.1 Curbside System Costs

The total system costs for the current system are shown in Table A 40 and include all costs relating to the collection, processing and disposal of both recycling and residual waste. The recycling processing costs are a net figure that take into account material revenues. The cost per tonne figures are attributed to all tonnes handled through the system, which is currently 3,557,470.

Table A 40: Baseline System Costs

	Total Cost ($M)	Cost/Tonne ($)
Cost of Recycling Collection	186.17	186.75
Cost of Recycling Treatment	115.41	115.77
Cost of Transfer (Recycling only)	27.02	27.10
Other Costs	25.76	25.84

	Total Cost ($M)	Cost/Tonne ($)
Material Revenue	-96.37	-96.67
Cost of Residual Collection	24.60	24.67
Cost of Residual Disposal	30.36	30.46
Total	**312.94**	**313.93**

Source: Eunomia calculations

Table A 41: shows the change in costs for the new system in comparison to the current system.

Table A 41: New System Costs

	Total Cost ($M)	Cost/Tonne ($)	Change ($M)
Cost of Recycling Collection	156.80	140.70	-29.36
Cost of Recycling Treatment	112.55	101.00	-2.85
Cost of Transfer (Recycling only)	26.35	23.64	-0.67
Other Costs	25.12	22.54	-0.64
Material Revenue	-94.15	-84.48	2.22
Cost of Residual Collection	15.90	14.27	-8.70
Cost of Residual Disposal	23.01	20.65	-7.36
Total	**265.59**	**238.32**	**-47.35**

Source: Eunomia calculations

A.3.6.2 DRS System Costs

Table A 42: shows the total system cost for the proposed DRS system. This table also includes a cost per unit redeemed. A further breakdown of these costs is shown in Table A 43.

Table A 42: DRS System Costs

	Total Cost ($M)	Cost/Tonne ($)	Cost per Container Redeemed (cents)
Net System Cost	34.48	228	0.91

Source: Eunomia calculations

The total new system cost, as shown in Table A 41: is then added to the DRS system cost to give a new total that shows the system as a whole, including collections, processing, disposal and DRS operations. This results in a total cost of $557.13M, as shown in Table A 43:.

Table A 43:Total System Operating Costs of Recycling and Residual (Blue Box and Proposed DRS)

	Total Cost ($M)	Cost/Tonne ($)
New Curbside System Cost	265.59	313
DRS System Cost	34.48	228
Total Operating Costs	**300.07**	**269**

Source: Eunomia calculations

There are additional environmental and economic benefits delivered through the proposed program as set out in Table A 44:.

Table A 44: Total Net Cost of Proposed System (Blue Box and Proposed DRS)

Service Area	Activity	Cost of Current Service ($M)	Cost of Future Service (with move to bi-weekly curbside) ($M)	Change ($M)
Curbside	Cost of recycling collection	186.17	156.80	-29.36
	Cost of recycling treatment	115.41	112.55	-2.85
	Cost of transfer (Recycling only)	27.02	26.35	-0.67

Service Area	Activity	Cost of Current Service ($M)	Cost of Future Service (with move to bi-weekly curbside) ($M)	Change ($M)
	Other costs (promotions, administration from BB cost revenue recycling only))	25.76	25.12	-0.64
	Material revenue	-96.37	-94.15	2.22
	Cost of residual collection (% of costs associated with PPP)	24.60	15.90	-8.70
	Cost of residual disposal (% of total cost associated with PPP)	30.36	23.01	-7.36
	Curbside Subtotal	312.94	265.59	-47.35
DRS – Non-Alcoholic Beverages	Producer Responsibility Organization	0	9.73	9.73
	Handling Fees - Retailers, Redemption Centres, Bag Drops	0	93.96	93.96
	Transport Costs	0	44.89	44.89
	Counting Centre and Sorting Costs	0	12.38	12.38
	Materials Income	0	-63.35	-63.35
	Unclaimed Deposits	0	-68.81	-68.81
	Fraudulently Claimed Deposits	0	5.67	5.67
	DRS Subtotal	0	34.48	34.48
System Costs		312.94	300.07	2.32
Environmental Benefits	GHG	0	0	-2.63
	Air	0	0	-2.33
	Amenity	0	0	-4,555.61
	Environmental Subtotal	0	0	-4,560.57

Service Area	Activity	Cost of Current Service ($M)	Cost of Future Service (with move to bi-weekly curbside) ($M)	Change ($M)
Economic Benefits	GVA	-709.74	-800.54	-90.80
	Tax Revenue	-58.84	-66.60	-7.76
	Economic Subtotal	-768.58	-867.14	-98.56
Total				**-4,672**

Source: Eunomia calculations