ATTACHMENT B



# AUTOMATED SOLID WASTE COLLECTION SERVICE POST-IMPLEMENTATION REVIEW

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# CHAPTER 1 INTRODUCTION

Through a two-phase implementation program that began in October, 2017, and ended in July, 2018, the City of Nanaimo introduced an automated residential solid waste collection service to replace a manual system that was in use at the time. In its first two years of operation under the new service, the City has realized considerable efficiencies and a range of other important benefits. Not surprisingly, the City has also encountered certain challenges that, left unaddressed, may undermine the City's ongoing ability to provide excellent customer service in a costeffective way.

As a best management practice, and to ensure that the system remains sustainable in the face of ongoing growth and other pressures, the City decided to conduct a *Post-Implementation Review* of the service.

#### **POST-IMPLEMENTATION REVIEW**

Neilson Strategies Inc., a BC-based local government consultancy, was retained to assist the City in undertaking the review. The consultant was asked to examine the service and its key elements, review the system's original business case and its assumptions, identify service issues to address, and recommend changes aimed at ensuring the service's sustainability and success in the years ahead.

This *Draft Report* presents the consultant's work. The report begins by profiling the City's automated curbside collection service as it exists today. All major elements of the service are documented as part of the profile. The report then identifies some of the important benefits the City has realized under the new system, along with the key challenges that the City is experiencing. Recommendations are provided at the end of the report to build on the benefits and address the challenges. Recommendations for the City to consider implementing in 2021 are presented first followed by recommendations to consider for action in future years, beyond 2021.

#### SUSTAINABLE SERVICE

The *Post-Implementation Review* was initiated to identify changes that the City should consider making to its collection system in order to ensure that the service remains sustainable in the years ahead. For the purpose of the assignment, a "sustainable" collection service is one that:

- has the staffing, vehicles and equipment necessary to consistently meet the collection needs of residents on all collection routes, in accordance with published collection schedules
- has sufficient built-in redundancy to accommodate vehicle maintenance needs, staff absences and other challenges that can be expected to occur on a regular basis or from time to time

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- anticipates future growth and growth-related pressures, and adjusts as necessary
- has the facilities necessary to efficiently maintain, fuel and store vehicles
- incorporates the proper asset management needed to build adequate vehicle, cart and other equipment replacement reserves
- makes use of effective demand-management programs to improve system efficiency, achieve diversion targets and promote other service goals
- is operated as a self-financing utility with sufficient user fee revenues to consistently cover all costs related to the service
- provides a safe, relatively low-risk work environment for staff
- is cost-effective, cost-competitive relative to similar services in other municipalities, and affordable for users

The *Post-Implementation Review*, it should be noted, was not undertaken to assess collection service options that could be implemented in place of the City's automated system. The City has invested considerable resources in its new system and is committed to retaining the service. The City is also committed to the inhouse operating model through which the service is delivered. Finally, the City is not contemplating any change to the level of service provided, either in terms of the number of solid waste streams collected, or the frequency of collection. Potential service level alternatives, therefore were not examined in the *Review*.

# COVID-19

The City identified the need to conduct a *Post-Implementation Review* of its automated collection service prior to the COVID-19 pandemic. COVID-19 has, however, contributed to sizable increases in the volume of materials generated for collection. These increases have created capacity challenges for the service that are taken into account by the changes put forward in this *Draft Report*.

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# CHAPTER 2 AUTOMATED SOLID WASTE COLLECTION SERVICE

This chapter profiles the City of Nanaimo's automated solid waste collection service as it exists today. The chapter outlines the purpose and scope of the new service, the service's legislative framework, and the City's in-house service delivery model. An overview of the revenues and expenses related to the service is also presented, along with data on the amounts of materials collected.

All of the information in this chapter is presented without commentary or analysis to outline the current service. Benefits and challenges associated with the service are presented later in the *Draft Report*.

# **PURPOSE AND SCOPE**

The City of Nanaimo provides a solid waste curbside collection service to collect household garbage, organics<sup>1</sup> and recyclables directly from single family residences, and from multi-family buildings with up to four units. Household garbage and recyclables are collected every other week (EOW) on alternating weeks; organics are collected weekly. All three solid waste streams are collected using an automated system in which wastes are separated by residents into separate, stream-specific bins and placed curbside for collection. Collection vehicles equipped with hydraulic lifting arms stop in front of households to collect and empty the carts. On each vehicle, the lifting arm is maneuvered by the driver to take hold of a container, lift it off the ground, and empty it — or "tip" it — into the vehicle's designated storage compartment. As of September, 2020, the service is provided to approximately 29,200 households across the entire City.

Curbside collection is, at its core, an essential public health service, provided to remove solid waste from households and transport it to centralized facilities where it can be processed and/or disposed in a safe and timely manner. The service is also provided to promote environmental protection goals related to the diversion of wastes from the garbage stream that can be broken-down and repurposed.

# **LEGISLATIVE FRAMEWORK**

The legislative framework for the City's curbside collection system consists primarily of British Columbia's *Community Charter* and the City's own *Municipal Solid Waste Collection Bylaw, 2011, No. 7128.* Section 8(2) of the *Community* 

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In Nanaimo, the term "organics" includes yard waste, food waste, compostable containers, paper towels and napkins, and a range of other biodegradable items that can be broken down into carbon dioxide, water, inorganic compounds and biomass in a relatively short period of time.



*Charter* gives the City the authority under to provide "any service that the council considers necessary or desirable". Section 8(3) specifies that "council may, by bylaw, regulate, prohibit and impose requirements" in relation to a number of specific matters, including municipal services.

Nanaimo's *Bylaw No. 7128* provides for the "collection and disposal of garbage, food waste, recyclables and other solid waste" in the City. The bylaw:

- introduces the three-stream (i.e., garbage, recycling, organics) automated solid waste collection service that has been established for residents
- identifies the frequency of collection for each of the streams, and the use of carts
- states that participation in the service is mandatory for all single family residences and multi-family dwellings with four or fewer units<sup>2</sup>
- gives residents the ability to request an upsized garbage cart and/or recycling cart
- identifies materials that may not be disposed of through the service
- assigns a range of responsibilities to owners/occupiers of dwellings that receive service
- outlines the cost to households, paid as a solid waste user fee, to receive the service
- sets out offences and penalties under the service

The responsibilities that are assigned to owners/occupiers of dwellings are important to explain. Under section 11(1) of the *Bylaw*, owners/occupiers are required to separate household wastes into three different carts. Specifically:

- household garbage must be placed into the wheeled garbage cart provided by the City
- comingled organic waste must be placed into the wheeled organics cart provided by the City
- recyclables must be placed into the wheeled recyclable waste cart provided by the City

The *Bylaw* requires owners/occupiers to limit the weight of carts, and set out carts curbside by 8:00 am on the assigned collection day. The *Bylaw* is specific in its requirements related to the placement and positioning of carts for pick-up, as well as the storage and care of carts.

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Dwellings on Protection Island and those throughout the City deemed unserviceable by the General Manager, Engineering and Public Works, are not included in the service. "Unserviceable" properties are those that are difficult to or unsafe to access, or are located remotely.



#### SERVICE DELIVERY MODEL

The solid waste residential collection service and its associated bylaw are administered by the Engineering and Public Works Department, and delivered by staff in the Department's Sanitation Division. The key characteristics of the delivery model are as follows:

- *Collection Method* The City's current service uses an automated collection method that features collection vehicles equipped with hydraulic lifting arms, and hard plastic collection carts with wheels and lids.
- *Waste Streams* As noted earlier, the City collects three streams of household solid waste: garbage, organics and recyclables.
- Carts The City provides each dwelling unit with three different coloured carts, including a black cart for household garbage, a blue cart for recycling, and a green cart for organics. Carts are available from the City in different sizes for garbage and recycling streams, but in one size only for organics. Figure 2.1 shows the standard set of carts that each single family dwelling receives from the City, as well as the upsizing options available to households.<sup>3</sup>

#### Figure 2.1 Standard Carts and Upsizing Options Single Family Dwellings

CART	STANDARD	UPSIZE	ADDITIONAL ANNUAL COST
	CAPACITY	OPTION	FOR UPSIZING
GREEN CARI	<b>120</b>	No upsize options are available	
Yard & Food Waste	litres	for the Green Cart	
BLUE CART	<b>240</b>	<b>360</b>	No additional charges
Curbside Recycling	litres	litres	
BLACK CART	<b>120</b>	<b>240</b>	\$100
Garbage / Landfill	litres	litres	

Dwellings that contain a secondary suite and that choose to make use of one set of carts (in place of two separate household accounts), receive a 240 litre capacity green cart and black cart in the standard set.

Each cart is equipped with a radio-frequency identification (RFID) tag that enables the City to track how often carts are placed curbside for collection, investigate complaints of missed collection, and — in combination with onvehicle cameras — identify households that are not properly separating

The City charges a \$25 administration fee to upsize carts.

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household wastes into the separate carts (and, therefore, are in violation of requirements in *Bylaw No. 7128*). All carts and their RFIDs are owned by the City; the cost of the equipment is recovered from households through the solid waste user fee.

- Collection Schedule Household garbage and recycling are collected on an alternating EOW schedule. Organic wastes are collected weekly. The City makes use of an "add-a-day" feature in its scheduling. This feature advances a household's day for collection by one weekday following statutory holidays.
- Processing and Disposal Each waste stream collected by the City is delivered to a different facility for processing or disposal. Garbage is delivered for disposal to the Nanaimo Regional Landfill, owned and operated by the Regional District of Nanaimo, on Cedar Road in the City. Recyclables are taken to the Waste Connections Materials Recovery Facility on 10<sup>th</sup> Street. Organic wastes are delivered to Nanaimo Organic Waste Ltd. facility on Maughan Road.
- *Collection Vehicles* The City's fleet of collection vehicles includes:
  - two (2) compressed natural gas (CNG) vehicles purchased by the City in 2016 for delivery and introduction into service in late 2017
  - six (6) CNG vehicles purchased by the City in 2017 for delivery and introduction into service in the summer of 2018
  - one (1) CNG vehicle purchased by the City in 2019 for delivery and introduction into service in the summer of 2020
  - one (1) older diesel vehicle (Vehicle 301) that has been equipped with a hydraulic lifting arm for use as a back-up resource
  - two (2) older diesel vehicles, retired from service in the Central Okanagan, purchased for use as back-up resources

All trucks in the City's fleet are split-load — or, dual-chamber — vehicles designed to collect and hold two waste streams at the same time. One of the holding compartments in each vehicle occupies 60% of the vehicle's total storage capacity; the other compartment occupies the remaining 40%. Each week, household organic wastes (i.e., green carts) are collected and held in the smaller of the two on-vehicle storage compartments. On alternating weeks, household garbage (i.e., black carts) and recyclables (i.e., blue carts) are collected and held in the larger of the two compartments.

 Vehicle Fueling — The diesel back-up trucks are fueled on-site at the City's Public Works Yard. The CNG vehicles are fueled at the Mid-Island Co-Op station on Boxwood Road, 2.0 kilometres from the Yard.

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- Staffing City of Nanaimo staff in the Sanitation Division deliver the service. The total staffing complement in 2020 includes:
  - one (1) Manager (Sanitation, Recycling & Cemeteries)
  - one (1) Supervisor
  - nine (9) Refuse Collector/Operators (i.e., drivers)
  - one (1) Administrative Assistant
  - one (1) Zero Waste Coordinator
  - four (4) Permanent Auxiliary Collector/Operators for additional capacity as required (e.g., coverage for periods of staff absence; operation of additional vehicle)

All staff, with the exception of the Manager, are members of the Canadian Union of Public Employees (CUPE) Local 401 collective bargaining unit. Shift lengths, working hours, and other work conditions for these employees are set out under the *Collective Agreement: January 1, 2019 – December 31, 2022* between the City and CUPE Local 401.

#### **HOUSEHOLD NUMBERS**

As per *Bylaw 7128*, all single family dwellings and all multi-family buildings with four or fewer units are required to join the curbside collection service.<sup>4</sup> As the City grows so, too, does the number of households using the service. The total increase in users every year will depend on the types of new housing that are added to the City's housing stock. Growth in the number of curbside collection users will be limited by the degree to which growth the City's housing stock continues to tilt in favour of condominiums, apartments, townhouses and other multi-family types with more than four units per building.

Shifts in new housing types notwithstanding, the collection system has experienced a steady increase in new households over the past five years, under both the previous manual system and current automated system. Figure 2.1 shows the increases.

#### REVENUES & EXPENSES Service Revenues

The curbside collection service is operated as a fully self-funded — or self-liquidating — service in which all costs incurred by the City to provide

Figure 2.1 Households on Collection System 2016-2020				
Year*	Households	Growth		
2016	27,445	-		
2017	27,908	1.69%		
2018	28,256	1.25%		
2019	28,669	1.46%		
2020	29.200	1.85%		

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OCTOBER 2020 PAGE 7 The exceptions for Protection Island residents and properties deemed unserviceable were noted earlier.



the service are fully offset by revenues that are specific to the service. There are two major sources of service revenue:

User Fees — Households that directly use the service pay the bulk of the service costs (the service does not rely on and does not receive any property tax revenues). Each household pays a standard user fee that is currently set at \$170 per year (increased from \$165 in 2019). Households that choose to upsize their garbage carts are required to pay a user fee premium of \$100 per year. In 2020, user fee revenues are budgeted to total \$4.94 million.

Figure 2.2 compares the City's \$170 user fee to those in place in a range of other local government systems that offer curbside collection for all three waste streams. Some of the comparison systems are on Vancouver Island; others are in communities elsewhere that are comparable in size to Nanaimo. The figure shows that Nanaimo's user fee is competitive relative to those of other jurisdictions.



Recycle BC — Pursuant to the BC Recycling Regulation in the Environmental Management Act, producers of "packaging and printed paper" (PPP) in the province are responsible for collecting and processing all PPP materials from single- and multi-family residents. To fulfill their responsibilities, the producers established a recyclables collection and processing program through Recycle BC, a non-profit industry association. In municipalities that join the Recycling BC program, Recycle BC collects all residential recyclables using either its own contractor, or by contracting collection to the local

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government. Municipalities that opt for the contract option are paid an incentive rate which is determined based on the number of households in the collection service, the type of collection used, and a range of other factors.

Similar to most other local governments in the province, the City of Nanaimo is a member of the Recycle BC program and a contractor to Recycle BC for the collection of curbside residential recycling. The incentive rate that is paid to the City to deliver this service is \$1.01 million in 2020.

#### **Service Expenses**

Tipping costs for garbage and organics represent one of the largest line item costs incurred by the City each year in its service. In 2020, the total budgeted tipping cost is  $\frac{1.55 \text{ million}}{1.55 \text{ million}}$ . The cost of labour is another major line item, projected at  $\frac{1.22}{1.52}$ million in 2020. Fleet charges, at 1.15 million in 2020, take into account the cost to replace vehicles at the end of their lifespans, all operating costs, and the vehicles' share of shop overhead costs that are incurred to run the City's fleet facility. A further \$1.25 million in 2020 is directed towards short-term payments on debt that was incurred at the inception of the new service to help pay for vehicles and carts.

#### AMOUNT OF MATERIALS COLLECTED

Considerable change has occurred to residential curbside collection in Nanaimo since the transition from manual to automated collection. Changes in the amount of household wastes set out for collection have been particularly noticeable. Figure 2.3 presents figures on the amount of curbside organics, recycling and garbage collected by the City from 2017 through to the end of 2019. The figure presents the same information for the first eight months of 2020, and the total for the comparable eight-month period in 2019.

Figure 2.3 shows that there has been a significant increase in the amount of organics and garbage, in terms of kilograms per household, collected under the automated system. In 2018 — the year in which the transition from manual to automated collection was completed — the City collected 37% more organics and 21% more garbage than the in 2017. This trend continued through 2019 and the first eight months of 2020.<sup>5</sup> Figure 2.4 tracks the year-over-year changes. The increases in organics can be largely explained by two factors:

- the expansion of the organics collection program in 2018 to include yard waste in addition to kitchen waste
- the distribution to each household at the start of the automated system of 120 litre carts that can hold considerable material

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<sup>5</sup> Staff report that the increase has continued since the end of August, 2020, to the point where the total increase in kg per household in 2020 is close to 18% compared to the same period in 2019.



#### Figure 2.3 **Material Collected** Weight (kg) Per Household 2019 2020 Waste Stream 2017 2018 2019 (Jan-Aug) (Jan-Aug) Organics 133 182 247 163 196 Recycling 118 126 125 86 83 140 169 193 Gargage 125 147 Total 391 477 565 374 426 64% 65% 67% **Diversion Rate** 66% 65%

# Figure 2.4 Year-Over-Year Change in Materials Weight (kg) Per Household

Waste Stream	2017	2018	2019	2019 (Jan-Aug)	2020 (Jan-Aug)
Organics	-	37%	36%	-	20%
Recycling	-	7%	-1%	-	-3%
Gargage	-	21%	14%	-	18%
Total	-	22%	18%	-	14%

The COVID-19 pandemic is a third influencing factor that helps to explain the increase in the first eight months of 2020. During COVID-19 residents have spent more time at home than in previous years and have generated more organics waste as a result.

COVID-19 has also contributed to the higher amounts of garbage per household in Figures 2.3 and 2.4, as has the convenience of large-capacity garbage carts.

Figure 2.4 does not show an increase in recycling per household, but only because the figure records the amount of material in terms of weight. The trend for recyclables is quite different when volume of material is taken into account. All municipalities that have transitioned to cart-based automated collection services have experienced increases in the volume of household recyclables put out for collection. Large-capacity blue carts are able to easily accommodate significant

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volumes of low-density items that do not add significantly to the weight of materials, but that do add to the overall volume.

Municipalities across the province are also reporting sizeable increases in the volume of recyclables as a result changed consumer behaviour during COVID-19. Significant volumes of cardboard and wrapping material, in particular, are being placed out for collection in all centres including Nanaimo. Volumes of materials are not measured directly — the incentive fees paid by Recycle BC to municipalities are based entirely on the weight of materials. Staff at the Waste Connections Materials Recovery Facility (MRF) in Nanaimo, however, estimate that the volume of recyclables being delivered to the facility is up approximately 15% in 2020; staff in other municipalities report similar increases. Volumes can also be gauged by the frequency with which collection vehicles are required to deliver their loads to the MRF. On recycling collection days, Nanaimo's collection vehicles are required to pause collection and empty their loads twice to create capacity for additional materials.

In January, 2019, at the start of the first full year of operation under the automated service, the City began to collect and track considerable amounts of data using the on-board vehicle computers and other information sources. Included in these data are the number of "tickets" assigned to City vehicles by the different disposal and processing facilities to which the City delivers its curbside collection waste streams. Each ticket represents one visit to one of the facilities. Figure 2.5 shows that over the first eight months of 2019 and 2020, City vehicles made almost twice as many visits to the Waste Connections MRF to tip recyclables as they did to the Nanaimo Regional Landfill to dispose household garbage. Measured by weight, household

garbage amounts in both eight month periods were considerably greater than household recyclables (see Figure 2.3). As suggested by the ticket numbers, however, the opposite was the case when wastes are measured by volume.<sup>6</sup> Figure 2.5 also shows the increases in ticket numbers for all streams in the 2020

Figure 2.5 Tickets and Weights by Solid Waste Stream First Eight Months 2019, 2020						
2019 (J	ul-Aug)	2020 (Jul-Aug)				
Tickets	Tonnes	Tickets	Tonnes			
1,483	4,639	1,785	5 <i>,</i> 674			
1,419	2,434	1,584	2,391			
773	3,544	883	4,269			
	<b>irst Eight</b> 2019 (J Tickets 1,483 1,419 773	First Eight Months 20     2019 (Jul-Aug)     Tickets   Tonnes     1,483   4,639     1,419   2,434     773   3,544	Tirst Eight Months 2019, 2020 (Jul-Aug)   2019 (Jul-Aug) 2020 (Jul-Aug)   Tickets Tonnes Tickets   1,483 4,639 1,785   1,419 2,434 1,584   773 3,544 883			

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OCTOBER 2020 PAGE 11 Tickets and weight for organics are shown for the purpose of completeness. It should be remembered that organics are collected every week, whereas both garbage and recyclables are collected EOW on alternating weeks. It should also be noted that when organics and recyclables are collected together, organics must be tipped every time before recyclables are tipped, even though the organics storage containers on the vehicles may not be full.



period. These increases can be attributed to the increase in the number of households the system, as well as the COVID-related changes noted earlier.

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# CHAPTER 3 BENEFITS OF AUTOMATED COLLECTION

When the City began to examine closely the option of transitioning to an automated collection service, several benefits for users, the community and Nanaimo's Sanitation Division staff were identified. In most cases these benefits have come to fruition. This chapter identifies and reflects on a selection of these benefits. Recommendations that build on the benefits are addressed in the *Draft Report's* final chapter.

#### WORKER SAFETY

In the manual collection system that was in place previously at the City, each collection vehicle was staffed by one person (a Refuse Collector/Operator) who was responsible for driving the vehicle and emptying the garbage and kitchen waste containers into the storage compartments. The system required workers to enter and exit vehicles, and to repetitively lift and tip heavy containers over the course of a full day in all types of weather.

The City's manual solid waste collection system was a physically-demanding job that exposed workers to a high level of risk from injury, and that resulted in a high number of injuries. The City reports that all Refuse Collectors/Operators who worked on the system suffered some level of work-related injury during their tenure. The City notes, as well, that from 2014 to 2018,<sup>7</sup> the City averaged seven WorkSafe BC injury claims per year from its collection vehicle drivers (2017 was a particularly high year).

The desire to reduce the workplace injuries, and in so doing to improve worker safety, was cited by the City as a key reason for shifting from manual to automated collection. This desire has been cited almost universally by municipalities that have made or that are contemplating the same transition. Each injury that occurs in the workplace has the potential to impact an individual's long-term quality of life. Each injury, and the risk of injury occurring, also has a direct financial cost to the employer. In the case of Nanaimo, the injuries related to manual collection would have increased the City's WorkSafe BC premiums, and would have resulted in extra costs for replacement workers. The prevalence of injury in the service also caused WorkSafe BC to impose limits on the number of households each vehicle could serve on an individual route. These limits forced the City to add routes and increase capacity, all at a cost.

The City's decision to transition to automated collection has undoubtedly benefitted City workers in the Sanitation Division. In 2019, only one injury claim was submitted to WorkSafe BC; in 2020, there have been two. It is not clear if the City will benefit financially from lower WorkSafe BC premiums — impacts on premiums take three

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The transition to the automated system was completed in the summer of 2018.



years to emerge, and may be offset by developments in other parts of the organization. It is significant to note, however, that Refuse Collector/Operators interviewed by the consultants report significant improvements in workplace safety in the new service.

#### SERVICE SCOPE

The transition to automated collection enabled the City to expand its organics program to include curbside yard waste, and to take on the curbside recycling Recycle BC contract that was previously assigned to a private contractor. The addition of yard waste has allowed residents to reduce the number of self-haul trips to dispose of grass clippings, leaves and other items that can now be placed into the green carts. The assumption of the Recycle BC contract, which was made possible by the increase in collection efficiency, is worth upwards of  $\frac{1}{1}$  million per year — revenues that help to minimize the user fee charged to households.

#### **GHG EMISSIONS**

When designing the automated system, the City chose specifically to purchase CNG vehicles in place of new diesel trucks. CNG vehicles have become the vehicle of choice in municipalities across British Columbia (and beyond) because they emit fewer greenhouse gases than their diesel counterparts. FortisBC cites studies that report overall GHG reductions of up to 30%, with 95% reductions of nitrogen oxides (NO<sub>x</sub>). CNG vehicles also emit almost no particulate matters.

Additional GHG emissions savings are realized through the fewer self-haul trips, noted earlier, required by residents to dispose of yard waste.

# DATA COLLECTION

The RFID tags that are embedded in the automated carts, in conjunction with the on-board computers and sensors in the collection vehicles, allow the City to:

- track the location of all carts
- identify incidents of contamination
- determine when individual carts are collected
- monitor participation rates (i.e., the percentage of households that place carts curbside for pick-up during a scheduled collection time)
- collect a variety of other data

All of the information collected can be used to target education and — where necessary — enforcement efforts aimed at addressing concerns related to the placement of carts for pick-up, the sorting of materials by waste stream, contamination of recyclables and organics, the care of carts, and a range of other issues. Importantly, the information can also be used to optimize collection routes in order to reduce the frequency with which collection vehicles must tip their loads, and can be used to determine when additional capacity (i.e., vehicles, staffing) is required.

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#### CONVENIENCE

The large-capacity, highly-durable collection carts that are used in automated collection make the system extremely convenient and easy to use for households. Residents in the system are required to sort materials into only three different categories — a level of source separation that is the most basic. Residents are able to place recyclables and yard wastes directly into the designated carts as loose materials; there is no need to purchase or use blue bags or large brown bags. Garbage bags are still used by most residents; however, garbage cans no longer need to be purchased. The wheels on the carts make it relatively easy for most residents, even when carts are full, to position their carts curbside for collection.

The City has not yet conducted a survey of households to gauge the level of satisfaction with the automated system. In other centres in which automated collection has been introduced, however, user satisfaction rates have been exceedingly high. In the Township of Langley, for example, a survey of residents who participated in a cart-based system pilot project in 2014 found that 96% of residents rated their experience as excellent or good. In a 2012 survey on a similar pilot project in the City of Abbotsford, 94% of residents approved the use of the carts. Both municipalities subsequently made the decision to shift to automated collection.<sup>8</sup> User experience was an important factor in their decision-making.

#### **CLEANLINESS**

The use of durable carts with lids protects materials from wind and pests, and in so doing helps to prevent litter from being strewn across roadways and front yards. The carts' large capacity allow them to hold a considerable amount of material, which in turn helps to eliminate the inconsistency, clutter and unsightliness of multiple bags and piles of material.

#### EFFICIENCY

Efficiency relates to the amount of curbside solid waste that can be collected using a given set of resources, such as labour and vehicles. Using this definition, the City's new automated collection service is inherently more efficient than its previous manual system. A driver in the manual system was required to leave the vehicle at every stop, physically lift and tip containers into the vehicle's storage compartment, return the containers to the curbside, then re-enter the vehicle and drive on. The same driver in the automated system performs all tasks without ever leaving the cab.

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OCTOBER 2020 PAGE 15 Efficiency gains are offset slightly by the higher cost of the vehicles. It is true, as well, that the per-household amount of solid waste under the new system is greater than that which was collected under the previous method (see Figures 2.3 and 2.4).

At the time of writing, Abbotsford is transitioning to a fully-automated system that is similar to Nanaimo's service. The Township of Langley opted for a semi-automated system in which carts are physically moved by drivers onto a lifting device bolted to the side of the collection vehicle.



These caveats do not take away from the overall finding, however, that for a given amount of product automated collection is the more efficient alternative.

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# CHAPTER 4 CHALLENGES TO ADDRESS

All municipalities that choose to transition from a manual curbside collection system to an automated collection service conduct extensive consultation, investigation and analysis to inform their decisions and guide their transitions. Nanaimo offers a strong example of the significant level of effort that was required and undertaken. Over a number of years, beginning in 2014, the City examined collection options, considered service delivery models, and ultimately built a business case to explain the net benefits of an automated system to the City and the community.

Invariably, all municipalities that make the transition experience challenges that need to be addressed in order to capture the full benefits of the new model. In some cases the challenges result from assumptions that, in retrospect, were overly ambitious. In other cases, the challenges could not have been anticipated, or are linked to factors over which municipalities have little or no control. Nanaimo is no different from other municipalities in experiencing both types of challenges.

Once identified, challenges must be understood and addressed, irrespective of their nature or causes. The City of Nanaimo recognizes this need. Nanaimo also recognizes that to do otherwise would only undermine the performance of what is, at its core, a strong and innovative municipal service.

This section of the chapter identifies a list of challenges for the City to consider addressing. The list includes:

- a range of issues related to the City's CNG collection vehicles
- the number of drivers available to operate the vehicles, and the potential for improved driver training
- management of the collection carts
- resident education

All of the challenges presented in the chapter were identified by the consultant based on interviews with a broad range of City staff, a review of City reports and key data, and comparative research on other municipalities with automated collection systems. Over the course of the assignment, the consultant was given full access to all requested information in order to fully understand the service and its evolution. The consultant conducted site visits of the Public Works Yard and the three facilities to which residents' garbage, organics and recyclables are taken. The consultant also joined Refuse Collector/Operators on portions of two collection routes.

#### **COLLECTION VEHICLES**

As noted in Chapter 2, the City made the decision to purchase split-load, CNG-powered collection vehicles for the automated system. A total of nine (9) such

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vehicles are now in service; a tenth is scheduled to arrive for service in 2022. The vehicles are relatively easy to operate, and are responsive both to air quality and noise concerns.<sup>9</sup> The vehicles also perform well in a curbside collection setting in which constant stops and starts are required, and hills are common. The vehicles are not, however, without their issues.

#### **Split-Load Vehicles**

The City made the decision in 2009 under its previous manual system to switch from single-load to split-load vehicles. The decision was based in part on the belief that split load vehicles are more efficient because they can collect two streams of solid waste at the same stop. A further reason is related to the fact that the solid waste drop-off facilities are all located in relatively close proximity to one another at the south end of the City. This location pattern allows vehicles to drop two waste streams on the same trip without having to waste significant time driving from one facility to the next.

In the current automated system the split-load vehicles may be less ideal than originally thought. The City has discovered that it is difficult to fill each storage compartment to capacity on each collection route. Invariably, when one compartment is filled and unable to accommodate additional material, the other compartment is under-filled. Vehicles in this situation must leave the route and tip both waste streams, then return to the route to complete collection of the remaining units. The increase in the volume of recyclables, noted earlier, is exacerbating this downside of split-load vehicles by increasing the frequency with which recycling compartments are filled and trips to the MRF and organics facility must be made.

Split-load vehicles are used in some other municipalities and do make sense in many situations, particularly on routes in low-density rural areas in which it is not efficient to send separate single-load trucks for relatively small amounts of each waste stream. Split load vehicles are also used in some places, such as Nanaimo, where drop-off facilities are either on the same site or close to one another. Municipalities that use the vehicles, however, face the same challenge that Nanaimo is facing regarding optimization of storage spaces. Some places have addressed the challenge by adjusting the compartment split from 50-50 to 60-40, or even 70-30 — Nanaimo has chosen 60-40. Others have chosen to incorporate into their fleets a mix of single- and split-load vehicles, and to use single-load trucks for specific streams (e.g., recycling) or specific routes. In addition or in place of these steps, some municipalities have changed the number and size of routes in an effort to improve optimization.

#### **Vehicle Amortization**

Capital plans for solid waste collection systems are based on a number of assumptions, one of which is the useful-life period over which collection vehicles

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CNG vehicles are significantly quieter than their diesel counterparts.



are amortized. The standard amortization period across municipalities (and the private waste collection industry) for automated collection vehicles is seven (7) years. Municipalities that borrow funds to purchase vehicles generally plan to repay the loans over this seven year period. Alternatively, municipalities that follow a pay-as-you-go approach to capital funding for vehicles make sure in their planning to set aside enough funding each year to replace the vehicles after seven years.

Nanaimo adopted an amortization period of ten (10) years in its business case planning for the new system. This decision served to lower the system's annual borrowing and equipment replacement charges by lengthening the period of time over which the charges needed to be absorbed. The decision appears to have been influenced, if not driven, by the organization's expectation at the time that the user fee for the new service would be lower than that under the manual system.

To be clear, the City's vehicles can be made to last the full ten years (or longer) set out in the City's business case. The City should expect, however, to incur increased maintenance costs in the final years of the ten-year period.

#### **Vehicle Maintenance**

Large, heavy collection vehicles that are driven in excess of 16,000 km each year, in challenging conditions with constant starts and stops, require regular preventative maintenance as well as ongoing repair. CNG vehicles are not necessarily more expensive to maintain than traditional diesel machines. Certain features of the vehicles and maintenance function in Nanaimo, however, tend to make maintenance more complicated and in some cases more expensive. For example:

- *Split-Load* The split-load vehicles have mechanical parts to move loads as they are received into different storage compartments. The care of these parts add to overall maintenance.
- Facilities CNG vehicles require special maintenance facilities with higher ceilings than normal garages. When the City began exploring the possibility of a CNG fleet, FortisBC provided some funding to modify part of the City's existing fleets facility. The work with FortisBC was started but not completed. The result today is that the City needs to outsource portions of its collection fleet maintenance to third parties with the facilities and knowhow to perform key maintenance tasks. The City's reliance on contractors adds to the cost of maintenance; it also involves sending vehicles off site, which effectively removes them from use for periods of time.
- Compaction of Materials In an attempt to manage the increase in recycling volumes, Refuse Collector/Operators have inadvertently overcompacted materials. Vehicles with recycling materials that are compacted too much are difficult to empty at the MRF — a problem that drivers have experienced and that causes delays. Vehicles with overly-compacted

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recyclables also incur problems with packing arms and rear doors that must be repaired or replaced.

 Mechanics' Working Hours — The City's mechanics work from Monday to Friday on shifts that, to a large degree, overlap those of the curbside collection drivers.<sup>10</sup> There is little time, as a result, for preventative maintenance or repair work to be undertaken on the vehicles outside of normal collection times. Vehicles must, instead, be removed from service in order to be maintained and repaired.

The City's Fleet Division has worked to improve the situation by introducing flexible start times for shifts. Three mechanics are now available to undertake preventative maintenance on the vehicles from 5:00 am to 8:00 am on weekdays. One hour of this adjusted time must be paid as overtime.

In 2019, the City spent an average of almost \$37,000 to maintain each of its CNG vehicles. This amount was higher than the annual figure of close to \$21,000 anticipated in the 2016 business case, but is on par with 2019 updates to the service's capital program.

#### **Vehicle Fueling**

The City's fleet of CNG vehicles must be fueled once per shift at a specialized CNG fuelling facility.<sup>11</sup> There are three CNG fuelling stations available for general use on Vancouver Island, including two in the City of Nanaimo.<sup>12</sup> The closest station to the City's Public Works Yard is the Mid-Island Co-op on Boxwood Road, 2.0 km from the Yard. The other station is the BC Transit facility beside the Regional District of Nanaimo on Hammond Bay Road, 6.3 km from the Yard.

There are two methods of CNG fuelling available for fleets: fast fill and slow fill.

- Fast Fill Large collection vehicles that use fast fill stations are typically able to fuel in under 20 minutes, not including driving time to and from the facility. The method is ideal for CNG vehicles that must re-fuel during a work shift, and/or vehicles that must re-fuel away from their storage yard. All CNG vehicles at the City use the fast fill method at the Mid-Island Co-op.
- *Slow Fill* The slow fill method, as its name suggests, takes considerably longer to re-fuel a large collection vehicle. It is ideal for CNG fleets that can fuel overnight on-site at their storage yard.

<sup>12</sup> Additional private facilities may also exist.

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<sup>&</sup>lt;sup>10</sup> The City did at one point have the ability to schedule mechanics for weekend shifts. This provision, however, no longer exists in the *Collective Agreement*.

<sup>&</sup>lt;sup>11</sup> There are times when vehicles need to be re-fuelled twice; however, the data show that one fuelling per trip is standard.



The City's reliance on an off-site facility to re-fuel its collection vehicles reduces the efficiency of the collection system. Once per shift, drivers must drive to the Mid-Island Co-op, re-fuel their vehicles, then either return to their route or drive to the Public Works Yard, depending on the time of day. Data collected using the City's GPS system show that vehicles spend, on average, 16 minutes fueling, and two minutes driving to the Public Works Yard. The same data show that it takes an average of 15 minutes to drive from the Landfill to the Co-op, 15 minutes from the organics facility, and 12 minutes from the MRF. The combination of time will vary by trip depending on when each driver is required to re-fuel. On an eight-hour shift, however, all of time spent re-fuelling, regardless of precise amount, cuts into the time available to collect from households.

In the coming years the City intends to re-develop its Public Works Yard. At that time the City will have an opportunity to build in an on-site slow fill CNG fuelling facility at which the collection vehicles, when parked overnight, can re-fuel. The addition of this facility would improve the system's overall efficiency. Importantly, the addition would also relieve the City from its dependence on an outside fueling source over which it has little control. An incident affecting the fueling source — e.g., accident, labour unrest, increased demand — could threaten the City's ability to maintain its collection service level.

#### **COLLECTION DRIVERS**

#### **Overtime Hours**

Under the automated system, Refuse Collector/Operators have incurred significant overtime relative to that which was incurred under the previous manual system. Figure 4.1 on the following page shows the increases that began to occur with the Phase I introduction of the new system in 2017. The significant overtime amounts in 2018 and 2019 were a reflection of:

- the increases, noted earlier, in the amount of materials collected under the automated system compared to the earlier manual method
- a lack of additional capacity, or redundancy, built into the system's staffing model as outlined in the business case for the new service

Throughout 2018 and 2019, the increased volumes and lack of staffing capacity were managed largely by having the Refuse Collector/Operators work additional hours to finish their own routes, and/or to assist their colleagues in finishing theirs.

The overtime situation has improved considerably in 2020. Based on overtime records for the first eight months of the year, the total amount of overtime for 2020 is projected at approximately 1,400 hours, which is only 57% of the 2019 total. This number is still both excessive and unsustainable for the City and the individuals who work the time. It is, however, a major improvement over the 2018 and 2017 totals.

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The improvement is attributable to changes introduced by the City in 2020 to better manage the collection of curbside recyclables. More specifically, the Sanitation Division added an extra recycling collection route using one of the back-up vehicles and a back-up (Permanent Auxiliary) driver. The Division was also able to tap into Public Works auxiliary staff that had been brought in by the City to help with overall workload changes anticipated to result from COVID-19.

On a go-forward basis, the City intends to continue to rely on these auxiliary drivers to better manage workloads. This reliance, coupled with further efforts to optimize routes, will help to minimize the need for staff to work overtime hours. Both the City and the individual staff will benefit.

#### **Driver Training**

Refuse Collector/Operators are responsible for driving expensive, heavy vehicles throughout the City on a regular basis. Constant attention is required to protect driver and public safety, avoid causing damage to parked cars, and minimize wear-and-tear on the vehicles. Attention is also required to properly maneuver the hydraulic arms, lift the carts, examine (using the onboard cameras) cart contents for contaminants, return the carts to their curbside positions, and make entries as required on the vehicles' on-board computers.

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Refuse Collector/Operators require initial and ongoing training to perform these functions properly. Training under the automated system has been provided since the inception of the service. To date, however, such training appears to have been somewhat informal in nature. Additional formal training, conducted in accordance with a proper module-based training program, could help to improve the system's overall efficiency. Training on the following items would be particularly helpful:

- Computers Regular and consistent use of the vehicles' on-board computers by drivers is needed to bolster the City's data-collection capacity. Data are critical to efforts aimed at optimizing routes, targeting household education, monitoring cart assignment, and addressing other needs. Driver training on the use of the computers is needed both to highlight the importance of the devices, and to improve their functionality.<sup>13</sup>
- Vehicle Operation The sustainability of the service depends, in part, on the City's ability to manage vehicle maintenance and repair costs. Targeted training on efficienct vehicle operation can help to reduce the wear-and-tear on the trucks, and in so doing help to keep maintenance and repair costs in check.
- Inspections Staff in the City's Fleets Division have identified the need for drivers to conduct post-trip vehicle inspections at the end of every shift to identify maintenance issues for mechanics to address early the next morning, beginning at 5:00 am, prior to the start of the next shift. Failure to conduct such inspections, or to conduct them properly, can delay the departure of vehicles from the Public Works Yard the next morning.

It is understood that managers and staff in the Sanitation Division, with input from others, spent time in the summer of 2020 to develop new training resources in a variety of formats. These resources, combined with others yet to be developed, can be used to create the formal module-based training program needed.

# COLLECTION CARTS

In 2017 and 2018, the City borrowed a total of \$<u>4.3 million</u> to purchase the collection carts needed for the three-stream automated service.<sup>14</sup> When the carts arrived, considerable effort was taken to assemble, assign and deliver them to users. Efforts were also made to educate residents on proper cart use and placement, and to give residents the option to exchange certain carts for larger or smaller ones. In the early months of the service, resources were made available to ensure that carts were managed properly.

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- It is important to ensure that all vehicles used in the collection system are outfitted with an onboard computer. One vehicle Truck 317 appears to be without a computer.
- <sup>14</sup> In the business plan for the service the carts are amortized for a ten-year period. Based on the experiences of other places, the City will likely find that its carts last 15 years or longer before having to be replaced.



The City today has an inventory of well over 80,000 collection carts. Nanaimo has discovered that the effort required to manage the carts on an ongoing basis is significant. Ongoing tasks include:

- receiving and addressing requests for cart exchanges
- identifying and eliminating "phantom carts" (i.e., carts with missing or misassigned RFIDs)
- ensuring that carts are properly repaired rather than being left idle
- ensuring that carts are assembled and delivered to new dwellings that join the service
- ordering new carts as required

All municipalities that have transitioned to a cart-based automated collection system have come to realize the need for ongoing cart management. Several have found in necessary to create a cart administrator position or to assign the tasks to existing staff with available capacity. Nanaimo may need to consider a similar course of action.

#### **RESIDENT EDUCATION**

Residents who use the automated service have an important role to play in making the system function efficiently. Efforts made by residents to sort materials properly, place carts curbside at the right time and in correct way, ensure that parked cars do not impede collection, and address other needs are important to the service's overall success.

Considerable education and information for households was provided in the service's early days, as would be expected. Targeted information has been provided on various items since that time in response to issues that arise. Additional efforts may be needed to address specific issues that persist. Consider the following points:

 Cart Hold-Backs — Each Refuse Collector/Operator is required to stop and collect every cart that is put out for collection on his or her assigned route. Each stop for a cart adds time to the collection process and limits the overall size of route than can be collected.

It is clear from on-board cameras and the City's data that not all collection carts placed curbside are fully packed with material. Indeed, in some cases the carts are not even half full. In these instances, overall system efficiency would be increased if residents held back their carts until the following collection time. Over time, this type of consistent cart management on the part of residents could help to optimize route sizes and make the system more efficient.

 Cart Placement — Proper cart placement increases the efficiency with which Refuse Collector/Operators are able to collect carts and complete their routes. Conversely, improper placement can add time to pick-ups by drivers

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who are forced to reposition their vehicles or — worse — exit their cabs to manually reposition the carts. The City has materials available to help residents understand the importance of cart placement and how to do it. Efforts to draw attention to these materials may be needed.

 Cardboard — Since the beginning of the COVID-19 pandemic, Nanaimo and other municipalities have experienced a significant increase in the amount of carboard in the recycling waste stream. The cause of this increase is believed to be changes in consumer behaviour in favour of online buying and home delivery of goods. Cardboard causes blockages, capacity issues, delays and other problems in automated collection systems when it is not cut into smaller pieces and flattened properly.

The City has issued public information notices on the need for proper cardboard management by users of the automated system. Additional efforts may be needed.

 Contamination — The high-capacity blue carts that are used for household recyclables are convenient and easy to use. Residents are able to co-mingle all recyclables into one bin only, and are not forced to separate plastics cardboards, paper, packaging and other items. The convenience and ease of use encourage recycling, result in higher volumes of recyclables, and can help to increase a jurisdiction's diversion rate. The same attributes, however, tend to result in higher levels of contamination as well.

Contamination levels are monitored by Recycle BC. The company has the right under its contract with the municipality to charge financial penalties for loads with contaminants that exceed 3% of the total weight of the materials. To date, Recycle BC has only infrequently imposed penalties against municipalities. This leniency cannot be expected, however, to continue.

The City has some useful educational materials available to help residents avoid contamination. Additional efforts, however, are required. It is hoped that the City's new Zero Waste Coordinator will be able in the near future to develop and deliver portions of the education that is needed. To date, the position has been focused on responding to COVID-related needs in the Sanitation Division.

Demand Management — Efforts aimed at helping residents manage their demand for service are also important. Working with residents to reduce the amount of waste they generate — "reduce" being the first of the five "r's" — would help to reduce the need for service and the amount of household solid waste to be processed and/or landfilled.

Efforts by the City's Zero Waste Coordinator aimed at waste reduction will be important in helping to manage service demand.

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# CHAPTER 5 RECOMMENDATIONS TO CONSIDER

The City of Nanaimo has made a considerable investment in its automated curbside collection service. The service provides many benefits City workers, the municipal corporation, households that use the system, and the broader community. The service also, however, faces a number of challenges that, left unaddressed, may undermine the success of the service and its long-term sustainability.

This final chapter of the *Draft Report* presents a series of recommendations that are designed to build on the service's benefits and address its challenges. The recommendations are divided into two groups beginning with recommendations to consider for implementation in 2021. These recommendations, if accepted, will have budget implications for the coming fiscal year. The second group of recommendations includes those to consider for action beyond 2021.

#### **RECOMMENDATIONS FOR 2021** Route Optimization

The City's Sanitation Division is struggling with its current resources to maintain curbside collection service levels in the face of significant growth in household organics, garbage and recyclables. Additional resources are needed to help the service cope without having to rely on significant amounts of overtime labour. Additional resources should not be added, however, until the existing network of collection routes is reconfigured — or, optimized — to achieve greater efficiency.

Optimized collection routes on a system with split-load vehicles are those that can be completed by a single truck, within an eight-hour work shift that allows time for mandated breaks, trips to disposal/processing facilities, refuelling stops, and preand post-shift vehicle inspections. Optimized routes are designed based on all of these factors, plus data on:

- the volumes of different waste streams to be collected
- the number of households
- user participation rates
- the age of collection vehicle (vehicles purchased for Phase I of the implementation have slower hydraulic lift arms than the vehicles bought for Phase II)
- the total driving distance to and from disposal facilities
- the driving distance to and from the Public Works Yard

The City has two years' worth of data from on-board computers and other sources with which to perform route optimization. City staff have used these data to suggest reconfiguring the system into ten separate collection zones, each of which would feature five separate garbage/organics collection routes, and six separate

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recycling/organics routes. By elevating one of the three diesel back-up trucks to fulltime usage, by assigning the current single-axel collection vehicle to collect one small route from two zones each day, and by bringing on an extra Refuse Collector/Operator in January, 2021, instead of as planned in July, 2022, the City would realize an increase in system capacity of 20%. This added capacity would address the challenge identified in Chapter 4 related to excessive overtime, as well as the significant increases in the amount of materials. In all, the extra capacity would place the service on a more sustainable path.

The capital plan for the service calls on the City to order an additional new CNG vehicle in 2021, for delivery to the system in July, 2022. Once delivered, this vehicle would replace the back-up truck that is proposed to be elevated to full-time use starting January, 2021.

With an extra full-time Refuse Collector/Operator in January, 2021, the City would have the core staff needed to run the ten-zone system. Support from the four available Permanent Auxiliary drivers would be important to keep in place in order to provide adequate coverage for periods of core staff absence.

#### > Recommendations

THAT Council endorse the ten-zone route optimization proposal developed by staff for implementation in January, 2021; and

THAT Council direct staff to advance the hiring of an additional Refuse Collector/Operator (1.0 FTE) from July, 2022, to January, 2021.

#### **Cart Management**

The need for and importance of ongoing management of the City's inventory of collection carts was highlighted in Chapter 4.

# ➤ Recommendation

THAT Council direct staff to create an administrative position (0.5 FTE) to manage the collection cart inventory.

#### **Driver Training**

The City's Refuse Collector/Operators have received some training to help them perform their jobs and to help increase the overall efficiency of the collection system. As suggested in Chapter 4, however, additional targeted training should be considered.

# > Recommendation

THAT the City develop and provide targeted training to Refuse Collector/Operators on a variety of topics, including:

• the proper use of the collection vehicles' on-board computers to bolster the City's data collection efforts

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- the proper operation of the vehicles to reduce wear-and-tear, and to better manage vehicle repair and maintenance costs
- the inspection of vehicles at the end of each shift to identify issues for mechanics to address prior to the start of the next shift

It is difficult for the Sanitation Division to carve out a block of time for group training during the work week (collection takes place on every weekday with the exception of statutory holidays). The City should, therefore, consider creating a separate training day each year by adding one non-collection day to the collection schedule.

# ➤ Recommendation

THAT Council direct staff to add one non-collection day to the collection schedule each year to allow for Refuse Collector/Operator training.

# **Data Collection**

The importance of the City's data collection efforts has been emphasized in this *Draft Report*, including in the recommendation on driver training. To strengthen its data capacity the City should ensure that all collection vehicles are equipped with the necessary on-board computer. One collection vehicle — Truck 317 — does not currently have such a computer.

# Recommendation

THAT Council direct staff to purchase and install an on-board computer for Truck 317.

# **Resident Education**

Residents have a significant role to play in increasing the collection system's overall efficiency. Additional education and information for residents may be needed to help residents fully contribute.

# > Recommendation

THAT the City develop and provide targeted education and information resources to guide residents in:

- determining when to hold-back carts until the following collection day
- placing carts for pick-up
- preparing cardboard for collection
- reducing contamination in recyclables
- reducing the amount of household waste generated

# **RECOMMENDATIONS BEYOND 2021**

The recommendations listed for 2021 are designed to create additional service capacity through the reconfiguration of routes, and the addition of a relatively modest amount of resources. The recommendations for driver training and resident education are designed to add to efficiency gains by lowering vehicle maintenance

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costs, and improving households' use of the system.

Recommendations beyond 2021 do not have budget implications for the coming fiscal year, but are no less important to the service's long-term success. These recommendations are presented in this section of the text.

#### **Collection Vehicles**

The discussion on collection vehicles in Chapter 4 highlighted challenges related to the reliance on split-load vehicles, and the longer-than-standard vehicle amortization period. Challenges related to the fleets (maintenance) facility, the vehicle fuelling situation and the scheduling of mechanics were also identified. All of these challenges inform the following recommendations:

# > Recommendations

THAT the City examine the potential to diversify its collection fleet by including single-load vehicles in future years, either in addition to or in place of end-of-life split-load vehicles, for the collection of high-volume streams such as recycling;

THAT the City use a seven-year amortization period in its capital planning for new collection vehicles;

THAT the City incorporate into its future re-design of the Public Works Yard a fleets facility that can accommodate the City's CNG collection vehicles;

THAT the City incorporate into its future re-design of the Public Works Yard a slow-fill CNG fueling facility with sufficient capacity to fuel the City's entire CNG collection fleet; and

THAT the City explore the potential to alter shift times for vehicle mechanics to enable collection vehicles to be consistently maintained and repaired outside of collection times.

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