

May 2017



CITY OF SASKATOON

Waste Diversion Opportunities Report

Final



May 31, 2017

City of Saskatoon
202-4th Ave N
Saskatoon, SK
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Attention: Mr. Daniel Mireault
Environmental Coordinator

Waste Diversion Opportunities Report (Final)

Dear Mr. Mireault:

Based on comments received at our review session on March 3, 2017 and subsequent refinements requested by the City, we have prepared a finalized version of the City of Saskatoon's Waste Diversion Opportunities Report. The Report contains 21 recommended actions that were developed based on our review of the City's existing solid waste management system and the objective of meeting Saskatoon's long term diversion goals.

It has been the Dillon team's distinct pleasure to work with you and your colleagues during the completion of this assignment and hope to be of further service to the City in the years ahead.

Sincerely,

DILLON CONSULTING LIMITED



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Table of Contents

Acronyms and Abbreviations	vi
Executive Summary	vii
1.0 Introduction	1
1.1 Study Area	2
1.1.1 Population	2
1.1.2 Housing Units	4
1.1.3 Industrial, Commercial and Institutional (ICI) Properties	5
2.0 Existing Conditions	6
2.1 Organizational Structure	6
2.2 Legislative Requirements	8
2.2.1 Provincial – Saskatchewan	8
2.2.2 City of Saskatoon.....	9
2.2.3 Banned Material.....	11
2.3 Current Waste Management Services	11
2.3.1 Single-Family Collection Services	11
2.3.2 Multi-Family Collection Services	13
2.3.3 ICI Collection Services	14
2.3.4 Other Waste Management Services	15
2.4 Current Waste Management Facilities	17
2.4.1 Regional Waste Management Facility (Landfill)	19
2.4.2 Recycling Depots	21
2.4.3 Compost Depots.....	22
2.4.4 Proposed Facility – Recovery Park	23
2.5 Waste Quantities and Diversion Rates.....	24
2.5.1 Waste Quantities	24
2.5.2 Waste Diversion Rate	27
2.6 Education and Promotion	29
2.6.1 Recycling	29
2.6.2 Website and Online Engagement	31
2.6.3 Collection Calendar	31

2.6.4	Rolling Education and the Let's Roll Recycling Team.....	31
2.6.5	Home Composting Education	32
2.7	Waste Bylaw Enforcement.....	32
2.8	Status of 2007 Waste and Recycling Plan Recommendations.....	33
3.0	2016 Waste Characterization	36
3.1	Methodology.....	36
3.2	Single-Family Waste Composition	36
3.3	Multi-Family Residential Waste Composition.....	37
3.4	Industrial, Commercial and Institutional (ICI) Waste Composition	38
3.5	Construction and Demolition (C&D) Waste Composition.....	39
3.6	City Landfill Self-Haul Waste Composition.....	40
3.7	Overall Waste Composition	41
4.0	Forecast of Waste Stream Quality and Quantity (2017-2027)	44
4.1	Quality.....	44
4.2	Quantity	44
5.0	Needs Assessment	49
5.1	Identified Issues and Potential Actions.....	49
6.0	Waste Management System Best Practices	53
6.1	Solid Waste Utility.....	53
6.1.1	City's Current Approach	53
6.1.2	Description of Alternative Approaches.....	53
6.1.3	Potential Advantages and Benefits.....	55
6.1.4	Potential Disadvantages and Challenges	56
6.1.5	Impact to Other Operational Areas	56
6.2	Disposal Bans and Measures.....	56
6.2.1	City's Current Approach	56
6.2.2	Description of Alternative Approaches.....	57
6.2.3	Potential Advantages and Benefits.....	60
6.2.4	Potential Disadvantages and Challenges	60
6.2.5	Impact to Other Operational Areas	60
6.3	Influence/Enforce Diversion of ICI and C&D Waste.....	61
6.3.1	City's Current Approach	61
6.3.2	Description of Alternative Approaches.....	61

6.3.3	Potential Advantages and Benefits	63
6.3.4	Potential Disadvantages and Challenges	63
6.3.5	Impact to Other Operational Areas	63
6.4	Mandatory Recycling and Enforcement of Bylaws	64
6.4.1	City's Current Approach	64
6.4.2	Description of Alternative Approaches.....	64
6.4.3	Potential Advantages and Benefits	69
6.4.4	Potential Disadvantages and Challenges	69
6.4.5	Impact to Other Operational Areas	69
6.5	Implementation of City-wide Organics Collection Program	70
6.5.1	City's Current Approach	70
6.5.2	Description of Alternative Approaches.....	70
6.5.3	Potential Advantages and Benefits	72
6.5.4	Potential Disadvantages and Challenges	72
6.5.5	Impact to Other Operational Areas	73
6.6	Data Management – Alternative Technologies	73
6.6.1	City's Current Approach	73
6.6.2	Description of Alternative Approaches.....	73
6.6.3	Potential Advantages and Benefits	75
6.6.4	Potential Disadvantages and Challenges	75
6.6.5	Impacts to Other Operational Areas.....	76
6.7	Litter & Illegal Waste Management.....	76
6.7.1	City's Current Approach	76
6.7.2	Description of Alternative Approaches.....	76
6.7.3	Potential Advantages and Benefits	79
6.7.4	Potential Disadvantages and Challenges	79
6.7.5	Impact to Other Operational Areas	80
7.0	Development of Diversion Plan Components	81
7.1	Criteria Development.....	81
7.2	Ranking of Candidate Action Items.....	82
7.3	Forecasted Waste Diversion Plan Performance.....	82
7.4	Implementation Considerations	90
7.5	Impact on Diversion Rates	90
7.5.1	Getting to 70%	94

8.0 Development of an Implementation Plan**96****Figures**

Figure 1-1: Methodology to Complete Waste Diversion Plan.....	2
Figure 1-2: City of Saskatoon and Bordering Rural Municipalities.....	3
Figure 1-3: Saskatoon Population Projection from 2015 to 2035 ²	4
Figure 2-1: Organizational Structure for Waste Management Services.....	7
Figure 2-2: Participation and Cost of HHW Days (2007-2015) ⁴	16
Figure 2-3: Curbside Swap Poster Template	17
Figure 2-4: Waste Management Facilities in Saskatoon	18
Figure 2-5: Waste Received at the Landfill (2016)	19
Figure 2-6: Historical Quantities of Waste Disposed at the Landfill (2009-2016) ¹⁷	20
Figure 2-7: Recycling Depot Quantities (2009-2016)	22
Figure 2-8: Historical Waste Quantities Managed by the City (2009-2016)	25
Figure 2-9: Waste Landfilled by Sector Type (2014-2016)	25
Figure 2-10: Per Capita Waste Disposed (2014 to 2016)	26
Figure 2-11: Seasonal Variation of Waste Collected (2016).....	27
Figure 2-12: Programs/Facilities Managing City's Waste (2016) ¹⁷	28
Figure 2-13: Historical Waste Diversion Rates (2009-2016) ¹⁷	28
Figure 2-14: Barriers to Household Recycling	30
Figure 3-1: Single-Family Residential Waste Composition	37
Figure 3-2: Multi-Family Residential Waste Composition	38
Figure 3-3: ICI Waste Composition	39
Figure 3-4: C&D Waste Composition.....	40
Figure 3-5: C&D Waste Composition – Breakdown of the C&D Category	40
Figure 3-6: Self-Haul Waste Composition	41
Figure 3-7: Total Estimated Waste Composition, all Generators.....	43
Figure 4-1: City of Saskatoon Waste Generation Growth (2009-2016)	46
Figure 4-2: Saskatoon CMA Real GDP Growth (% change), 2009-2017	46
Figure 4-3: Waste Quantity Forecast (2017-2017).....	47
Figure 8-1: Implementation Plan for Recommended Actions.....	97

Tables

Table 2-1: Age of Existing City Sideload Vehicles	12
Table 2-2: Name and Location of the City's Recycling Depots	21
Table 2-3: City of Saskatoon Waste and Recycling Plan	33
Table 3-1: Overview of Seasonal Waste Characterization Studies.....	36
Table 3-2: Estimated Waste Disposed per Waste Generator per Year	42
Table 3-3: Estimated Waste Quantities per Generator per Year	42
Table 4-1: Estimated Annual Waste Quantities Generated by Sector	45
Table 4-2: Generated Waste Forecast (2017-2027)	48
Table 5-1: Issues and Actions Identified in Existing Waste Management System	49
Table 6-1: Metro Vancouver Banned Materials	59
Table 6-2: Enforcement Mechanisms in Jurisdictions with Mandatory Recycling Programs, as of November 2012	65
Table 7-1: Final Scoring Criteria and Weighting	81
Table 7-2: Results and Ranking of Candidate Action Items.....	83
Table 7-3: Forecasted Diversion Plan Performance (2023 and 2027).....	87
Table 7-4: Implementation Consideration of Options	91
Table 7-5: Estimated Diversion Rates Achieved with Recommended Actions.....	94

Appendices

A	Summary Report on 2016 Waste Characterization Study
B	Long-List of Potential Actions

Acronyms and Abbreviations

5Rs	Reduction, reuse, recycling, recovery and residuals management
C&D	Construction and Demolition
EPO	Environmental Protection Officer
EPR	Extended Producer Responsibility
EPRA	Electronic Products Recycling Association
FTE	Full Time Equivalent
HH	Household
HHW	Household Hazardous Waste
HRM	Halifax Regional Municipality
ICI	Industrial, Commercial and Institutional
MF	Multi-Family Residential
MMSW	Multi-Material Stewardship Western
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MURR	Multi-Unit Residential Recycling
OCC	Old Corrugated Cardboard
PAYT	Pay As You Throw
RFP	Request for proposal
SARRC	Saskatchewan Association for Resource Recovery Corporation
SF	Single-Family Residential
SME	Saskatchewan Ministry of Environment
SS	Single Stream
SSO	Source Separated Organics
SWANA	Solid Waste Association of North America
SWM	Solid Waste Management
SWRC	Saskatchewan Waste Reduction Council
TPY	Tonnes per year
WEEE	Waste Electrical and Electronic Equipment
YGW	Yard and Garden Waste

Executive Summary

Introduction

The City of Saskatoon (the City) recently developed a performance dashboard to provide a snapshot into the progress Saskatoon is making towards the 25 targets included in its Strategic Plan. One of the targets was to divert 70% of waste (by weight) from the Saskatoon landfill (by 2023) as a measure of the City's success in environmental stewardship. Achieving the target would mean that more of Saskatoon's waste would be reduced (e.g., not generated), reused, recycled, or composted instead of landfilled. In 2016, 22% of the waste handled by the City was diverted from disposal through programs such as the single and multi-family residential recycling programs, the subscription food, yard and garden waste collection program, recycling and compost depots and Household Hazardous Waste (HHW) drop-off events.

In December 2015, the City retained Dillon Consulting Limited (Dillon) to conduct a four-season waste composition study (completed by sub-consultant, 2cg Inc.) and a review of the City's existing solid waste management program to identify opportunities to improve waste diversion performance for residential and Industrial, Commercial, and Institutional (ICI) generators.

Study Area and Existing Conditions

Saskatoon is the largest city by population in the Province of Saskatchewan. The 2016 Statistics Canada Census reported a City population of 295,100; representing a growth rate of 12% between 2011 and 2016. There are currently approximately 102,000 housing units in Saskatoon. Approximately 67,800 (66%) are single-family households and 34,200 (34%) are multi-family (greater than three residential units) buildings. There are approximately 6,140 ICI properties in Saskatoon which mainly consists of food, automotive, retail, and personal care services.

The City owns and operates a regional landfill (Saskatoon Regional Waste Management Facility), two compost depots, and four recycling depots. Noted waste management services provided to residents and the ICI sector include:

- Curbside garbage and recycling collection for single-family households
- Garbage collection for some multi-family and ICI customers
- Multi-family residential recycling collection
- Subscription-based curbside collection of yard and food waste
- Drop-off of yard waste at compost depots
- Drop-off of recyclables at recycling depots
- Public space recycling;
- Diversion of select materials at the landfill
- Household hazardous waste drop-off events
- Curbside swap event
- Education sessions for residents

Waste management services are delivered under the City's Environmental Health Business Line by the Water and Waste Stream Division and the Environmental and Corporate Initiatives Division.

Part IV of the Government of Saskatchewan's Environmental Management and Protection Act, 2010 (the Act) relates to waste management. Part IV is broken down into three Divisions, defining requirements for the Beverage Container Program, Stewardship Programs and Solid and Liquid Waste Management. The City's Waste Bylaw No. 8310 is made up of 10 parts which lays out provisions for waste storage, collection, handling and disposal, along with enforcement mechanisms, definition of offences and penalties to be paid if the bylaw is violated.

In 2015, the City commissioned a business case to develop service delivery options for an integrated waste management facility called Recovery Park. Recovery Park is planned to receive and/or process three important divertible material streams: HHW, Construction and Demolition (C&D) waste and organic waste. The City's Administration identified a site near the City's landfill where Recovery Park could be established. In 2016, KPMG completed the business analysis of the proposed development; findings of that review were incorporated by Dillon into the preparation of the Waste Diversion Plan presented in this report.

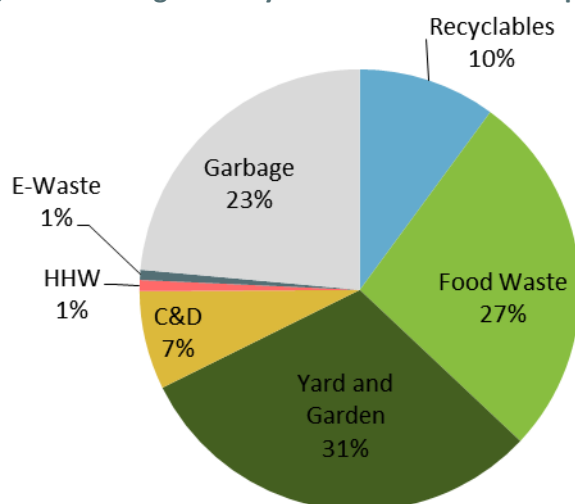
Waste Composition Study

The waste composition study was completed in 2016 and four separate reports, one for each season, were prepared and submitted to the City. A summary report was prepared which combined the data from the seasonal studies to present overall waste quantity and composition data. Highlights from the completion of the summary report include the following:

Single-Family Residential Waste Composition

- The average quantity of garbage set out was approximately 16 kg/hh/wk. The least amount of waste was generated in the winter (9 kg/hh/wk) and the highest amount of waste was generated in the spring (22 kg/hh/wk). Most of the seasonal differences can be attributed to yard and garden waste.
- Based on the results of the waste characterization study (see **Figure ES-1**) an estimated 77% of wastes could be diverted through existing and future programs.

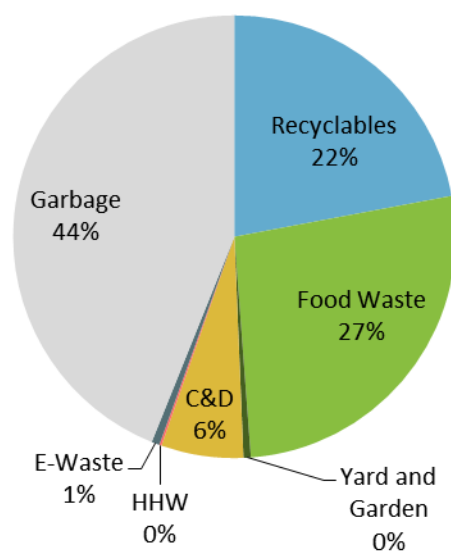
Figure ES-1: Single Family Residential Waste Composition



Multi-Family Residential Waste Composition

- In Saskatoon, the multi-family category includes buildings consisting of three or more residential units.
- The average quantity of garbage set out was approximately 7 kg/hh/wk, which is less than half of what was found to be generated by single-family households.
- Based on the results of the waste characterization study (see **Figure ES-2**) an estimated 61% of wastes could be diverted through existing and future diversion programs.

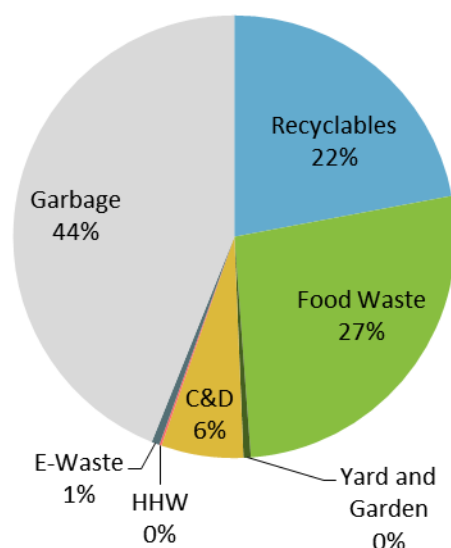
Figure ES-2: Multi-Family Residential Waste Composition



Industrial, Commercial and Institutional (ICI) Waste Composition

- It appears that most ICI waste is managed by the private sector and is assumed to be disposed of in private landfills in the City. Estimating the ICI garbage composition was undertaken by completing audits of the top six estimated waste generator types by North American Industry Classification System (NAICS) codes (manufacturing, retail trade, health care and social assistance, accommodation and food services, other services, and public administration).
- It is estimated, based on waste audit and other data sources (see **Figure ES-3**), that the majority of ICI waste (56%) can be diverted.

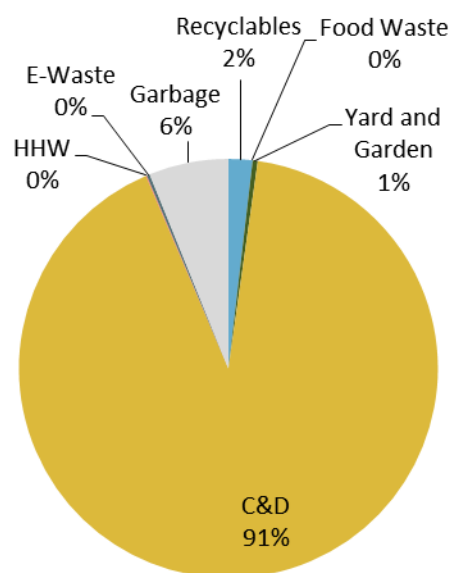
Figure ES-3: ICI Waste Composition



Construction and Demolition (C&D) Waste Composition

- It appears that most C&D waste is managed by the private sector and is assumed to be disposed of in private landfills in or near the City. Estimating C&D composition (i.e., the disposal stream) was undertaken by completing visual waste audits of loads of C&D waste received at a private landfill facility.
- Based on the results of the audits (see **Figure ES-4**), approximately 91% of each load was C&D waste. This included untreated wood, asphalt roofing shingles, asphalt, concrete, bricks and metals. Most of these materials could have been diverted in various recycling programs.

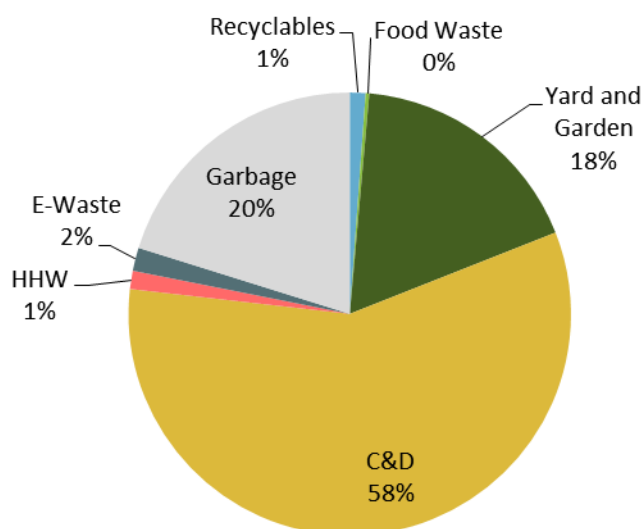
Figure ES-4: Construction and Demolition (C&D) Waste Composition



City Landfill Self-Haul Waste Composition

- Residents and businesses can self-haul garbage to the City landfill for disposal. The waste characterization results of self-haul loads were averaged to develop an overall estimate of self-haul waste composition.
- Based on the results of the audits (see **Figure ES-5**), the main material stream found in the self-hauled loads consisted of C&D materials (58%). Organic waste accounted for approximately 18% of the audited waste, with 98% of the organic waste consisting of yard and garden waste.

Figure ES-5: City Landfill Self-Haul Waste Composition



Overall Waste Composition

The weighted overall waste composition of the various municipal solid waste streams (see **Figure ES-6**) was calculated using a model based on data provided by the City and information derived from Statistics Canada. Data provided by the City included single-family, multi-family and self-haul waste collected by the City.

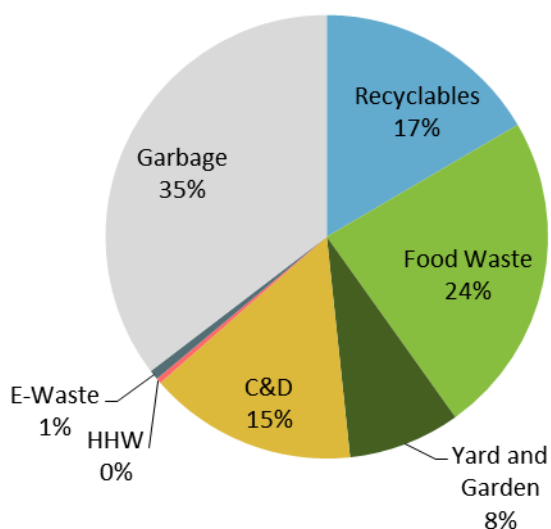
A summary of current (2016) estimated waste quantities for each generator is presented in **Table ES-1**.

Table ES-1: Current Waste Quantities by Generator Type

Generator	Tonne/Year
Single-family	51,900
Multi-family	9,100
Self-Haul	17,100
ICI	152,900*
C&D	16,100*
Total	247,100

* Refers to amounts that were inferred from Statistics Canada

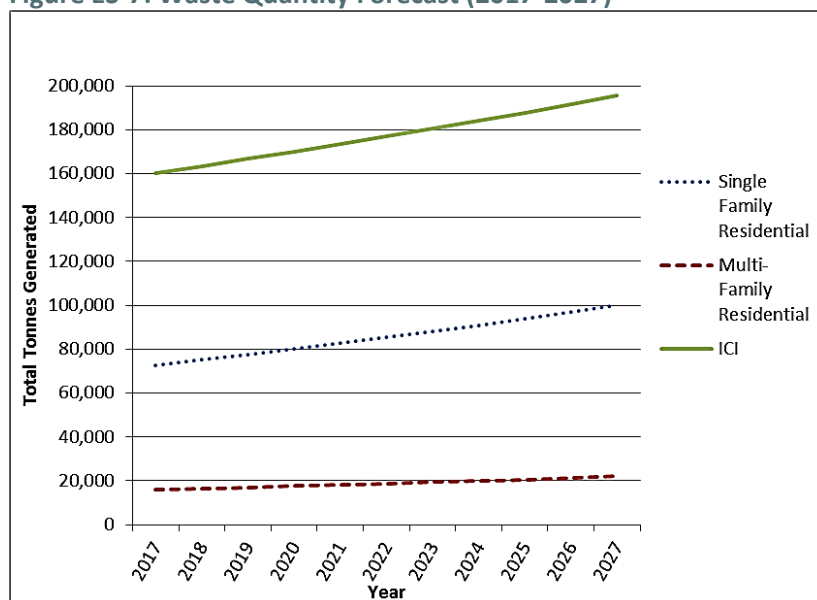
Figure ES-6: Total Estimated Waste Composition, all Generators



Forecast of Waste Stream Quality and Quantity (2017-2027)

Waste quantity forecasts (see **Figure ES-7**) were developed based on 2cgs's Waste Composition Study, Statistics Canada data and population projections prepared by the City's Planning and Development Division's report City of Saskatoon & Saskatoon Census Metropolitan Area Population Projection 2015-2035.

Figure ES-7: Waste Quantity Forecast (2017-2027)



Needs Assessment and Waste Management System Best Practices

Based on the review of existing conditions, the results of the 2016 Waste Composition Study and information obtained through interviews with City staff and key stakeholders, a number of issues with the current waste management system and potential actions to reduce/eliminate the issues were identified. The issues and actions were categorized into one of the following six categories: 1) System Governance and Management, 2) User Education and Awareness, 3) Reuse and Recycling, 4) Organics Management, 5) Collection and Transfer, and 6) Processing and Disposal.

The seven issues that were identified as warranting best practices research were provided to the City for approval prior to commencing investigations. The approved list of topics used to direct the best practices research included; 1) solid waste utility, 2) disposal bans and measures; 3) influence/enforce diversion of ICI and C&D wastes, 4) mandatory recycling and enforcement of bylaws, 5) implementation of city-wide source separated organics collection program, 6) data management - alternative technologies, and 7) litter and illegal waste management.

Results of the research were carried forward into the development of the Waste Diversion Plan.

Development of Diversion Plan Components

Following the development of a long-list of potential recommended actions to improve the City's waste diversion performance, the actions were ranked (using a set of scoring criteria and weightings) to establish a preferred short-list. Four criteria were used for the sorting exercise; 1) Environmental, 2) Social/legal, 3) Financial and 4) Operational.

With reference to **Table ES-2**, 21 short listed actions, complete with a ranking to guide implementation priority, were identified to provide the basis for the Waste Diversion Plan.

Table ES-2: Number of Recommended Actions by Category

Category	Number of Recommended Actions
1. System Governance and Management	8
2. User Education and Awareness	3
3. Reuse and Recycling	4
4. Organics Management	2
5. Collection and Transfer	3
6. Processing and Disposal	1

An estimated incremental (e.g., in addition to existing levels of waste diversion) diversion rate associated with the phased implementation of the recommended actions was prepared. For forecasting purposes, and linked to the proposed development of Recovery Park, two milestone years (2023 and 2027) were selected to evaluate diversion performance in the future. 2023 was selected as it is in line with the timeline of the City's goal to achieve 70% diversion and 2027 to represent the end of the 10-year planning period.

Founded on these assumptions, **Table ES-3** presents the estimated incremental diversion rate for the milestone years of 2017, 2023 and 2027.

Table ES-3: Estimated Diversion Rates Achieved with Recommended Actions

Year	Residential		ICI	Residential Total (SF + MF) (Weighted Average)	Total (Weighted Average)
	Single Family	Multi-Family			
2017	27.9%	12.3%	3.5%	25.1%	11.2%
2023	43.1%	19.4%	25.0%	38.8%	36.5%
2027	60.5%	27.8%	35.5%	54.6%	42.9%

Dillon held a workshop with City staff to develop a draft implementation plan for the recommended options. Discussions were held regarding the sequencing of planning and implementing each option and how the actions fit together. Following the workshop, the actions were arranged in one of three implementation phases; Phase I – Planning and implementation of administrative and promotion and education options, Phase II – Implementation of programs and facilities, and Phase III – Operational refinements. **Figure ES-8** presents a phased implementation plan for the 21 recommended actions.

It was assumed that all three phases of Recovery Park, including the establishment of an organics processing facility, would be in place by 2020 with the organics collection program starting in 2021. By 2023, the majority of actions will be implemented. By 2027, the actions will have been fully active for five years. Overall, the assumptions adopted for the report allowed for the preparation of a forecast of how the suggested actions might perform against Saskatoon's 70% diversion target.

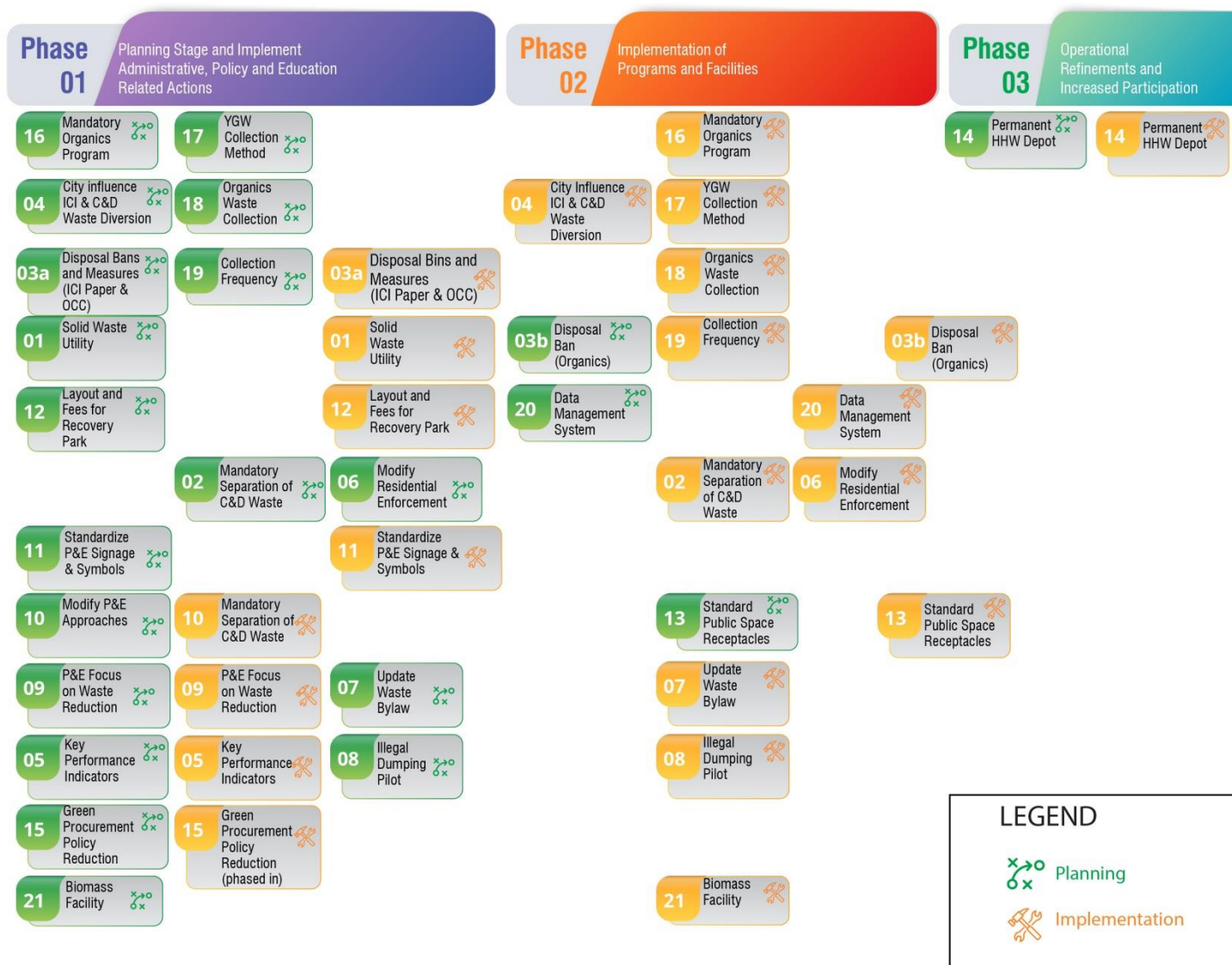
Getting to 70%

The City has set a goal to achieve 70% diversion (by weight) from disposal by 2023 through municipally operated diversion and disposal programs. The goal was initially intended to include diversion from both residential and non-residential sources. The City may want to consider elimination of ICI diversion expectations since it manages a relatively minor amount of the sector's waste. Instead, the diversion goals could be focused on the waste the City manages - which is predominately residential waste. In any event, to achieve a 70% diversion rate by either 2023 or 2027, additional actions would be required in addition to the status quo and the recommended actions presented in the Draft Waste Diversion Plan.

It is assumed that the current "base" diversion rate of 22% will remain constant. In 2023, the recommended actions included in the Draft Diversion Plan are estimated to achieve an additional 36.5% which totals 58.5%. For 2027, this is increased to 65%. *An additional 11.5% diversion in 2023 or an additional 5% diversion in 2027 will be required to meet the 70% diversion target.* The following provides a listing of additional initiatives or programs that could support the enhanced level of diversion required to reach the target 70% (diversion potential estimates taken from 2016 waste composition study on the single-family sector garbage stream):

- Textile recycling program (2% available);
- Increased promotion and incentives for backyard composting (at-source reduction, 7% of fruit and vegetable waste in the garbage stream – estimate 1-2% diversion potential);
- Ban on grass in the leaf and yard waste collection program with enhanced education on the benefits of grasscycling (at-source reduction, 8% available – estimate 1% diversion potential); and
- Selection of an organics processing technology that can manage diapers, sanitary and pet wastes (11% available).

Figure ES-8: Implementation Plan for Recommended Actions



Introduction

The City of Saskatoon (the City) recently developed a performance dashboard to provide a snapshot into the progress Saskatoon is making towards the 25 targets included in its Strategic Plan. One of the targets was to divert 70% of waste (by weight) from the Saskatoon landfill (by 2023) as a measure of the City's success in environmental stewardship. Achieving the target would mean that more of Saskatoon's waste would be reduced, reused, recycled, or composted instead of landfilled.

In 2016, 22% of the waste handled by the City was diverted from disposal through programs such as the single and multi-family residential recycling programs, the subscription food, yard and garden waste collection program, recycling and compost depots and Household Hazardous Waste (HHW) drop-off events. It did not include at-source reduction or reuse initiatives or recycling through non-City recyclers such as SARCAN.

In December 2015, the City retained Dillon Consulting Limited (Dillon) to conduct a four-season waste composition study (completed by sub-consultant, 2cg Inc.) and a review of the City's existing solid waste management program to identify opportunities to improve waste diversion performance determine for all generating sectors in Saskatoon including single and multi-family residential and Industrial, Commercial, and Institutional (ICI). The waste composition study was completed in 2016 and four separate reports, one for each season, were prepared and submitted to the City. A summary report was prepared which combines the data from the seasonal studies to present overall waste quantity and composition data. The summary findings are discussed in **Section 3.0** and attached as **Appendix A**.

In order to prepare the Draft Waste Diversion Plan, seven steps were completed and are discussed in this report as shown in **Figure 1-1**. Note the numbers in the graphic correspond to the section number in this report.

Figure 1-1: Methodology to Complete Waste Diversion Plan

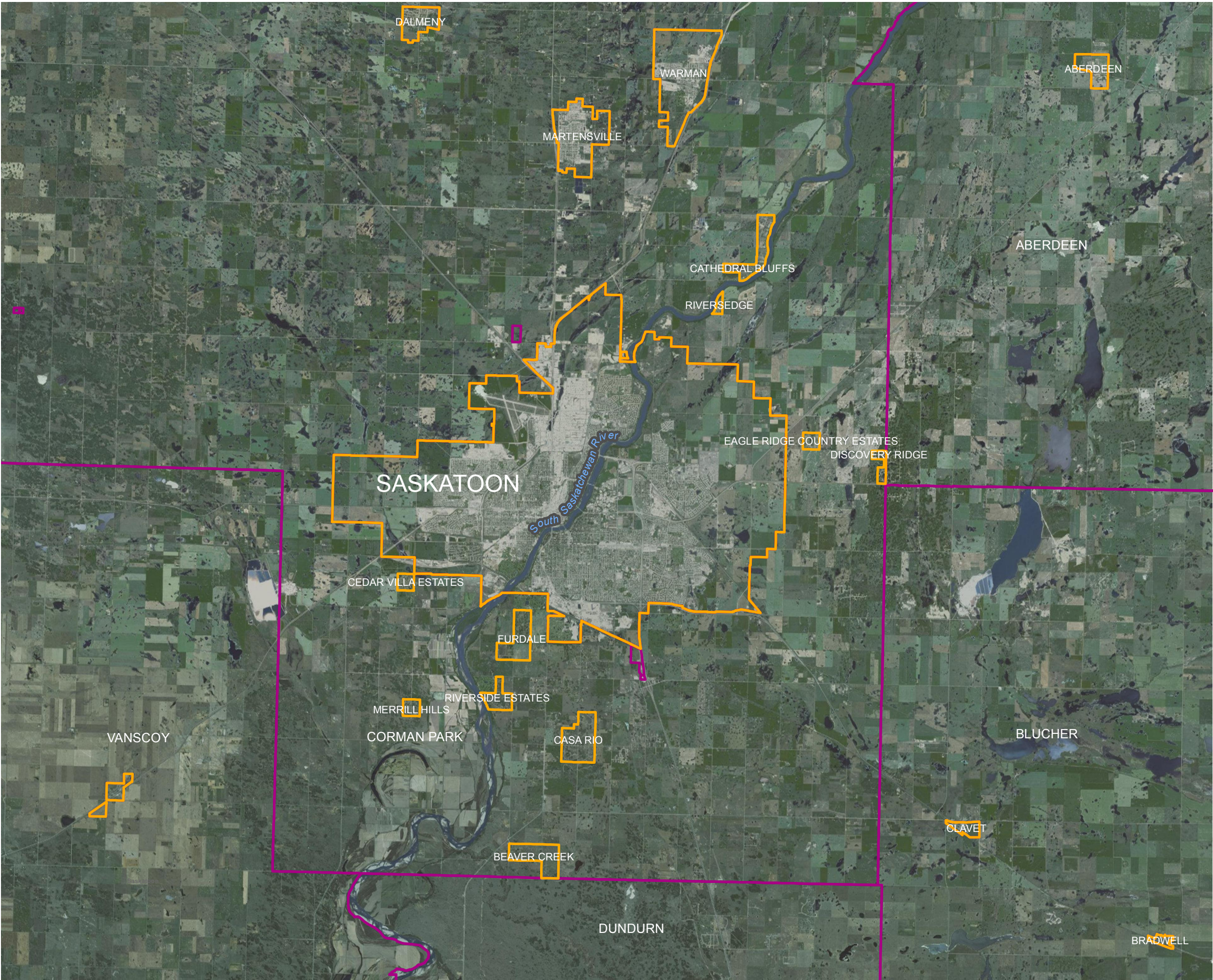
The end product of this assignment provides a recommended course of action that will allow the City to enhance and expand existing solids waste operations and achieve their goals, consistent with the Strategic Plan.

1.1 Study Area

Saskatoon is located in the mid-southern portion of the Province of Saskatchewan with a total land area of 5,215 square km¹ (**Figure 1-2**). Saskatoon has a relatively flat topography with the South Saskatchewan River passing through the center of the city. Saskatoon is located approximately 260 km north-west of the City of Regina and 430 km north of the border of Montana.

1.1.1 Population

Saskatoon is the largest city by population in the Province of Saskatchewan. The City was incorporated in 1906 and has a population of approximately 255,200 people² (note that the recently released Statistics Canada Census data gives Saskatoon a 2016 population of 246,376). As reported in the 2016 Census, the city experienced a population growth of 11% between 2011 and 2016. Approximately 18% of the city's population is under the age of 14, 70% is between the ages of 15 and 64, and 12% is over the age of 65. The population density of the city is 50 persons per square kilometre¹.



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Opportunities Report

FIGURE 1-2: CITY OF SASKATOON AND
NEIGHBOURING RURAL MUNICIPALITIES

- SASKATOON CITY BOUNDARY
- RURAL MUNICIPALITY BOUNDARIES
- URBAN MUNICIPALITY BOUNDARIES



SCALE 1:180,000
MAP DRAWING INFORMATION:
DATA PROVIDED BY GEOSASK/ESRI

MAP CREATED BY: PMH
MAP CHECKED BY: BV
MAP PROJECTION: NAD 1983 UTM Zone 13N

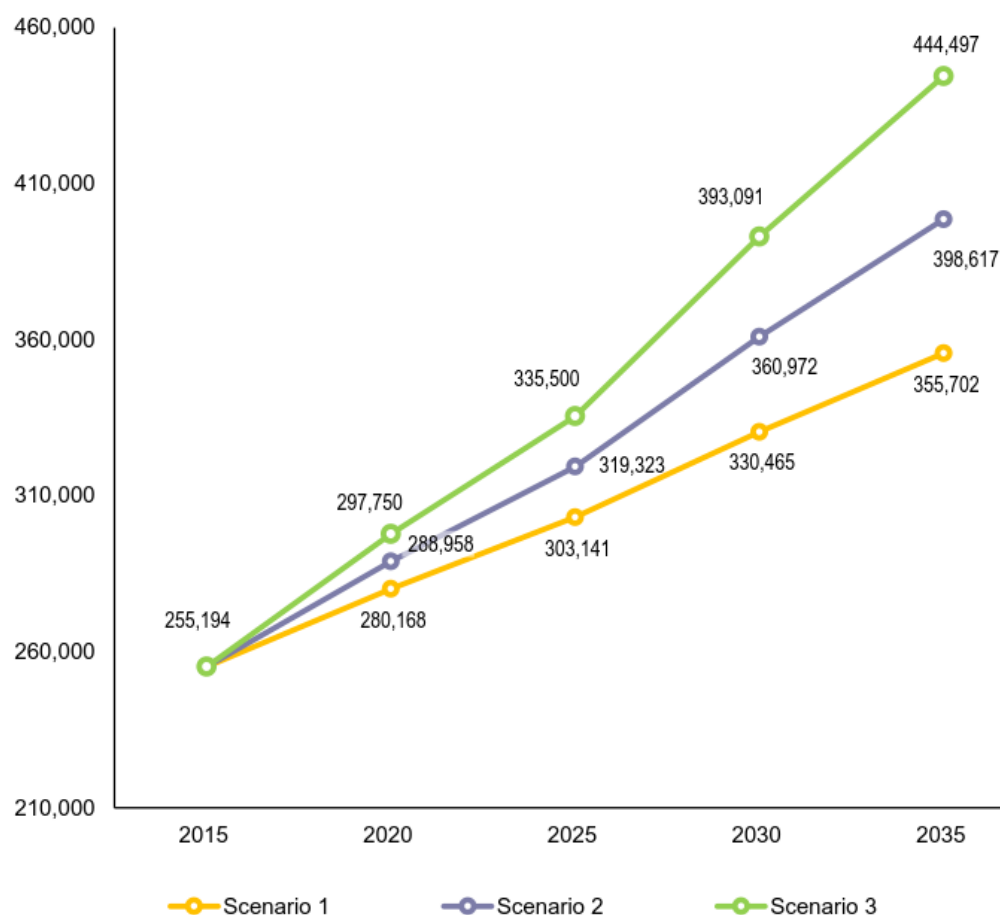
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PROJECT: 152998
STATUS: DRAFT
DATE: 6/2/2017

The City of Saskatoon's Planning and Development Division released a report in 2015 to project population growth for Saskatoon and the Saskatoon Census Metropolitan Area (CMA). Based on historic data and trends, the population for Saskatoon was projected for 20 years (2015 to 2035) using three different scenarios with varying growth rates of 1.7%, 2.2% and 2.8%². **Figure 1-3** illustrates the population projections of Saskatoon between 2015 and 2035.

Figure 1-3: Saskatoon Population Projection from 2015 to 2035²



According to Statistics Canada, approximately 169,500 people are in the employed labour force and the unemployment rate was 7% as of December 2016³.

1.1.2

Housing Units

There are currently approximately 102,000 housing units in Saskatoon. Approximately 67,800⁴ (66%) are single-family households and 34,200⁵ (34%) are multi-family residential units. There are approximately 845 multi-family residential buildings⁵ in the city which are defined as buildings consisting of three or more residential units. Saskatoon's average household size is 2.4 people per household².

1.1.3

Industrial, Commercial and Institutional (ICI) Properties

There are approximately 6,140 ICI properties in Saskatoon which mainly consists of food, automotive, retail, and personal care services⁶. The ICI locations are spread throughout the city and employ approximately 83,280 people⁶ on full time, part time and seasonal basis.

2.0

Existing Conditions

The City owns and operates a regional landfill, two compost depots, and four recycling depots. Core waste management services provided to residents and the ICI sector include⁴:

- Curbside garbage and recycling collection for single-family households;
- Garbage collection for some multi-family and ICI customers (others are serviced by private haulers);
- Multi-family residential recycling collection;
- Subscription-based curbside collection of yard and food waste;
- Drop-off of yard waste at two compost depots;
- Drop-off of recyclables at four recycling depots;
- Public space recycling;
- Diversion of additional materials at the landfill (e.g., scrap metals, used oils);
- Household hazardous waste drop-off events;
- Curbside swap event; and
- Education sessions for residents.

Additional waste management services provided to residents and the ICI sector include SARCAN depots for beverage containers, electronics and used paint which are located across the city.

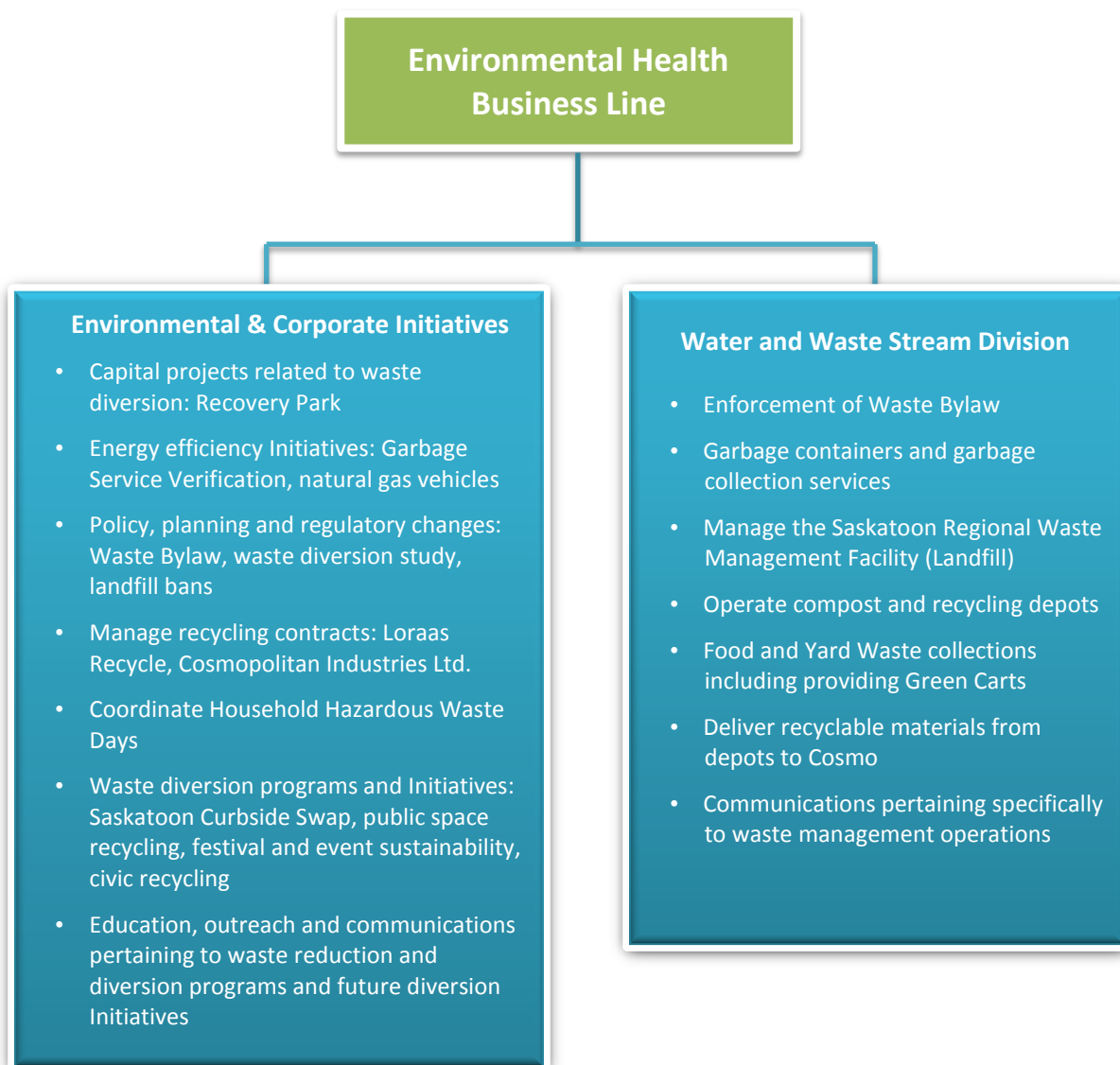
This section outlines the City's organizational structure, legislative requirements, current services provided, waste management facilities, waste quantity data, education and promotion activities, bylaw enforcement and status of the recommendations coming out of the City's 2007 Waste and Recycling Plan. Background information on the City's existing program was obtained through reports, waste quantity data and interviews with internal and external stakeholders.

2.1

Organizational Structure

Waste management services are delivered under the City's Environmental Health Business Line by the Water and Waste Stream Division and the Environmental and Corporate Initiatives Division.

Figure 2-1 presents the responsibilities of each department as it relates to waste management⁷.

Figure 2-1: Organizational Structure for Waste Management Services

The Water and Waste Stream Division has approximately 75 employees that are involved in waste collection, facilities and education which is broken down as follows:

- Division Director;
- Environmental Operations Manager;
- Environmental Protection Officers;
- Senior Project Management Engineer;
- Operations Superintendent (Collections & Containers) plus 41 staff;
- Operations Superintendent (Landfill) plus 27 staff;

- Operations Engineer;
- Depots Supervisor; and
- Project Engineer (Landfill Gas).

The Environmental and Corporate Initiatives Division is responsible for other areas such as Waste Services, Wastewater and Facilities Management. The resources available to deliver waste management related services include:

- Division Director;
- Education and Environmental Performance Manager plus six staff;
- Land and Water Manager plus three staff; and
- Energy and Sustainability Manager plus three staff.

In addition to the above resources, the following City divisions also support waste management services:

- Business Administration (finance);
- Corporate Revenue (billing of residential recycling collection services);
- Community Services (Community Services (bylaw enforcement)); and
- Communications.

2.2 Legislative Requirements

2.2.1 Provincial – Saskatchewan

Part IV of the Government of Saskatchewan’s Environmental Management and Protection Act, 2010 (the Act) relates to waste management. The Act defines waste as a solid or a liquid that is either: “rubbish; tailings; effluent; sewage; garbage; refuse; scrap; discarded articles, bottles or can; or any other material that is prescribed or is set out in the code”.

Part IV is broken down into the following three Divisions:

1. Beverage Container Program - covers the obligation to pay a deposit and environmental handling charge for beverage containers, the charges per container type, how the charges are collected and remitted to the government and the refund process;
2. Stewardship Programs - covers the requirements for stewardship programs for prescribed products; and
3. Solid and Liquid Waste Management - covers facilities and operations for the management of waste (landfills, transfer stations, other prescribed category of facilities), areas where the Lieutenant Governor in Council can make regulations (e.g., creating waste collection systems, wastes not accepted at facilities), abandonment of waste and prohibition of littering.

Private, industrial or municipal landfills that accept more than 20% of industrial waste is issued an Industrial Waste Works permit under the Act. Municipal or government owned landfills are permitted under The Municipal Refuse Management Regulations, June 26, 1986⁸.

Household Packaging and Paper Stewardship Program Regulation

The Household Packaging and Paper Stewardship Program is in force under Regulation 5 of The Environmental Management and Protection Act, 2010. This program requires stewards who generate residential paper and packaging waste, (i.e., packaging made of glass, metal, paper, boxboard, cardboard, paper fibre, plastic, or paper materials such as brochure, booklets, newspaper and magazines) to register with the ministry. The Province identifies a steward as “the brand owner with respect to the packaging or paper, unless the brand owner is a non-resident brand owner; if there is no brand owner, the person that first imports the packaging or paper into Saskatchewan; or if there is no brand owner or person that first imports the packaging or paper, the purchaser of the packaging or paper outside of Saskatchewan that purchases it for use in Saskatchewan”⁹.

All stewards are required to register. Through registration, stewards pay a portion of a cost that will be required to recycle the amount of residential paper and packaging waste. This program is called the Multi-Material Recycling Program (MMRP) and is administered by Multi-Material Stewardship Western (MMSW) which commenced operations in January 2016. MMSW reimburses municipalities up to 75% of the net cost of operating a recycling program. Participating municipalities currently receive \$11.75 per household from MMSW¹⁰. In 2016, these funds were put towards the Multi-Unit Residential Recycling Program, Recycling Depot operations, the Green Cart collection program and the Compost Depot operations. MMSW funding is anticipated to change in 2018 and moving forward once the program is audited and re-evaluated (the first two years of the program were not based on Saskatchewan data).

Disposal of Elm Trees

Due to a history of Dutch Elm Disease (DED) in Saskatchewan, there is a provincial ban on pruning elm trees between April 1 and August 31; however, full removal of trees can take place at any time of the year. All elm material must be disposed of at the nearest elm tree disposal site in the municipality where the elm tree is located¹¹.

2.2.2

City of Saskatoon

The City’s Waste Bylaw No. 8310 came into effect in 2004. The bylaw is made up of 10 parts which lays out provisions for waste storage, collection, handling and disposal, along with enforcement mechanisms, definition of offences and penalties to be paid if the bylaw is violated. It is noted that the title of Utility Services Manager is now referred to as the Transportation and Utilities Department General Manager.

Under Part II of the bylaw, stipulations are provided for the collection and disposal of waste such as types of waste containers and situations for when waste may not be collected (e.g., container is too

heavy or locked, improperly placed). Part III covers waste collection from residences which states that the Utility Services Manager determines the type of waste collection to be provided and Council determines the collection frequency. Requirements for manual and automated waste collection for different bin types are provided (note that manual collection of waste is conducted for public spaces and parks while the remainder of collection is provided by automated waste collection vehicles).

The bylaw defines a multi-family residential building to consist of three or more residential units that is not an institutional property. In the multi-family residential buildings, the property owner is responsible for supplying and maintaining the waste bin(s) and the bylaw includes requirements for the bin/container type and storage requirements.

Part IV of the bylaw requires the ICI sector to send their waste to Provincially-approved recycling or disposal facilities. Private waste haulers are required to report the volume and types of waste collected within city limits on an annual basis to the Utility Services Manager; however, this reporting has not been put in practice.

Part V of the bylaw covers the management of construction and demolition (C&D) waste with regards to minimizing accumulation and littering. There are no requirements for diversion of C&D waste from disposal. Part VI of the bylaw provides requirements for the Regional Waste Management Facility including types of waste accepted, fees paid if a load contains more than 10% (by weight) of recyclable materials and procedures for handling unacceptable wastes.

Collection of recyclables is covered under Part VII of the bylaw and includes provisions for how recyclables are to be set out, that the Utility Services Manager establishes the collection program and that Council determines the collection frequency. Schedule E contains a list of recyclable materials to be collected. It is noted that the bylaw does not state that participating in the recycling program is mandatory nor does it include any information on the management of organic waste.

Enforcement and Offences and Penalties are carried out as per Parts VIII and IX of the bylaw, respectively, with the authority delegated to municipal bylaw inspectors. Types of offenses are listed along with the procedures to issue notices of violation and corresponding payments and fines. A notice of violation for a first offence is a \$100 fine, a second offence holds a \$200 fine, and for subsequent offenses individuals could be fined between \$200 and \$10,000 and corporations up to \$25,000.

Rates for garbage collection services for commercial properties and fees to dispose of waste at the City's Waste Management Centre are provided in Schedules A and B of the bylaw, respectively. Schedule C describes what is meant by special waste, Schedule D provides the residential recycling collection fees, Schedule E lists permitted recyclable materials and Schedule F sets fees for commercial customer use of the compost depots.

2.2.3 Banned Material

To control Dutch Elm Disease, the Province requires disposal of elm material at municipally approved disposal sites. Pruning elm trees is banned in the Province between April 1 and August 31.

In 2017, the City will begin consulting with the ICI sector on options for the mandatory diversion of paper and cardboard. The consultations will cover mandatory recycling, discuss opportunities for disposal bans on paper and cardboard and ensuring that options exist for the ICI sector to recycle these materials.

2.3 Current Waste Management Services

The City offers various programs and services to its residential and ICI sector customers. This section summarizes the services each sector receives from the City and the private sector. It is noted that scale house data for City fork trucks includes waste collected from multi-family residences and the ICI sector. Estimates on the proportion of waste collected from each of these sectors are provided in Section 2.5.

2.3.1 Single-Family Collection Services

The City provides curbside garbage collection services and subscription-based curbside Yard and Garden Waste (YGW) collection services to single-family households. The collection and processing of recyclables is contracted out. All waste is collected at curbside using automated collection vehicles. Residents are required to place their carts at the curb by 7:00 am on the day of collection and remove within 24 hours of collection.

It is noted that when the waste collection carts were distributed, not all carts were assigned to the proper address, some tags were faulty and some carts did not receive a tag at all. In addition, some households (particularly ones in back lanes and cul-de-sacs) take their neighbours carts instead of the original one that was assigned. Therefore, the City is unable to geo-reference a specific cart to its respective address accurately, identify which carts have been replaced or estimate how much waste is generated along each route.

Single-Family Garbage Collection

City workers collect garbage from approximately 67,800 single-family households⁴ on a weekly basis from May through September and bi-weekly from October to April. Weekly collection in the summer was a result of resident concerns and complaints about odour issues. Residents are to use City-provided 95 or 65-gallon carts and place their carts at the curb on the day of collection. The City has a fleet of 24 automated sideloader vehicles, of which six are considered as spares¹². The years that the vehicles went into service, age and number of vehicles in the fleet are provided in **Table 2-1**. The City has a 15-year replacement period for the vehicles. Fifteen of the vehicles have been in service for five years or less.

Table 2-1: Age of Existing City Sideload Vehicles

In-Service Year	Age of Vehicles	No. of Vehicles
2016	1	5
2015	2	4
2013	4	3
2012	5	3
2010	7	4
2009	8	2
2007	10	1
2005	12	2
Total Number of Vehicles		24

The City uses between eight to 10 vehicles per day for bi-weekly collection and 14 to 16 vehicles for weekly collection in the summer. In an effort to improve efficiency, reduce greenhouse gas emissions, and to effectively incorporate new neighbourhoods, the City modified the collection routes and days in January 2016 to be as short and direct as possible.

The single-family curbside collection program cost the City approximately \$5.5 million in 2016¹² which was funded through property taxes. The proportion of property taxes for garbage collection is not visible to residents. It is important to note that these collection costs do not include the cost of disposal at the landfill.

Single-Family Recycling Collection

The City initiated a curbside single stream recycling program in 2013. The collection and processing of single-family recyclables is contracted to Loraas Recycle under a seven-year contract (January 1, 2013 to December 31, 2019). Recyclables are collected on a bi-weekly basis and residents are provided with a 95-gallon blue cart. Materials accepted include paper and cardboard, glass bottles and jars, metal cans and containers, milk jugs and containers, #1-7 plastics (e.g., yogurt containers, food clamshells, plastic bags, plastic wrap) but excludes Styrofoam. In 2016, Loraas collected approximately 9,770¹³ tonnes of single stream recyclables and had an average contamination rate of 9%¹⁴.

Currently, single-family households pay approximately \$65 per year through their utility bill to receive recycling services. Schedule D of Bylaw No. 8310 lists the residential fees to be paid from 2017 (\$5.39/month) to 2019 (\$5.66/month). The overall cost to operate the program was \$4.3 million in 2016¹⁵.

Subscription Service for Single-Family Organics Collection

The City provides curbside collection of select organic waste through a subscription-based program called the Green Cart Program. The program started in 2007 and included Yard and Garden Waste (YGW) only and expanded in 2016 to include select non-meat and dairy food waste and food-soiled paper products (e.g., tissues, plates, cardboard)¹⁶. Examples of materials not accepted in the Green Cart Program include dairy products, meats and bones, chips, baked goods, mixed table scraps, bags of any kind (plastic, compostable, biodegradable), pet waste, diapers and sanitary wastes.

In 2016, approximately 6,300 subscribers participated in the program, which diverted approximately 2,470¹³ tonnes of organic waste. The subscription costs \$55 per household on an annual basis for bi-weekly collection from May to October where customers are provided with a 95-gallon cart. The City requires two to three sideloader automated collection vehicles per day¹².

In addition to the Green Cart Program, the City encourages grass-cycling (leaving grass trimmings on the lawn) and home composting as a means to divert organic wastes such as food scraps, grass clippings and leaves. The City also provides a \$20 rebate for household composters purchased at retail stores.

2.3.2

Multi-Family Collection Services

The City defines a multi-family residential building as one with five or more units. There are currently 845 multi-family residential buildings in the City with approximately 35,200 multi-family residential units⁵. A combination of municipal services and private haulers are used to collect garbage from multi-family residences in the City. The recycling program for this sector was launched in October 2014 and was fully implemented in 2015. The materials accepted are the same as the single-family residential recycling program and the services are also contracted out to a private company.

Multi-Family Residential Garbage Collection

The City provides garbage collection services to approximately 655 multi-family buildings⁵ (23,000 units or 78% of all buildings in the City) on a weekly basis. The remaining buildings (approximately 12,000 units from 190 buildings) are serviced through private haulers.

In the City-serviced buildings, property managers are responsible for providing metal waste bins for collection. Property managers may apply for a Metal Waste Bin Grant, to help offset the cost of purchasing and maintaining bins, in the amount of \$8 per unit per year through the City's website¹⁷.

The City's garbage collection routes include both multi-family residential building and ICI customers. Based on the number and size of bins at each location, the City estimates that the proportion of waste collected from these sectors is 70/30, respectively. There are four forklift trucks that are used (one is used as a spare vehicle). Similar to the single-family garbage collection, multi-family residential customers pay for garbage collection through their property taxes and revenue is received from

commercial customers. The estimated cost to collect garbage from multi-family and ICI customers was \$1.3 million in 2016¹².

Multi-Family Residential Recycling Collection

The City launched the Multi-Unit Residential Recycling (MURR) program in 2014. The collection and processing of single-stream recyclables are contracted out to Cosmopolitan Industries Ltd. (Cosmo) under a nine-year contract (November 1, 2014 to December 31, 2023). Cosmo sub-contracts collection to Emterra Group who services approximately 33,000 units⁵. Residents can also drop off their recyclables at one of four City recycling depots or at recycling bins located at the landfill for no additional cost. In 2016, Cosmo collected approximately 1,830 tonnes of recyclables through the MURR program that had an average contamination rate of 23%¹⁸.

As set out in the Waste Bylaw, residents pay approximately \$34 per household on an annual basis (or \$2.81 per month per unit in 2017) through utility fees, which covers about 50% of the program cost. The remaining 50% is funded from the Multi-Materials Recycling Program. The overall cost to operate the program was \$2.2 million in 2016¹⁹.

2.3.3

ICI Collection Services

There are approximately 6,140 ICI properties in Saskatoon⁶. Waste management collection is provided by both municipal forces and private haulers.

ICI Garbage Collection

The City collects garbage from approximately 300 ICI customers with metal bins or 300 gallon poly containers. There are an additional 100 to 200 curbside customers (including residents, care homes and senior's residences) who choose to contract with the City for additional collections with 95 gallon rollout carts. The number of curbside contracts depends on the time of year (i.e., the number of customers increases between October and April when collections are regularly scheduled on a bi-weekly basis).

The City uses the same equipment and operators for City-serviced ICI facilities and multi-family properties. The number of multi-family properties that the City collects garbage from is 655 out of 845 (78%). The number of multi-unit dwellings that the City collects garbage from equates to approximately 22,600 out of 35,200 (64%)²⁰. The remainder choose to contract their garbage collection through the private sector.

In 2016, the City received approximately \$600,000 in garbage collection revenue from commercial customers¹².

ICI Recycling Collection

The private sector provides recycling services to ICI customers. The exception is for 18 civic facilities which are serviced through the municipal single-stream recycling collection program⁴. Recyclables from

civic facilities are co-collected with recyclables from municipal depots so quantities collected by each source are not known.

In 2016, the City began discussions with the ICI sector regarding banning paper and cardboard from landfill noting that the focus of this ban was on ICI generators.

2.3.4 Other Waste Management Services

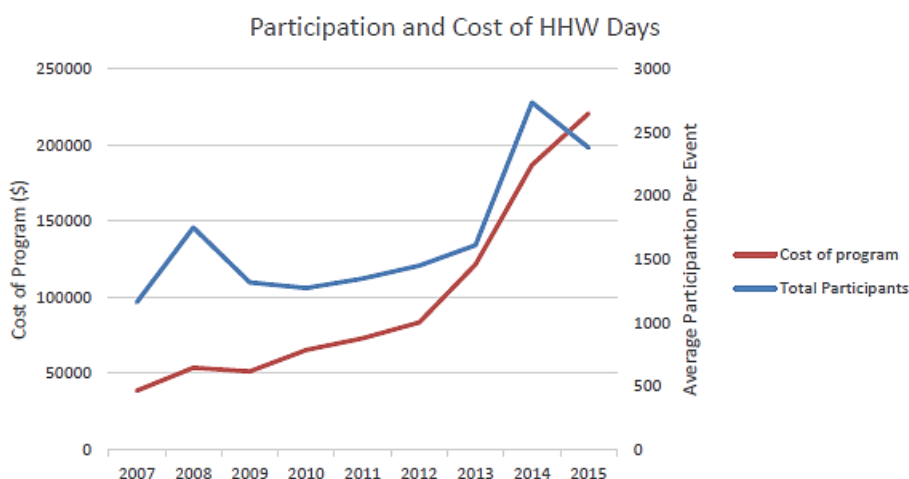
Public Space Recycling

The City has installed collection bins in pedestrian-oriented commercial areas and bus depots for paper, beverage containers and/or garbage. There are bottle baskets installed at other locations throughout the city (including civic parks) that collect beverage containers. Waste is manually collected by municipal collection vehicles. In 2016, the City collected about five tonnes of recyclables from public locations¹³. The cost of the program is currently covered through the contracted advertising.

Household Hazardous Waste (HHW)

The City started conducting Household Hazardous Waste (HHW) drop-off events in 2006¹⁴. In 2016, there were eight HHW drop-off days where residents could safely dispose of materials such as acids, batteries, cleaners, light bulbs, pharmaceuticals, propane cylinders, etc. The City contracts out the HHW events to GFL Environmental Inc. (formerly Envirotec Services Incorporated) and the events are held in the same location.

In 2016, about 100 tonnes of HHW was collected from eight events²¹. The number of participants ranged from about 280 to 510 per event. As illustrated in **Figure 2-2**, the cost to run the program is continuously increasing while the number of participants has been decreasing in the last two years. In 2016, the budget set aside to run the eight events was \$150,000 but the actual cost was about \$235,000 for approximately 2,890 participants¹².

Figure 2-2: Participation and Cost of HHW Days (2007-2015)⁴

The Saskatchewan Association for Resource Recovery Corporation (SARRC) manages the industry-led stewardship program for used engine oil, oil filters, oil containers and antifreeze. The City has an Eco-Centre located at the landfill that accepts these materials (up to 500 litres) at no charge to residents (costs are covered under landfill operation costs). In 2016, the total weight of materials collected at the Eco-Centre was 65 tonnes¹⁷. Note that historically the City has not counted the tonnes diverted through the Eco-Centre in the overall diversion quantity but going forward, the City intends to include the value in diversion estimates.

The City provides information on the website for alternative options for the safe management of other HHW such as paint, electronics and batteries.

Curbside Swaps

The City encourages residents to give away gently used, unwanted items for reuse at neighbourhood swaps. In 2016, there was one city-wide Curbside Swap and several neighbourhood-level swaps. Residents leave their items outside the morning of the swap day and must remove any unclaimed items by the end of the day. The City supports the neighbourhood swaps on Facebook and encourages interested organizers to contact their local community associations. There have been few complaints related to items left on lawns following a swap. The City provides customizable materials (posters, postcards, “Free” signs), a “how-to” guide, links to community associations and a listing of acceptable and unacceptable materials on the City’s website. A typical curbside swap poster is presented in **Figure 2-3**.

Figure 2-3: Curbside Swap Poster Template



Textile Clothing Program

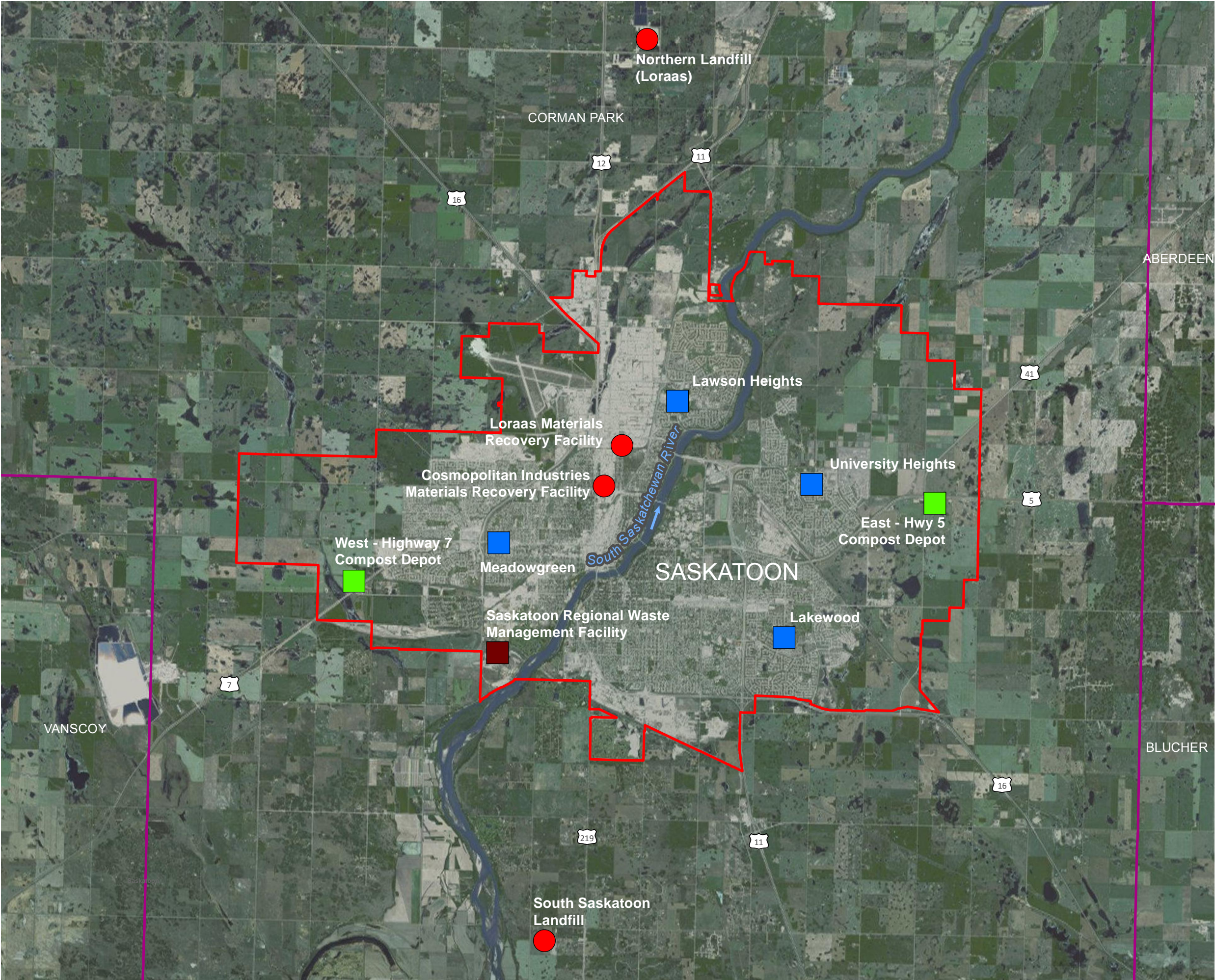
The City partners with local charities to collect gently used clothing via collection bins located at the recycling depots. In 2016, approximately 130 tonnes of clothing were diverted from disposal¹⁷.

Bicycle Reuse

In the past, bicycles that were received at the Regional Waste Management Facility were set aside for scrap metal recycling. Starting in January 2017, the City partnered with a local non-profit organization (Bridge City Bicycle Co-op) to extract usable parts in order to create new bicycles. The City designated a drop-off location at the landfill for unwanted bicycles to be diverted from scrap metal recycling. Once the suitable parts are extracted, the remaining unwanted parts are sent for scrap metal recycling. This program is expected to divert close to 2,000 bicycles a year from landfill.

2.4 Current Waste Management Facilities

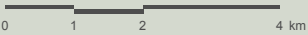
The City owns and operates a regional landfill, two compost depots, and four recycling depots, as seen in **Figure 2-4**. The City is in the midst of planning for an integrated waste diversion and disposal facility called Recovery Park. Information on these facilities is provided in this section.



CITY OF SASKATOON
Opportunities Report

FIGURE 2-4: EXISTING WASTE
MANAGEMENT FACILITIES

- SASKATOON CITY BOUNDARY
- RURAL MUNICIPALITY BOUNDARIES
- RECYCLING DEPOTS
- REGIONAL WASTE MANAGEMENT FACILITY
- COMPOST DEPOTS
- PRIVATE OR NON-CITY OWNED WASTE MANAGEMENT FACILITY



SCALE 1:110,000

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEOSASK/ESRI

MAP CREATED BY: PMH
MAP CHECKED BY: BM
MAP PROJECTION: NAD 1983 UTM Zone 13N

FILE LOCATION: \\DILLON.CA\\DILLON_DFS\\SASKATOON\\GIS\\152998\\MXD



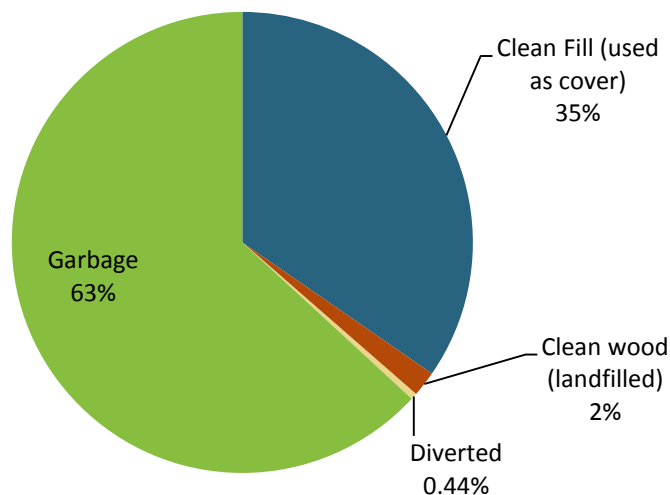
PROJECT: 152998
STATUS: DRAFT
DATE: 6/2/2017

2.4.1 Regional Waste Management Facility (Landfill)

The City owns and operates the Saskatoon Regional Waste Management Facility (landfill) located off Valley Road and south of 11th Street. The site has been used for waste disposal activities since 1955. Currently, the landfill accepts garbage from City-collected single family, multi-family and ICI customers, as well as garbage from paying customers who bring loads directly to the site. Every vehicle that enters the landfill must pay the Landfill Entrance Fee (currently \$15) plus additional charges based on the type or weight of waste being landfilled. Tipping fees for general garbage is \$105 per tonne.

In 2016, the landfill site received approximately 155,230 tonnes of material, of which approximately 100,000 tonnes were landfilled (including more than 2,800 tonnes of wood waste) and 54,700 tonnes was clean fill that was used for construction and landfill cover purposes¹⁷. In addition to municipal solid waste, small quantities of materials such as shingles, dried grit and street sweepings were landfilled. As mentioned in **Section 2.3.5**, the City accepts some materials for diversion such as used oil and antifreeze at the Eco-Centre, recyclables, white goods (e.g., fridges, stoves) and scrap metal. In 2016, almost 700 tonnes of material were diverted from disposal¹⁷. **Figure 2-5** illustrates all materials received at the landfill in 2016.

Figure 2-5: Waste Received at the Landfill (2016)

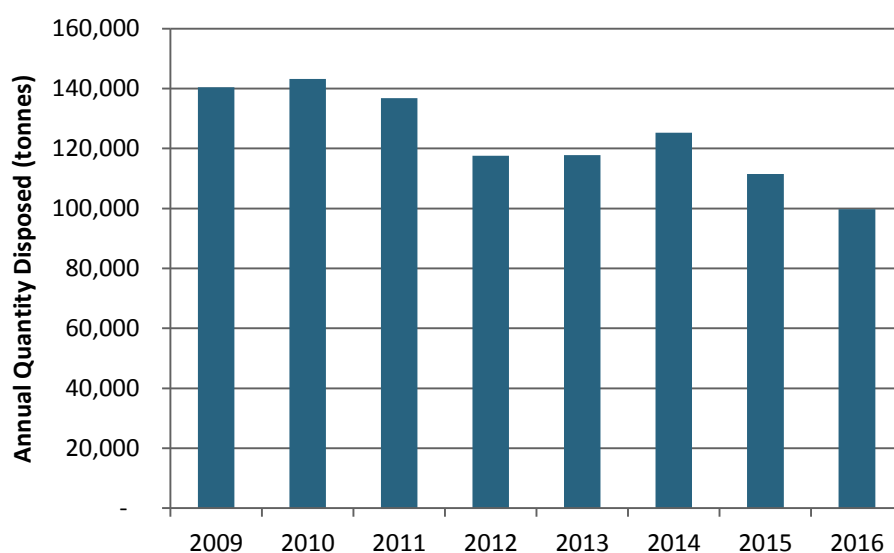


In a report to City Council in February 2016, City staff prepared a background document that looked at generating energy from elm wood. It is estimated that the quantity of elm wood received at the City's landfill for disposal during the pruning period is between 700 to 900 tonnes per year which translates to approximately \$75,000 in landfill tipping fees. The total estimated annual quantity of waste wood delivered to the City's landfill for disposal is about 1,600 tonnes. City staff commissioned a feasibility study on the option of using the waste wood as a biomass energy source. There is a local food bank who would be interested in partnering with the City to use this energy.

In 2016, the landfill's operating expenses were \$6.2 million which includes \$1.8 million that was transferred to the landfill reserve and approximately \$400,000 that was transferred to cover the compost depot operations. In terms of revenues, the City received approximately \$3.8 million in tipping fees. The remaining \$2.4 million was covered through property taxes¹².

The City has experienced a slight decrease in the annual quantities of waste disposed at the landfill over the last several years, as illustrated in **Figure 2-6**. Potential reasons for the decline include the two neighbouring landfills (Northern Landfill, which is operated by Loraas Disposal and South Corman Park Landfill which is operated by the Green Prairie Environmental) that receive waste from the private sector (ICI and multi-family residential waste collected by private haulers), decreases in the weight of waste and/or a reduction in waste generated.

Figure 2-6: Historical Quantities of Waste Disposed at the Landfill (2009-2016)¹⁷



According to the City's 2015 Landfill Volume Assessment completed in March 2016, approximately 148,000 cubic metres of landfill airspace was consumed between January 2015 and January 2016 which is based on comparing annual topographic surveys. The landfill has approximately 5.5 million cubic metres of airspace remaining for landfilling which equates to about 28 years (until 2044) based on the assumption that the City disposes 130,000 tonnes of waste annually from 2016 to 2044²².

2.4.2

Recycling Depots

The City has four recycling depots spread across the City as presented in **Table 2-2** and shown in **Figure 2-4**.

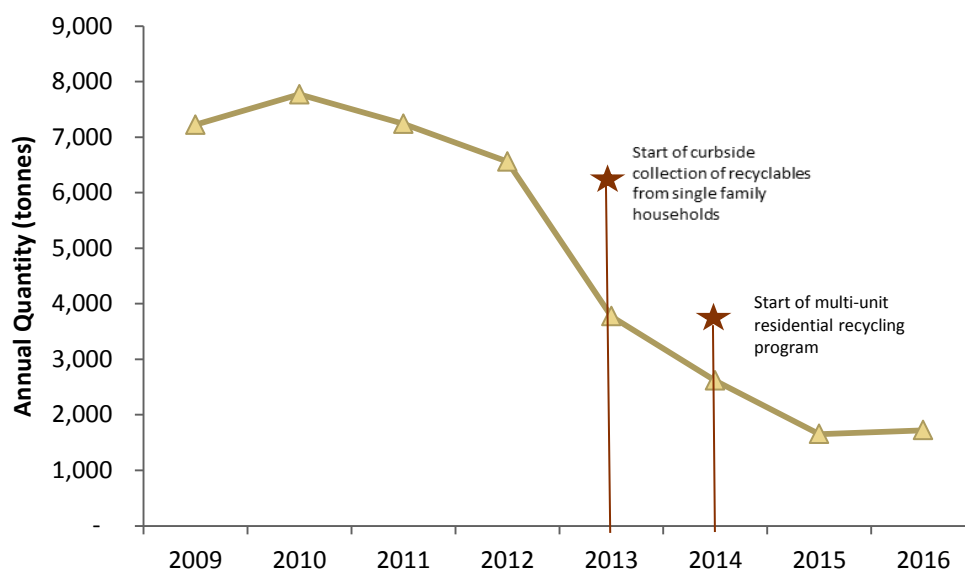
Table 2-2: Name and Location of the City's Recycling Depots

Recycling Depot Name	Location
Lawson Heights	Primrose Drive by the Lawson Civic Centre
University Heights	Lowe Road
Lakewood	McKercher Drive by the Civic Centre
Meadowgreen	Corner of 22nd Street West and Witney Avenue

Recycling depots consist of unstaffed, single-stream recycling bins which are free to use for City residents. In 2016, 1,720 tonnes of recyclable material was received through the depots¹⁷. With an estimated contamination rate of 16%, approximately 1,440 tonnes of recyclables were diverted from disposal. The use of the depots has decreased since the City introduced residential curbside collection of recyclables, as illustrated in **Figure 2-7**. It cost the City approximately \$250,000 to run the depots in 2016 which was covered through property taxes¹².

City staff use a fork truck to collect recyclables from the depots (stored in metal bins) and rear loader vehicles to collect illegally dumped waste. Illegal dumping and contamination are often problems since the depots are unstaffed and as such, workers spend time to clean up the sites. Better design of the depots and increased signage may assist with reducing illegal dumping and contamination levels. Collected recyclables are hauled to Cosmo for processing who receive the revenue for the marketed recyclables. The City is under contract with Cosmo until 2023 (rolled into the MURR collection and processing contract).

Figure 2-7: Recycling Depot Quantities (2009-2016)



2.4.3

Compost Depots

The City has two compost depots where residents can drop off Yard and Garden Waste (YGW) at no cost. The commercial sector can bring their YGW to the depots if they purchase a \$200 permit which allows them unlimited access for the season. Approximately 90 companies purchased permits in 2015 and it is estimated that about 25% of materials received at the depots were from these companies⁴.

The West Compost Depot is located at the junction of Highway 7 and 11th Street and the East Compost Depot is located off of Highway 5 by the junction of Highway 41 and Zimmerman Road. Both depots accept leaves, grass, non-elm trees, shrub branches, and garden waste⁷. The East Compost Depot is a transfer station and directs YGW to the West Compost Depot for processing. The City employs a depot Supervisor but contracts out the operations and equipment (site attendants, loader, windrow turner, etc.).

In 2016, approximately 13,700 tonnes of YGW was processed at the West Compost Depot of which 82% came from the drop-off depots and the remaining 18% from the subscription Green Cart program¹⁷. It is noted that the quantities are estimated since the depots do not have weigh scales onsite.

The City estimates the full cost to operate the compost depots and process all materials to be approximately \$800,000 on an annual basis¹². As previously mentioned, approximately \$400,000 in funding is transferred from the landfill operating budget. Due to insufficient funding, material processing (grinding and screening) has not occurred for two seasons, resulting in a significant backlog of unprocessed materials stockpiled at both sites. In addition, prior to 2014, the City's Parks Department used the majority of finished compost but then the City changed the tender requirement to allow the contractor to supply organic materials. This has resulted in challenges with finding uses for the end product.

Annually, from December 26 to January 31, the City sets up temporary drop-off sites to collect Christmas trees. The collected material is either chipped and transferred to compost depot or used as mulch.

2.4.4 Proposed Facility – Recovery Park

In 2015, the City commissioned a business case to develop service delivery options for an integrated waste management facility called Recovery Park. Recovery Park would be a key component in helping the City achieve their diversion goals. Recovery Park is planned to receive and/or process three important divertible material streams: HHW, Construction and Demolition (C&D) waste and organic waste. The City's Administration identified a site near the City's landfill where Recovery Park could be established.

KPMG was retained to complete the *Recovery Park Business Models Assessment*. The assessment looked at two options for comparison: status quo and development of Recovery Park. The status quo scenario would maintain the same level of service and include curbside collection of garbage and recyclables, two compost drop-off depots, organics processing using outdoor windrows, holding several HHW collection events each year and disposing of C&D waste in landfill. For the second scenario, KPMG used studies developed by City staff that broke down phases of the Recovery Park development as follows:

- **Phase 1A** – construct facility entrance, access road and areas for materials that will not be weighed (e.g., HHW, electronics, gently used item exchange, white goods);
- **Phase 1B** – construct scales, scale house and C&D processing facility;
- **Phase 2** – construct a staff training and safety facility (could also be used as a third party training and education centre) to provide the City with partnership opportunities with local institutions, agencies and northern Saskatchewan communities; and
- **Phase 3** – construct an organics processing facility with a capacity of 40,000 tonnes per year (dependent on having a City-wide Green Bin Program). Two service delivery options were looked at for this Phase: 1) City owns and operates an aerated static pile composting facility or 2) private sector owns and operates an anaerobic digestion facility.

The City provided KPMG with estimates of annual quantities anticipated to be diverted through the above mentioned facilities. For the first phase (Phases 1A and 1B), the City estimates an increase of 6% in diversion and for all three phases, an increase of almost 25%.

KPMG conducted market research with relevant industry organizations and companies to obtain input on: 1) their interest in partnering with or servicing the City at Recovery Park and 2) business models for managing HHW, C&D waste and organic waste. In general, participants indicated an interest to manage these materials at Recovery Park.

Since the issuing of this report, City staff have been preparing potential site configurations and details on the requirements to manage the materials (e.g., partners, area requirements and storage methods).

In Dillon's experience designing Community Recycling Centres (or Eco-Centre type facilities) across Canada, there have been several best practices learned that the City may want to consider during development of plans for Recovery Park which are:

1. The facility will only be successful in terms of diverting materials (especially potentially hazardous materials), if it is convenient and cheap/free for the users. There has been debate on whether to charge to dispose of the materials but there are concerns with this including:
 - Paying for disposal is a disincentive to the user;
 - Receiving a mixture of materials presents a challenge with how the user will be charged - by weight (e.g., C&D waste) and/or by number (e.g., fridge). If there are multiple ways the user can be charged, this would require the user to go over the weigh scales multiple times; and
 - The City could profit from the sale of certain recovered materials (e.g., scrap metals, wood).
2. Because of the above, careful consideration of the traffic flow patterns needs to be considered to minimize the number of times the user has to wait in line to go over the weigh scale, has the ability to exit quickly and does not encounter collection or transfer trailer vehicles.
3. Ensure the selected site has appropriate geological characteristics to support the establishment of load bearing foundations.

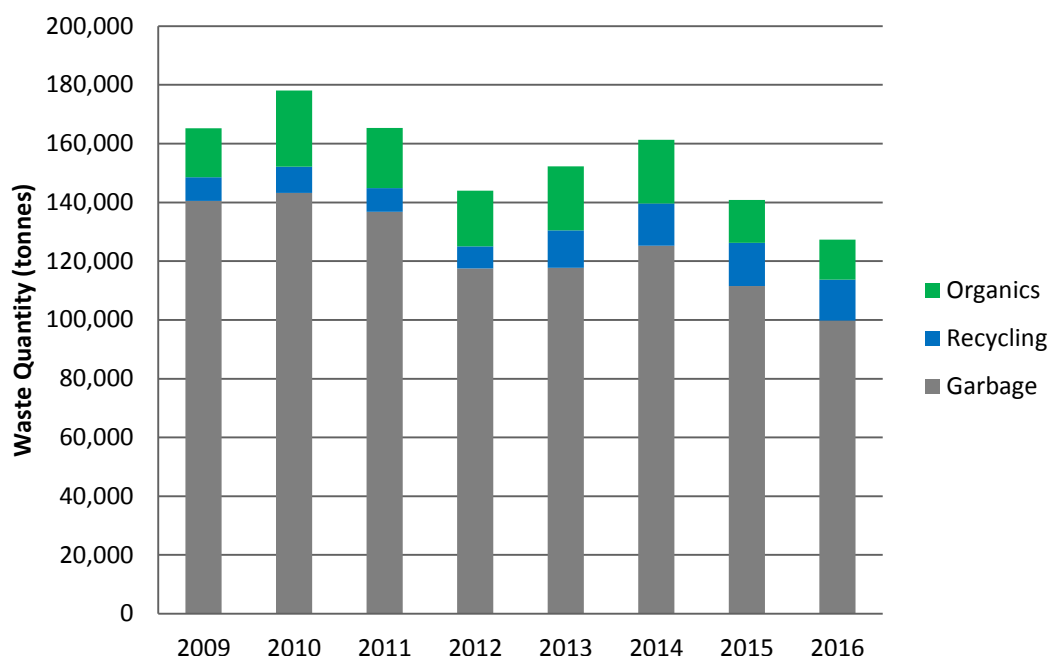
2.5 Waste Quantities and Diversion Rates

2.5.1 Waste Quantities

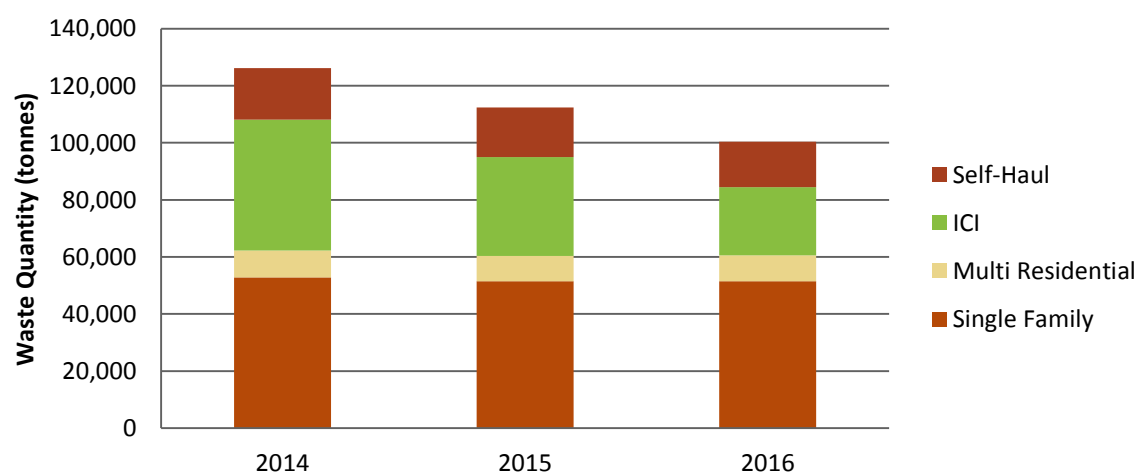
The City provided historical waste quantity data for the following streams:

- Recyclables – collected at depots and public spaces and from single and multi-family customers;
- Organics – collected at depots and through the subscription service;
- HHW – collected at drop-off events;
- Textiles – collected from charity organization donation boxes at recycling depots;
- Clean fill – received at the landfill; and
- Garbage – received at the landfill from residential and ICI collection and self-haul customers.

Figure 2-8 illustrates the historical annual quantities of recyclables, organics (mainly YGW) and garbage managed by the City between 2009 and 2016. These three streams make up almost 100% of the total wastes managed by the City aside from HHW and textiles. Clean fill is not counted towards diversion as it is used in construction or as cover for the landfill.

Figure 2-8: Historical Waste Quantities Managed by the City (2009-2016)

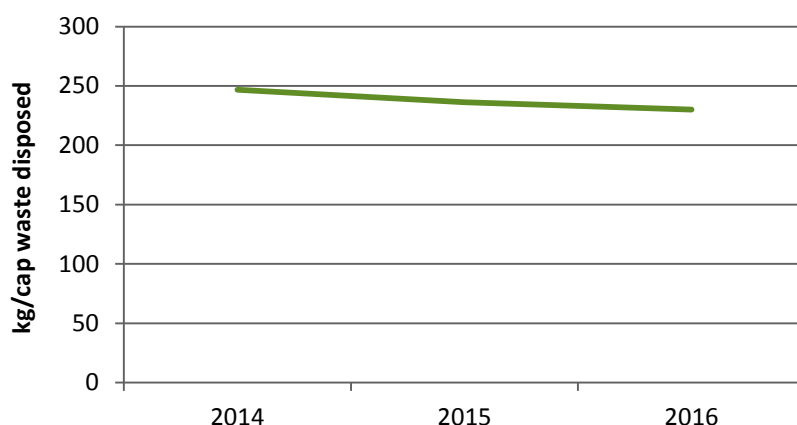
The sources of garbage received at the landfill over the last three years are shown in **Figure 2-9**. The estimated proportion of single-family, multi-family and self-haul garbage has stayed relatively constant however, the decline can be attributed to the ICI sector.

Figure 2-9: Waste Landfilled by Sector Type (2014-2016)

The City's Planning department provided historical residential population estimates. Using this along with the City's estimate of the quantity of residential garbage managed by the City, the estimated weight of waste disposed by resident (referred to as kg/cap disposed) was prepared and is illustrated in **Figure 2-10**. Linked to the implementation of Saskatoon's curbside recycling collection program, the kg/cap disposed has been decreasing in the past three years.

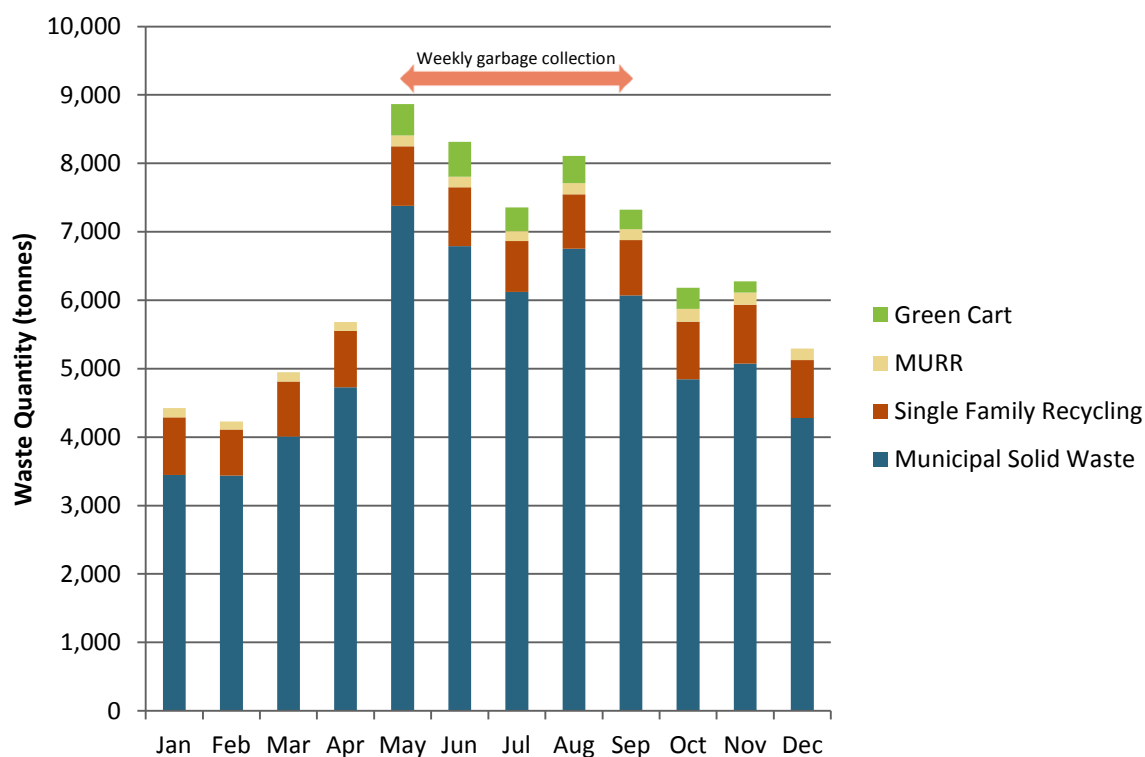
Using kg/cap disposed as a metric to measure performance is becoming more of an industry trend as it captures diversion at the source (i.e., reduction and reuse) which the traditional diversion rate does not. It is noted that before 2014, the total waste disposed may have included a portion of commercial waste.

Figure 2-10: Per Capita Waste Disposed (2014 to 2016)

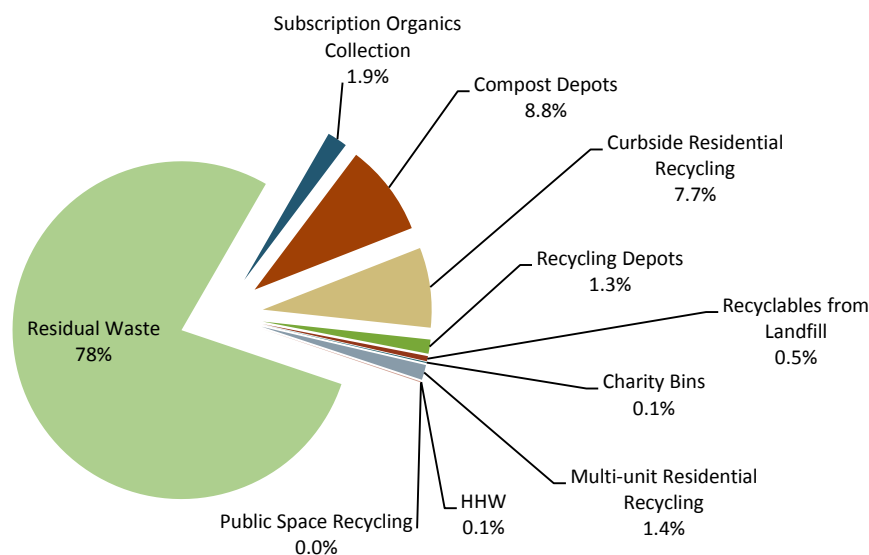


The monthly quantities of waste collected for garbage, recycling and organics are provided in **Figure 2-11**. The quantities of recyclables collected from single-family households remained relatively constant with a monthly average weight of 800 tonnes. The multi-family recycling program also had relatively constant quantities with a monthly average of 150 tonnes. The Green Cart tonnages were highest in May and June (460 tonnes and 510 tonnes, respectively) and lowest in November (165 tonnes).

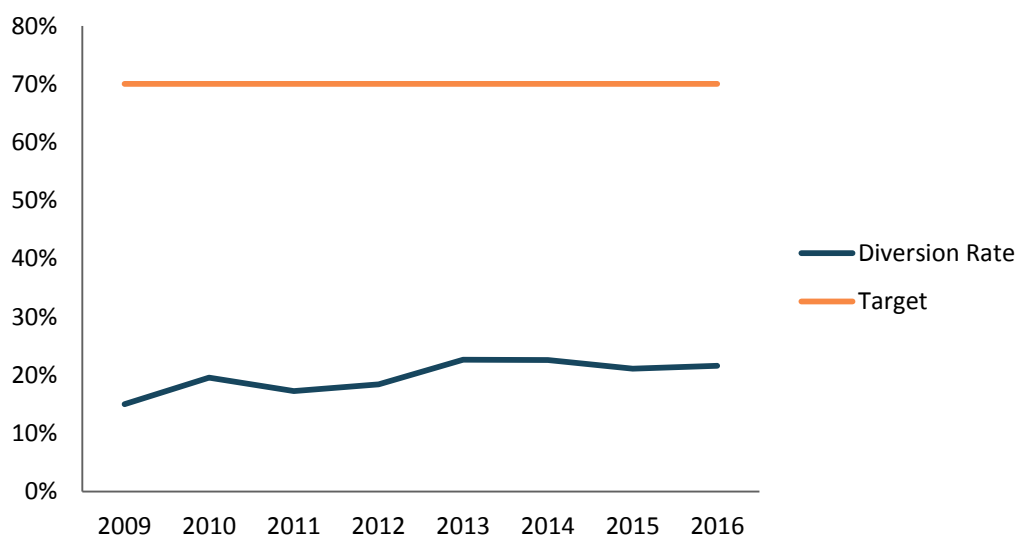
Based on discussion with City staff, it is assumed the majority of organic waste is yard waste which would explain the variances in monthly quantities collected as spring weather typically increases the production of yard waste. The garbage tonnages include single-family households, approximately 65% of the multi-family residential buildings and a small amount of ICI customers. The garbage weights varied from 3,400 tonnes in January and February to over double at 7,400 tonnes in May. Single-family households receive weekly garbage collection from May through September which corresponds to the increase in garbage tonnages received in those months. In our experience and as found in the 2016 Waste Characterization Study, garbage generation is typically at a peak in the spring and at its lowest in the winter which is also demonstrated in **Figure 2-11**.

Figure 2-11: Seasonal Variation of Waste Collected (2016)**2.5.2****Waste Diversion Rate**

One of the City's key waste management targets is to divert 70% of the waste from disposal by 2023. In 2016, approximately 22% of the materials managed by the City were diverted from landfill. The waste diversion programs that contributed to the overall diversion rate and the percentage of total waste disposed (78%) are illustrated in **Figure 2-12**.

Figure 2-12: Programs/Facilities Managing City's Waste (2016)¹⁷

As shown in **Figure 2-13**, the City's diversion rates have remained relatively constant, averaging 20% over the last eight years. ***Significant changes need to be made to the City's waste management programs in order to reach the target diversion goal of 70% by 2023.***

Figure 2-13: Historical Waste Diversion Rates (2009-2016)¹⁷

2.6 Education and Promotion

The City's Environmental and Corporate Initiatives Division has an Education and Environmental Performance Manager with several staff to deliver promotion and education (P&E) of the City's waste management programs. Some of the City's core education and engagement services include:

- Webpage and online engagement;
- Annual collection calendar;
- Single and multi-family recycling program education;
- Rolling Education Unit and Let's Roll Recycling Team;
- Home composting education;
- Curbside Swap; and
- Education through waste bylaw enforcement.

The following section describes the P&E activities conducted for waste management programs.

2.6.1 Recycling

The City and their recycling service providers work together to deliver P&E programs to increase participation and reduce contamination in the recycling stream. Examples of P&E activities include the use of social media marketing, billboards, attending community events to answer questions, activities at schools and the use of online engagement through the City's website, The Star Phoenix, and other media.

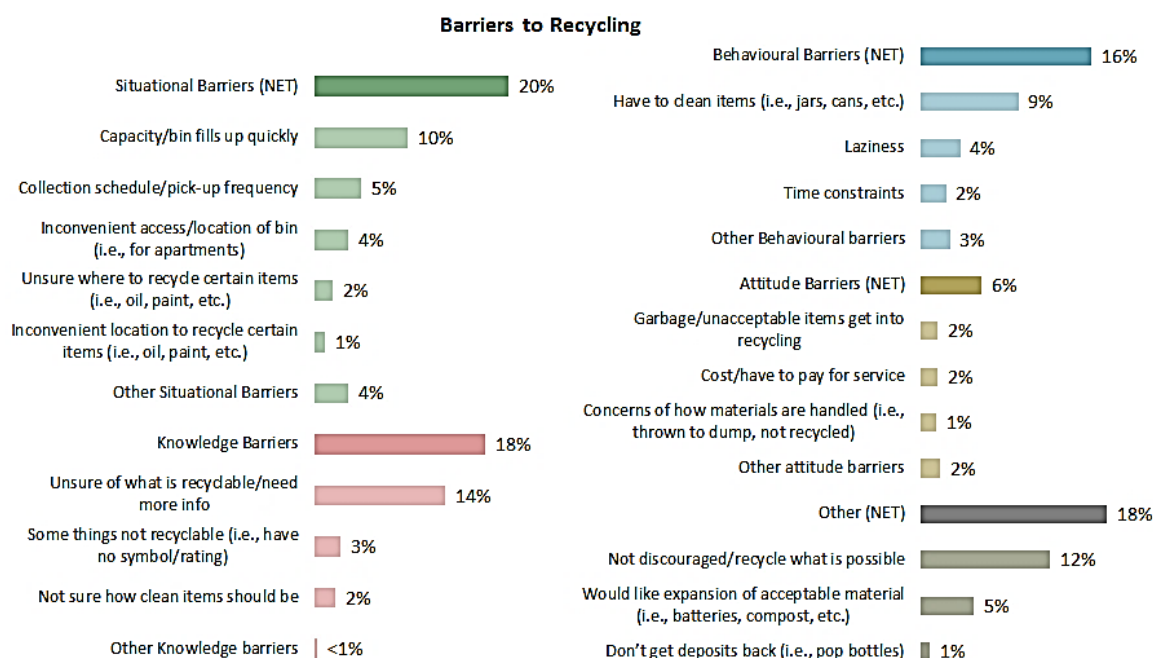
Additional tactics used for single-family household education includes distributing flyers and issuing notices for bylaw infractions or contamination issues (discussed further below). For multi-residential households, posters and pamphlets were distributed for tenant education. In the first year, it was noted that some building managers did not distribute the material. In the second year of the program, a door-knocker was distributed to each unit to ensure information got into the hands of each resident.

Education materials were developed in English only, although there are many tenants who do not speak English as their first language. Icons are used on materials to help non-English speakers to understand materials. Direct outreach through English as a Second Language classes are also used to better inform Newcomer populations. Engagement and education with building management is conducted through delivery of handbooks and presentations.

In 2015, the City commissioned a survey from 1,000 residents from both single and multi-family households (50% completed online and 50% completed via telephone). Residents were asked how frequently they recycle and the majority claimed to recycle either all or most of the time. More than 80% of the residents correctly identified most items that can be recycled with the weaker knowledge being for recycling of hard plastics, plastic grocery bags, Styrofoam, plastic toys, foil paper, and foil containers.

Some of the self-reported barriers to household recycling are shown in **Figure 2-14**. For multi-family residential buildings, some of the challenges included language barrier and posters and brochures not being distributed.

Figure 2-14: Barriers to Household Recycling²³



Although the contact information for recycling service providers is available on the City's website, residents indicated that they would contact the City with their inquiries. The City's contractors respond to inquiries and questions from residents via email and phone calls. In 2015, the City received approximately 18,500 phone calls. Approximately 320 inquiries per month were for the single-family recycling program, which is down from an average of 368 inquiries per month in 2014. The MURR program inquiries decreased from 276 in November 2014 to an average of 120 per month in the first half of 2015 and 80 calls per month during the second half⁴.

Community-based Social Marketing (CBSM)

In 2015, Loraas and the City conducted a community-based social marketing (CBSM) pilot program for single-family households. There were 500 households in one community selected for a visual inspection of the recycling cart contents over a period of six weeks. During this period, if the recycling cart contained a non-acceptable item, such as Styrofoam, bagged materials, scrap metals etc., the cart was tagged with a red "Oops!" tag. Alternatively, if the cart contained the appropriate material, it received a green "Good Job" tag. Over the period of six weeks, the contamination rate dropped from 32% to 20%²⁴.

A similar program was conducted in 2016 with five different neighbourhoods, each with 450 to 600 households. Similar red “Oops!” tags and slightly modified green “You Rock” tags were used to tag the carts. The back of the tags had further recycling education tips that residents could keep for future reference. Over the course of three weeks, the contamination rate dropped from 13% to 8%²¹. The participation rate was also measured and the sampled neighbours had a combined participation rate of 88%.

2.6.2 Website and Online Engagement

The City’s website provides information regarding waste collection programs (e.g., schedules, carts, acceptable and unacceptable materials, etc.), City facilities (e.g., landfill, compost depots, recycling depots), how to manage HHW (including links to stewardship programs) and how/who to contact for more information. The website includes a “Waste Wizard” search tool that allows residents to type in the waste they want to sort and the Wizard outputs the correct management method. Options for management could include a City collection program, City facility, donation for reuse, stewardship program like SARCAN and Saskatchewan Electronics Products Recycling Association or to look at the Saskatchewan Waste Reduction Council’s (SWRC) website for local places to recycle/reuse materials. There were over 125,400 visits to the Waste and Recycling section of the City’s website in 2015.

The City also promotes and/or educates the public using social media tools including Facebook and Twitter, which have almost 19,000 and 43,500 followers, respectively, as of February 2017.

2.6.3 Collection Calendar

The City distributes a waste and recycling collection calendar to single-family residents that identifies collection days and provides information on waste management programs. As per the City-wide Recycling Satisfaction Study conducted in December 2015, 77% of the respondents recall receiving a copy of the calendar, 17% claimed they did not receive a copy, and 6% said they were unsure²⁰. Of those that received a copy, 72% hang it in a specific spot in their home for easy reference.

The calendar is also available online in different forms where residents can enter their address and view their schedule, download a copy, add a reminder to their own online calendar, and/or sign up to receive reminders by email, phone and/or Twitter.

2.6.4 Rolling Education and the Let’s Roll Recycling Team

The Rolling Education Unit (REU) is a mobile education trailer that was established in collaboration with the City and the Saskatchewan Waste Reduction Council (SWRC). The City hires summer students to form the “Let’s Roll Recycling Team”. This team travels with the REU to various community events throughout the year to educate the public about waste diversion through interactive activities such as a game where participants spin a wheel and say how to sort the material the wheel lands on. The City estimates that over 13,300 residents were engaged and informed in the summer of 2015⁴.

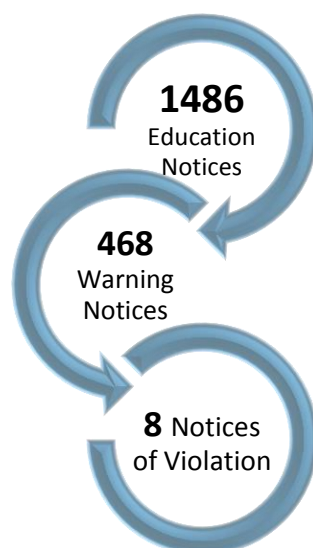
2.6.5 Home Composting Education

The City offers home composting education sessions through a partnership with SWRC. The program trains Master Composters each year who volunteer at events and workshops, and conducts in-home visits to educate residents on the composting process. A compost hotline is available where residents can call to get information on home composting. The website also includes a quiz to determine a residents' composting style (i.e., how many people in the house, type of home, types of organic wastes generated) and then recommends a composting approach based on the answers (e.g., vermicomposter, three-bin system, compost bin).

2.7 Waste Bylaw Enforcement

Parts VIII and IX of the Waste Bylaw (No. 8310) set the method in which the bylaw is to be enforced, the definition of what constitutes an offence and the penalties for not complying. Tickets can be issued (currently \$100 for a Waste Bylaw violation) for issues such as illegal dumping, where evidence exists. However, one of the main issues the City deals with is when carts are left in the public right-of-way (e.g., in back lanes). The City's main mechanism for enforcement of this type of violation is through neighbourhood blitzes conducted annually by Environmental Protection Officers (EPOs). An education notice first needs to be issued (considered a first warning), then a warning notice (second warning) before a notice of violation (ticket) is issued. This method of enforcement is resource intensive as it requires EPOs to conduct numerous inspections of the same locations. The neighbourhood blitz approach allows the EPOs to streamline their efforts and ensures that residents of any given neighbourhood are being held to the same standard. In 2016, EPOs focused on five neighbourhoods over a 29-week period (March to October) and issued a total of 1,962 notices²⁵.

The breakdown of the types of notices issued is illustrated below.



2.8 Status of 2007 Waste and Recycling Plan Recommendations

In October of 2007, the City released its Waste and Recycling Plan (WRP) to decrease the amount of waste going to landfill. The main goals of the WRP were to determine a new way to pay for garbage collection, implement recycling collection and diversion of organics, consider new facilities to divert waste from both the residential and ICI sectors, and enhance education programs. The WRP was designed to provide the direction and tools for the 20-year planning period (2007-2027).

The WRP developed recommendations and categorized them into four categories: Public Education and Outreach Activities, Programs for Everyone, Programs for Residents and Programs for Business, Industry and Institution. Recommendations were further categorized into one of four Phases of implementation timelines: Phase 1 (within a year), Phase 2 (within 2 to 5 years), Phase 3 (within 5-10 years) and Phase 4 (within 10-20 years). **Table 2-3** provides a summary of the recommendations that came out of the 2007 WRP and notes which ones have already been implemented (green font).

Table 2-3: City of Saskatoon Waste and Recycling Plan²⁶

Category	Phase	Program Recommendation
Public Education and Outreach Activities	1	Update & Expand Recycling Directory
		Expand Waste Reduction Calendar
		Promote and Facilitate Existing Reuse Opportunities
	2	Develop Public Displays on Waste Reduction
		Develop Illegal Dumping Prevention Program
		Initiate Smart Shopper Consumer Awareness Program
		Promote Grasscycling Program
		Develop Waste Reduction Education Program for Schools

Category	Phase	Program Recommendation
Programs for Everyone	1	Implement Incentive-Based Tipping Fees for Yard Waste
		Implement Disposal Ban on Paper and Cardboard
		Upgrade Yard Waste Composting Facility
	2	Develop Building Materials Reuse Facility at Saskatoon Landfill
		Develop Recyclables Processing Facility
	3	Develop Organics Management Facility
		Develop Construction and Demolition Materials Handling Facility
Programs For Residents	1	Continue Collection Events for Household Hazardous Waste
		Subsidize Home Composters for Residential Use
		Develop Additional Compost Demonstration Gardens
		Implement User Pay System for Waste Management
	2	Provide Recyclables Collection Service to Single-Family Residential Units
		Provide Recyclables Collection Service for Multi-Family Residential Units
	3	Provide Curbside Collection of Organics to Single-Family Residential Units
		Provide Source-Separated Organics Collection to Multi-Family Residential Units
		Implement Disposal Ban on Recyclables
		Implement Disposal Ban on Residential Organics
		<i>Residential Waste Collection Options</i>
Programs For Business, Industry and Institutions	1	Provide Waste Reduction Education Resources to ICI Sector
	2	Initiate Business Environmental Awards Program
		Promote Adoption of Environmental Purchasing Policy
		Implement Disposal Ban on ICI Yard Waste
	3	Implement Disposal Ban on All ICI Organics
		Implement Incentive-Based Tipping Fees for Construction & Demolition Waste
		Implement Disposal Ban on Construction & Demolition Waste
		Require Waste Management Plans in Building Permits
	4	Investigate Waste-to-Energy Technologies

As presented in **Table 2-3**, the City has implemented many of the recommended programs which include residential collection of recyclables, the Waste Wizard online sorting tool, curbside swap events, the Rolling Education Unit, the compost processing facility and windrow turner at the West Compost Depot and HHW drop-off events, to name a few.

In addition, the City is currently working towards implementing other recommended programs such as consulting with the ICI sector on setting disposal bans for paper and cardboard, increased education to the ICI sector and planning for Recovery Park which would divert more organics, C&D waste and HHW.

3.0 2016 Waste Characterization

As part of this project, a waste characterization study was conducted in order to estimate the overall residual waste composition. This was achieved by conducting four seasonal waste audit sampling rounds from single-family households, multi-family households, self-haul loads (to City landfill), industrial, commercial and institutional (ICI) waste and construction and demolition (C&D) waste in 2016. Four separate reports were previously submitted to the City that documented the findings for each seasonal waste characterization study.

A final report that presents the approach, results from each sector and overall waste composition estimates is attached in **Appendix A** and is summarized in the following sub-sections.

3.1 Methodology

The focus of the waste composition study was on wastes that are currently disposed in City or private landfills. **Table 3-1** presents an overview of the four seasonal waste characterization studies undertaken as part of the project. The waste frequency and season of each waste stream was selected with the City to maximize use of available resources.

Table 3-1: Overview of Seasonal Waste Characterization Studies

Sector	Winter	Spring	Summer	Fall
Single-Family Residential	✓	✓		✓
Multi-family Residential	✓	✓	✓	
ICI			✓	✓
C&D				✓
City Landfill Self-Haul		✓	✓	
Depot-Based Recycling Program		✓	✓	

The waste characterization results from the single-family, multi-family, self-haul, ICI and C&D waste streams were further analyzed to develop an estimated average waste composition for each waste stream. These average waste compositions were then applied to the various estimated waste flows in the City to:

- Develop an overall average City-wide waste composition estimate; and
- Develop an estimate of various waste streams that could be diverted from landfills.

3.2 Single-Family Waste Composition

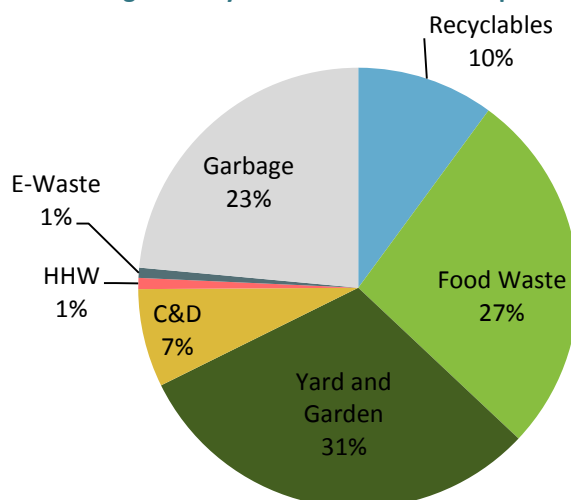
Essentially all single-family residual waste is disposed at the City landfill. The waste from 100 single-family households, in ten sampling areas (each with ten homes), were characterized in the winter, spring

and fall sampling rounds. The waste characterization results of these households were averaged to develop an overall estimate of the single-family waste composition.

The average quantity of garbage set out was approximately 16 kg/hh/wk. The least amount of waste was generated in the winter (9 kg/hh/wk) and the highest amount of waste was generated in the spring (22 kg/hh/wk). Most of the seasonal differences can be attributed to yard and garden waste.

Recyclable wastes, which could have been captured in the blue cart program represented approximately 1.5 kg/hh/wk (10%) of the waste stream. The recyclables consisted largely of paper packaging (3%), plastic (3%), paper (2%), metal (1%) and glass (1%). Approximately 9 kg/hh/week (58%) of organic waste was set out (food waste and yard and garden waste), with 27% of organic waste consisting of food waste. Of the food waste, 59% was found to be avoidable (i.e., edible at one point). Approximately 1 kg/hh/week (7%) of C&D waste was found in the single-family residential waste stream. Based on the results of the waste characterization study an estimated 77% of wastes could be diverted through existing and future programs. A summary of the waste characterization for single-family residential is presented in **Figure 3-1**.

Figure 3-1: Single-Family Residential Waste Composition



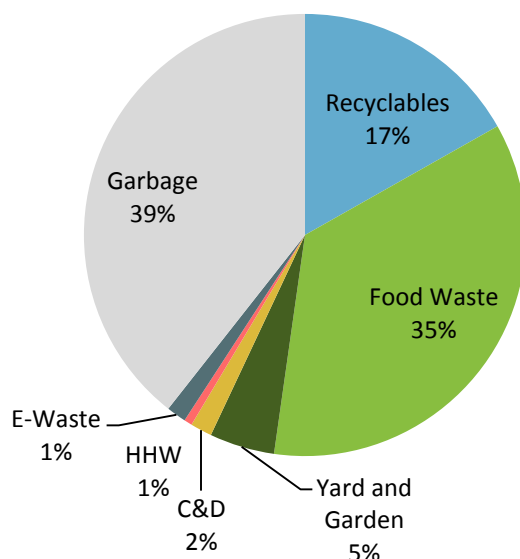
3.3 Multi-Family Residential Waste Composition

Multi-family residential residual waste is disposed of at either the City landfill or local private sector landfills. To characterize the waste composition from this sector, the waste from ten multi-family buildings, with 410 units were audited. Five of the buildings were characterized in the winter, four in the spring and one in the summer.

The average quantity of garbage set out was approximately 7 kg/hh/wk, which is less than half of what was found to be generated by single-family households. Recyclable wastes which could have been

captured in the blue cart program accounted for approximately 1 kg/hh/wk (17%) and consisted largely of paper packaging (6%), plastic (5%), paper (3%), glass (2%) and metal (1%). Approximately 3 kg/hh/week (40%) of organic waste was audited, with 88% of organic waste consisting of food waste. Over 50% of the food waste that was audited was found to be avoidable (i.e., edible at one point). Based on the results of the waste characterization study an estimated 61% of wastes could be diverted through existing and future diversion programs. A summary of the waste characterization for multi-family residential is presented in **Figure 3-2**.

Figure 3-2: Multi-Family Residential Waste Composition



3.4 Industrial, Commercial and Institutional (ICI) Waste Composition

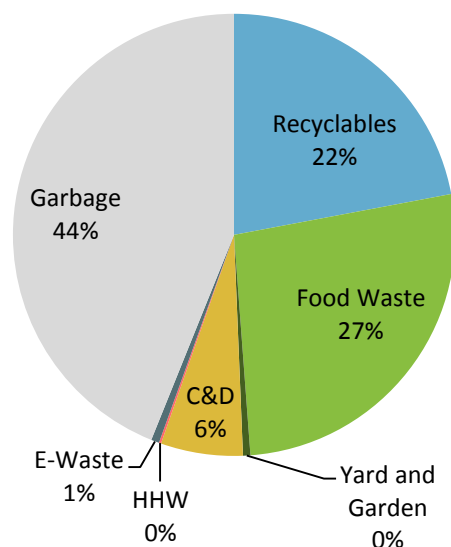
It appears that most ICI waste is managed by the private sector and is assumed to be disposed of in private landfills in the City. Estimating the ICI garbage composition was undertaken by completing audits of the top six estimated waste generator types by North American Industry Classification System (NAICS) codes (manufacturing, retail trade, health care and social assistance, accommodation and food services, other services, and public administration). Waste samples from 29 ICI locations, from these top six estimated waste generator types were characterized. These audits covered an estimated 62% of employment and 75% of ICI waste generation in the City.

The overall ICI waste composition was estimated in two ways: 1. Using waste composition for unaudited NAICS generators from another study (City of Calgary, 2013); and 2. Slotting unaudited NAICS generators to the waste composition of the nearest estimated audited NAICS categories. This approach was taken to facilitate comparisons between essentially backfilling Saskatoon data with data from another jurisdiction.

It is estimated, based on waste audit and other data sources, that the majority of ICI waste (56%) can be diverted. The key waste streams that could be diverted include food waste (27%), paper/paper

packaging (22%) and C&D (6%) wastes. A summary of the estimated waste characterization for ICI waste is presented in **Figure 3-3**.

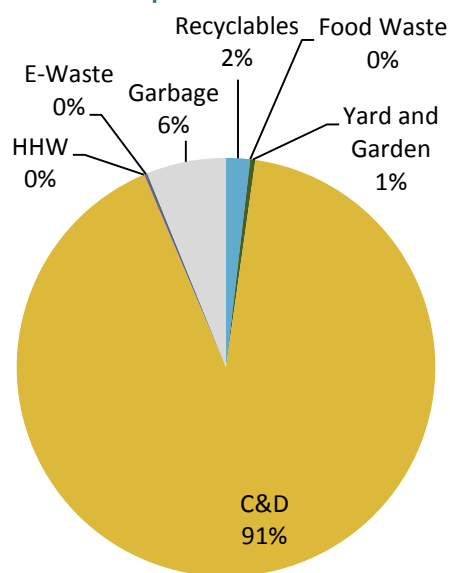
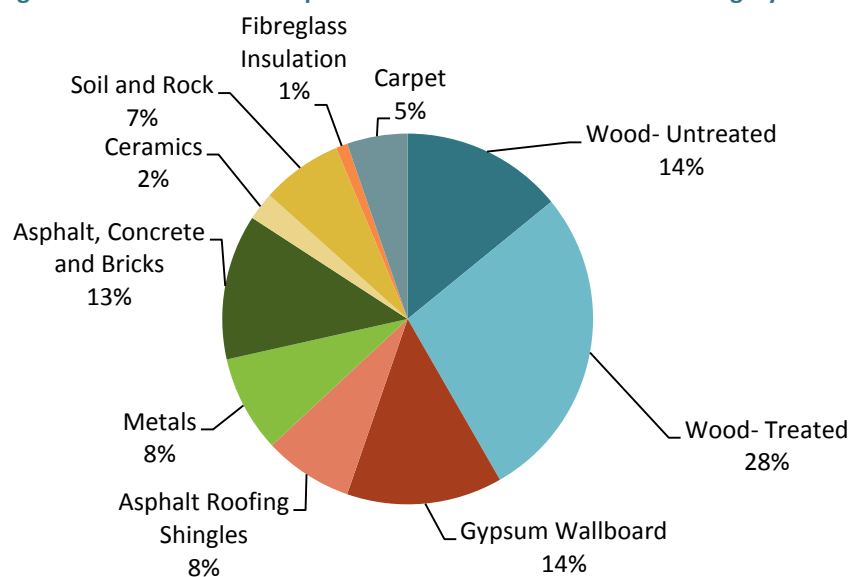
Figure 3-3: ICI Waste Composition



3.5 Construction and Demolition (C&D) Waste Composition

It appears that most C&D waste is managed by the private sector and is assumed to be disposed of in private landfills in or near the City. Estimating C&D composition (i.e., the disposal stream) was undertaken by completing visual waste audits of loads of C&D waste received at a private landfill facility. Visual waste audits were completed for 54 C&D waste samples and the average load sampled was approximately 2,500 kg. This data was then converted to weight-based data using standard waste densities for the various C&D waste types and the weight of each sample. The waste characterization results of C&D loads were averaged to develop an overall estimate of C&D waste composition.

Based on the results of the audits, approximately 91% of each load was C&D waste. This included untreated wood, asphalt roofing shingles, asphalt, concrete, bricks and metals. Most of these materials could have been diverted in various recycling programs, noting that some wastes (e.g., treated wood) are not readily recyclable. Of the audited loads, 2% consisted of recyclable wastes that could have been captured in the blue cart program. A summary of the estimated waste characterization for ICI waste is presented in **Figure 3-4**. A breakdown of the 91% of materials sorted as “C&D wastes” have been further summarized in **Figure 3-5**.

Figure 3-4: C&D Waste Composition**Figure 3-5: C&D Waste Composition – Breakdown of the C&D Category**

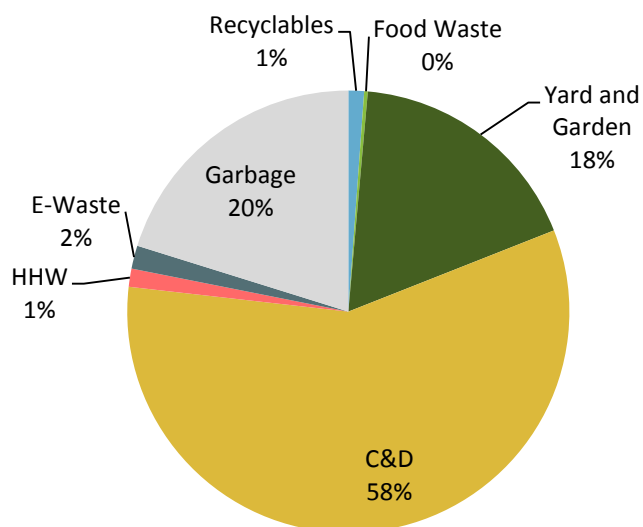
3.6 City Landfill Self-Haul Waste Composition

Residents and businesses can self-haul garbage to the City landfill for disposal. The waste of 38 randomly selected self-haul loads was characterized over the spring and summer sampling periods and the

average load was approximately 145 kg. The waste characterization results of self-haul loads were averaged to develop an overall estimate of self-haul waste composition.

The main material stream found in the audited self-hauled loads consisted of C&D materials (58%). Organic waste accounted for approximately 18% of the audited waste, with 98% of the organic waste consisting of yard and garden waste. Approximately 1% consisted of recyclable wastes which could have been captured in the blue cart program. A summary of the estimated waste characterization for ICI waste is presented in **Figure 3-6**.

Figure 3-6: Self-Haul Waste Composition



3.7 Overall Waste Composition

The weighted overall waste composition of the various municipal solid waste streams was calculated using a model based on data provided by the City and information derived from Statistics Canada. Data provided by the City included single-family, multi-family and self-haul waste collected by the City. ICI data includes data provided by the City and estimated private sector quantities. Private sector managed ICI and C&D wastes were inferred from Statistics Canada waste disposal data. The annual estimated waste disposal rates per generator that is collected by the City (i.e., does not account for multi-family waste collected by the private sector) are included in **Table 3-2**. These quantities were used as starting points to forecast future waste quantities.

Table 3-2: Estimated Waste Disposed per Waste Generator per Year

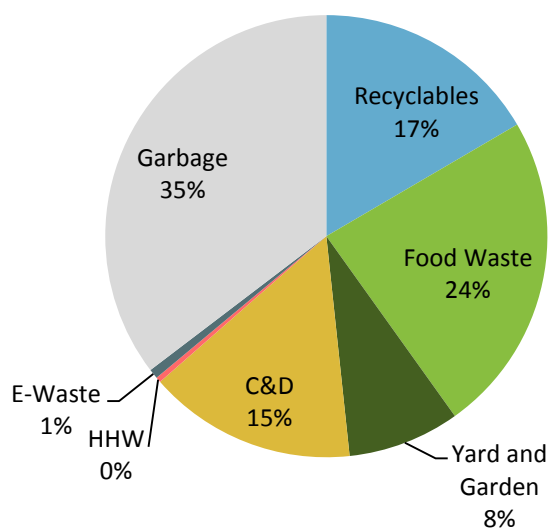
Generator	Tonne/Year
Single-family	51,900
Multi-family	9,100
Self-Haul	17,100
ICI	152,900*
C&D	16,100*
Total	247,100

* Refers to amounts that were inferred from Statistics Canada

A summary of the estimated waste quantities for each generator is included in **Table 3-3**. The table shows that almost 7,000 tonnes of residential (single and multi-family) and 34,000 tonnes of ICI wastes are materials that are accepted in the blue cart stream. There are approximately 58,000 tonnes of food waste, (primarily from the ICI sector); 20,000 tonnes of yard waste; and 38,000 tonnes of C&D waste that could be reduced and/or diverted. The estimated waste characterization for all generators is included in **Figure 3-7**.

Table 3-3: Estimated Waste Quantities per Generator per Year

Waste Stream	Single-Family Residential	Multi-Family Residential	Self-Haul	ICI	C&D	Total
Recyclables	5,233	1,530	196	33,698	298	40,955
Food Waste	13,977	3,224	46	40,940	0	58,187
Yard and Garden	15,919	433	3,010	822	64	20,247
C&D	3,745	144	9,881	9,179	14,701	37,650
HHW	424	54	227	242	10	956
E-Waste	386	131	290	900	38	1,745
Garbage	12,217	3,584	3,451	67,118	989	87,360
Total	51,900	9,100	17,100	152,900	16,100	247,100

Figure 3-7: Total Estimated Waste Composition, all Generators

4.0

Forecast of Waste Stream Quality and Quantity (2017-2027)

The waste quantity forecasts were developed based on 2cg's Waste Composition Study (**Section 3.0**), Statistics Canada data and population projections prepared by the City's Planning and Development Division's report *City of Saskatoon & Saskatoon Census Metropolitan Area Population Projection 2015-2035* (data was extrapolated assuming a linear increase between intervals for the Waste Diversion Plan planning period from 2017-2027). In order to estimate the population percentage split between those living in single-family households versus those living in multi-family residential buildings, Statistics Canada Census data was used which estimates that 25% of dwellings are multi-family residential and the remaining 75% are in other dwelling types including single-detached houses, semi-detached houses and row houses. ICI employment data was based on information from the Statistics Canada 2011 census which was 117,210. It was assumed that the ICI employment data would remain constant over the planning period.

4.1

Quality

The waste stream quality for the single-family, multi-family and ICI sectors was taken from the 2016 Waste Characterization Study (refer to **Section 3.0**). It has been assumed that the total waste stream quality will remain unchanged during the 10-year study period but the participation and capture rates will change over time due to addition of new programs and policies, increased promotion and education and product stewardship initiatives. It is difficult to predict what the future waste stream will look like based on how quickly and constantly waste has and continues to change. Some examples of how waste is changing include:

- Product packaging is getting lighter to reduce transportation costs;
- More people prefer to get their news from online sources which is decreasing the generation of newspapers;
- Increased online shopping generates more household cardboard; and
- Increased availability of single use products (e.g., coffee capsules, stand-up pouches).

4.2

Quantity

The 2016 Waste Characterization Study provided estimates on the quality and quantity of garbage generated by the single-family, multi-family and ICI sectors (**Section 3.7**). In order to project the total waste generated, the *as-generated* waste composition and quantities for 2016 needed to be developed. This involved the following steps:

- Allocating the quantity of waste diverted in 2016 to one of the three sectors (completed in consultation with City staff);

- Allocating 100% of the self-haul garbage quantities (estimated in **Section 3.7**) to the single-family residential sector and adjusting the single-family garbage composition accordingly; and
- Estimating the quantity of multi-family residential garbage collected by the private sector in 2016 (based on the per capita garbage generation rate from City-collected multi-family units and applying it to the remaining 12,000 multi-family units collected by the private sector).

It is noted that the ICI garbage quantity estimates may also include garbage generated from the multi-family sector since the two sources of garbage are typically collected together (as is the case with the City and likely in the Statistics Canada data used to supplement the 2016 Waste Characterization Study findings). Therefore, there is a potential for double counting quantities. However, the methodology is considered appropriate at this planning level stage but if/when more exact quantities are required, the City will have to work with the private sector and/or the Province. It is also noted that the C&D waste quantities estimated in **Section 3.7** were not included in the waste forecasting as these are highly variable from year to year in terms of both generation sources and quantities. The resulting estimate of the total waste generated (diverted plus disposed) in the City by sector is shown in **Table 4-1**.

Table 4-1: Estimated Annual Waste Quantities Generated by Sector

	Single-Family Residential	Multi-Family Residential	IC&I	TOTAL
All Recyclables	17,849	4,161	33,708	55,718
All Non-Recyclables	4,933	1,749	39,623	46,305
Food Waste	15,052	4,907	40,953	60,912
Yard Waste	29,565	659	4,185	34,409
C&D	11,908	219	9,182	21,309
WEEE	644	199	900	1,743
HHW	724	92	242	1,058
Other Materials	10,967	3,720	27,516	42,203
Tonnes/year	91,642	15,705	156,310	263,657

The population projections were used to project future waste generation quantities, based on 2016 per capita waste generation rates and assuming a 1% waste generation growth rate for all three sectors over the study period. A generation rate provides an estimate of the total quantity of materials generated by an individual/unit, including recyclables and organics. In the last two years, the City (as well as other jurisdictions such as Metro Vancouver) has experienced both increases and decreases in annual waste generation as illustrated in **Figure 4-1** that have varied as low as -13% and as high as 8%. Waste generation rates can also be closely linked with economic conditions. In general, the more prosperous the population is, the more money they will spend and in turn, the more waste they will generate. In the *Saskatoon Strategic Trends 2016 Report (An Overview of Demographic, Development, Economic,*

Environmental and Social Issues and Trends), December 2016, the historical (2009-2015) and forecasted (2016-2017) Real Gross Domestic Product (GDP) growth was provided in the extracted graph shown in **Figure 4-2**. Comparing the two figures, this trend holds true for some years (2010, 2013, 2014 and 2016 forecasted), but not all. In an effort to remain conservative and for planning purposes, a 1% waste generation rate was applied over the planning period.

Figure 4-1: City of Saskatoon Waste Generation Growth (2009-2016)

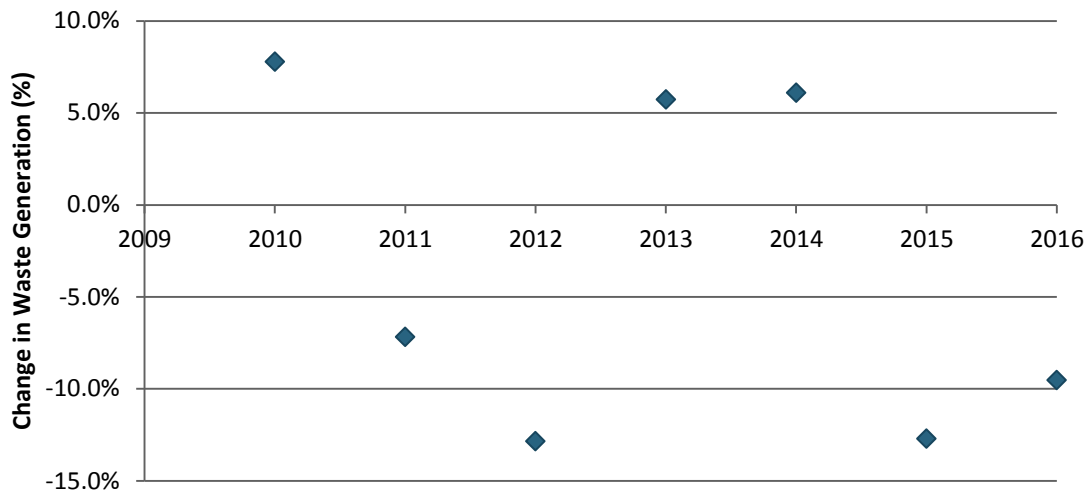
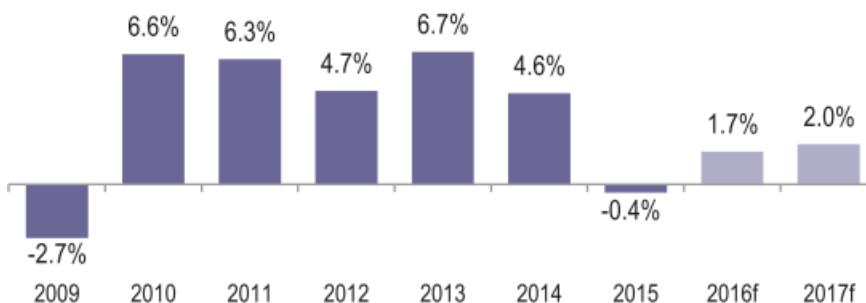


Figure 4-2: Saskatoon CMA Real GDP Growth (% change), 2009-2017²⁷



The total waste generated in 2017 (based on City provided data and the 2016 Waste Composition Report) and the estimated waste generated in 2023 and 2027 is provided in **Table 4-2**. A graphical representation of these forecasts is provided in **Figure 4-3**.

Figure 4-3: Waste Quantity Forecast (2017-2027)

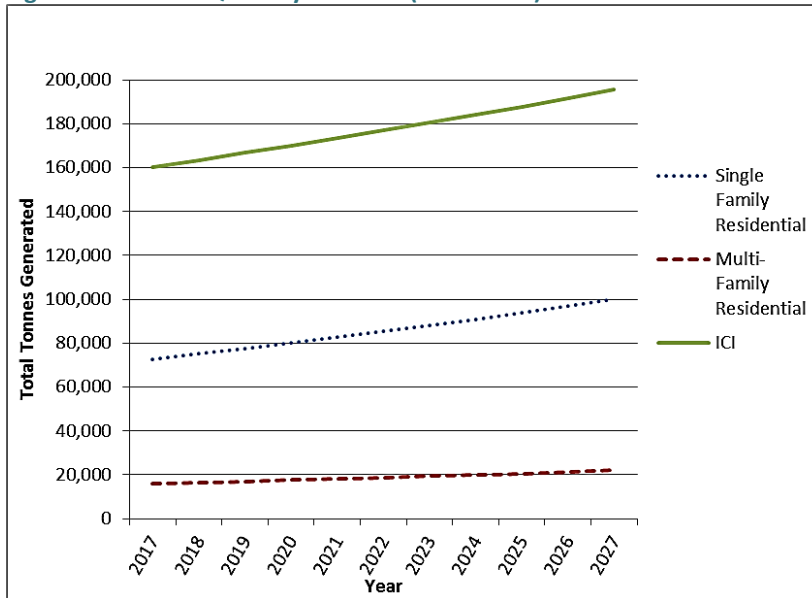


Table 4-2: Generated Waste Forecast 2017 - 2027

Assumptions:

- 1

Population growth projection per year (SF - Residential):
Population growth projection per year (MF - Residential):
Population growth projection per year (ICI):

2.2%

2.2%

1.0%
- 2

Annual waste generation rate growth estimate (%):

1.0%

Municipal Unit	Estimated 2017 Population	Sector	Estimated 2017 Population	Material		2017			2023			2027		
						Per Capita Generation Rate Managed Waste (kg/person/year)	Population	Total Tonnes Generated	Per Capita Generation Rate Managed Waste (kg/person/year)	Population	Total Tonnes Generated	Per Capita Generation Rate Managed Waste (kg/person/year)	Population	Total Tonnes Generated
Saskatoon	268,700	Single Family Residential	201,525	1	All Recyclables	85.9	201,525	17,318	90.9	230,383	20,947	94.4	251,987	23,780
				2	All Non-Recyclables	21.0		4,232	22.2		5,119	23.1		5,812
				3	Food Waste	70.7		14,241	74.8		17,226	77.6		19,556
				4	Yard Waste	119.6		24,108	126.6		29,161	131.4		33,105
				5	C&D	18.8		3,782	19.9		4,575	20.6		5,194
				6	WEEE	1.9		390	2.0		472	2.1		536
				7	HHW	2.6		520	2.7		629	2.8		714
				8	Other Materials	40.8		8,226	43.2		9,950	44.8		11,295
				TOTAL		361.3		72,818	382.3		88,079	396.8		99,991
		Multi-Family Residential	67,175	1	All Recyclables	64.3	67,175	4,321	68.1	76,794	5,226	70.6	83,996	5,933
				2	All Non-Recyclables	26.3		1,766	27.8		2,136	28.9		2,425
				3	Food Waste	73.8		4,956	78.1		5,995	81.0		6,805
				4	Yard Waste	9.9		666	10.5		805	10.9		914
				5	C&D	3.3		221	3.5		268	3.6		304
				6	WEEE	3.0		201	3.2		244	3.3		276
				7	HHW	1.4		93	1.5		112	1.5		128
				8	Other Materials	55.9		3,757	59.2		4,544	61.4		5,159
				TOTAL		237.9		15,981	251.7		19,330	261.3		21,944
	--	ICI	117,210	1	All Recyclables	291.2	117,210	34,132	309.1	124,421	38,461	321.7	129,473	41,648
				2	All Non-Recyclables	341.4		40,019	362.4		45,095	377.2		48,831
				3	Food Waste	352.9		41,363	374.6		46,609	389.8		50,470
				4	Yard Waste	55.4		6,491	58.8		7,314	61.2		7,920
				5	C&D	79.1		9,274	84.0		10,450	87.4		11,316
				6	WEEE	7.8		909	8.2		1,025	8.6		1,110
				7	HHW	2.1		244	2.2		275	2.3		298
				8	Other Materials	237.1		27,791	251.7		31,316	261.9		33,911
				TOTAL		1367.0		160,224	1451.1		180,545	1510.0		195,504
TOTAL								249,023			287,953			317,439

Note : Starting point is 2016 waste audits of garbage stream plus diverted materials plus 1%.

5.0 Needs Assessment

5.1 Identified Issues and Potential Actions

Based on the review of existing conditions, the results of the 2016 Waste Composition Study and information obtained through interviews with City staff and key stakeholders, a number of issues with the current waste management system and potential actions to reduce/eliminate the issues were identified. The issues and actions were categorized into one of the following six categories:

- System Governance and Management;
- User Education and Awareness;
- Reuse and Recycling;
- Organics Management;
- Collection and Transfer; and
- Processing and Disposal.

Table 5-1 provides a summary of the issues and actions that were identified as potential recommendations for the Waste Diversion Plan and the detailed table that also includes the source/reference for the issues is provided in **Appendix B**.

Table 5-1: Issues and Actions Identified in Existing Waste Management System

Category	Issue	Action
System Governance and Management	The waste management system is running a deficit. Tipping fees are not required for all facilities and funds allocated towards certain programs do not cover the true costs. User pay is for recycling (utility fee) but garbage is covered through property taxes which does not create an incentive to divert if garbage is viewed as "free".	Modify approach to financing the solid waste management system through options like user pay and a utility.
	Almost 18% of the overall garbage stream is C&D material that is being landfilled instead of being diverted. Recovery Park will process the C&D waste but to ensure success, will need supporting tools in place prior to the opening.	Mandate source separation of C&D waste and have timing coincide with opening of Recovery Park. Develop necessary education/promotion required prior to Recovery Park C&D processing facility opening.
	A significant amount of divertable materials are contained in the residual waste stream for all sectors that could be recovered for reuse or recycling through existing and/or future programs (e.g., food waste, C&D waste, ICI recyclables).	Implement disposal bans and measures as tools to increase diversion from all sectors on a material by material basis with timing coinciding with having processing capacity in place (start with materials to be handled through Recovery Park).

Category	Issue	Action
	ICI and C&D waste is mostly hauled by the private sector and disposed of in private landfills that contain a large percentage of materials that could be diverted. The City does not know how much waste is landfilled although Condition #48 of The Waste Bylaw requires the private sector to report annual tonnes of waste managed to the City (however, this has never been enforced).	City to influence and/or enforce diversion of ICI and C&D waste at the front end (e.g., through building permits, disposal bans).
	City Council adopted Waste Diversion Rate Performance Target of 70% by 2023. Diversion rates do not account for waste reduction and reuse initiatives as well as changes in how waste is packaged (lighter materials).	Define additional Key Performance Indicators (KPIs) that could be used to measure success of waste management system such as kg of waste disposed per person.
	Current enforcement measures for cart placement bylaw infractions is to issue two warning notices before a ticket is issued. Current method is to conduct neighbourhood blitzes. Illegal dumping infractions are ticketed immediately if evidence of the perpetrator(s) can be obtained.	Implement different methods of enforcement for residential sector that makes best use of City resources (e.g., issuing 1 notice instead of 2). Reasons for ticketing will change with new programs and policies in place.
	The Waste Bylaw came into effect in 2004. Since then, additional programs have been implemented and more are anticipated. With the proposed changes to the waste management system, an update to the Waste Bylaw will be necessary.	Update the Waste Bylaw. Recommended actions that will impact the Waste Bylaw include mandatory source-separation of C&D materials, mandatory participation in the curbside organics collection program and potentially requiring the ICI sector to report on waste quantities (Condition #48).
	City has hot spots for illegal dumping activities.	Select an option(s) to reduce illegally dumped waste and implement a pilot program at the hot spots such as the recycling depots. The City could also consider implementing a seasonal curbside bulky waste collection to help mitigate illegal dumping occurrences.
User Education and Awareness	Recycling is a good step in waste diversion however, residents need to remain aware that waste set out for collection is expensive and therefore, efforts should be made to reduce waste.	Implement promotion and education about ways to reduce waste. Example topics include reducing food waste, grasscycling and reducing waste during holidays.
	With younger generations preferring apps and social media to get their information and older generations preferring traditional methods to stay informed (e.g., newspaper, calendar), develop	Review options to improve Promotion & Education efforts and to launch potential new programs and improve existing programs (e.g., reduce contamination in

Category	Issue	Action
	varying types of promotion and education methods to reach the diverse geography.	recycling stream) which can include targeted development and distribution of education materials based on demographics.
	Better signage needed at City depots and at collection points.	Standardize signage and symbols throughout the City and continue for use at new facilities and in P&E materials.
Reuse and Recycling	In order for Recovery Park to be successful, it has to be easy for residents to bring waste there for diversion in terms of using the Park and affording it.	Have the layout of Recovery Park be user friendly and efficient for a user to drop-off their waste for diversion and/or disposal (e.g., look at the traffic flow and number of times a car needs to be weighed). Consider allowing free drop-off of materials that the City wants to either sell to markets or for safe disposal (e.g., HHW, C&D, recyclables, scrap metal).
	Dual stream (recyclables, garbage) waste receptacles are available at busy, pedestrian-orientated areas and parks contain baskets for beverage containers. Not all garbage bins have a recycling bin next to it.	Have standardized public space recycling bins tying the logos to curbside programs.
	HHW drop-off events are costly and are only available to residents eight times a year. The use of the unstaffed recycling depots has been decreasing since the implementation of single and multi-family residential recycling programs. With a mandatory recycling program, this trend will likely continue.	Following a review of options, establish a permanent HHW depot(s) that are staffed at existing City waste facilities or partnerships with HHW recycling/disposal providers.
	There are opportunities to reuse diverted waste such as compost and C&D materials. Finished compost is being stockpiled. This decline in end markets is in part attributed to underfunding of the compost facility and the Parks Department not using it in their projects. C&D reuse opportunities are being developed by private sector (e.g., concrete, asphalt).	Develop a green procurement policy to increase beneficial reuse of waste. Proper funding should be addressed through the utility option (Action No. 1).
Organics Management	The City's promotion of backyard composting and provision of composting through the depots and the subscription organics collection program is capturing a small percentage of the available	Plan for implementation of mandatory City-wide organics collection program which includes timing (to coincide with opening of organics processing facility) an enhanced

Category	Issue	Action
	organics generated while the remaining is sent for disposal. City-wide organics collection offers the potential for greatest increase in diversion and cost recovery.	promotion and education program, tender of carts/containers and in-house/unit kitchen catchers.
	The yard and garden waste compost facility is not suitable to handle food waste in terms of capacity and potential nuisance impacts. Funding is not sufficient to allow for necessary processing and therefore compost quality suffers and finished product is stockpiled.	Determine the most efficient method of collecting and processing YGW from all single-family households (e.g., separate processing and collection of YGW at the existing compost facility, co-collection and processing of YGW with food scraps and household organics at Recovery Park).
Collection and Transfer	When City-wide organics program is implemented, there will be a need for additional collection service. The City outsources recycling collection and contracts expire in 2019 and 2023 for single-family and multi-family, respectively. The City has 24 collection vehicles that are on 15-year replacement cycles for garbage collection.	Conduct an analysis of the preferred method of collecting the new stream. Options can include outsourcing collection or City collection. Review options for collection contracts (e.g., timing).
	Weekly garbage collection from May to September contributes to the City's budget deficit. When a new organics collection program is introduced, a new collection approach will be required.	Assuming source separation of organics is implemented, change to year-round bi-weekly collection of garbage and weekly collection of organics.
	Garbage bins and green carts (for subscription organics collection program) had RFID tags installed that corresponded to an address however, some tags were not installed, are faulty or were improperly assigned therefore, the data is unreliable.	Explore options to identify the benefits associated with the RFID technology and the effort required to re-tag and/or confirm addresses linked to the carts. Coincide with the implementation of the organics collection program and the change in fee structure (e.g., pay as you throw).
Processing and Disposal	A large portion of the waste received at the landfill for disposal is waste wood (including elm) which could be used to generate electricity. There are interested partners who would assist the City.	Work with potential partners to find beneficial uses for the recovery of energy from waste wood that would otherwise be landfilled.

Noting that recent evaluations completed by the City have determined that the existing landfill has almost 30 years of capacity remaining (i.e., lifespan to approximately 2044), options related to acquiring additional landfill disposal capacity (e.g., expansion, new site) were not actively investigated.

6.0 Waste Management System Best Practices

In **Section 5.0**, the issues and potential actions to improve the City's waste management system were identified. The actions identified were carried forward for consideration as final recommendations for the 2016 Waste Diversion Plan. The rationale and approach to implement the recommendations is developed by the experience of the consulting team; however, some require additional research on current best practices to supplement the rationale for the recommendations. Seven issues were identified as ones warranting best practices research which was put forward to the City for approval prior to commencing the research. The approved list of topics to conduct best practices research on is as follows:

- Solid waste utility;
- Disposal bans and measures;
- Influence/enforce diversion of ICI and C&D wastes;
- Mandatory recycling and enforcement of bylaws;
- Implementation of City-wide Source Separated Organics collection program;
- Data management - alternative technologies; and
- Litter and Illegal Waste Management.

The results of the best practices research, with a focus on specific issues identified for Saskatoon, are provided in the following subsections.

6.1 Solid Waste Utility

6.1.1 City's Current Approach

Based on information provided by City staff, Saskatoon's waste management system is currently running a deficit. Tipping fees are not required for all facilities and funds allocated towards certain programs do not cover the true costs. The City charges residents for garbage collection through property taxes where the specific cost for garbage collection is not broken out. Recycling collection is charged through utility billing where the fees are shown as a single line item. The Green Cart program is a subscription-based program where residents pay an annual fee in order to participate. This gives residents an impression that garbage collection is "free" whereas recycling and organics collection is an added financial cost.

6.1.2 Description of Alternative Approaches

There have been several jurisdictions in Canada that have adopted a utility model for funding for Solid Waste Services. The general premise of this model of cost recovery is based on funding solid waste services in a manner similar to that used for water, natural gas or electrical power. This system of funding is based on the principal that the "cost causer" pays for the service that he/she receives in proportion to the cost of providing that service. This principal has been established and implemented successfully by the water, natural gas and electrical service providers.

The two basic methods of payment are: 1) user pay based on actual services used; or, 2) a flat rate based on average customer usage. In the case of water, natural gas and electricity the amount paid by the customer is usually based on the services used since it is relatively easy to measure the consumption of individual customers (i.e., water meters, gas meters and electrical usage/consumption meters). Solid waste is more difficult since the measurement of usage can be complex and costly.

While it may be difficult to measure the actual usage by each household, apartment or business customer, the flat rate usage can be determined with relative ease providing some basic information is available on the users and the tonnages/costs of handling are known. This average charge can then be structured and applied to customers.

Many jurisdictions across the country have adopted a utility-style model for funding solid waste services. This method is based on the principle that the member pays for the service that they receive in proportion to the cost of providing that service, which is a similar manner that is used for water, natural gas or electrical power services. This method can increase customer awareness of the quantity of waste generated since residents see their direct impact on their solid waste utility bill.

City of Toronto

The City of Toronto currently has a solid waste utility that is comprised of volume-based rates, property taxes, fee revenue, sale of recyclables and industry stewardship funding. The volume-based rates are based on the size of the garbage cart/container which is collected bi-weekly. For single-family households, owners select which size of garbage cart they want and pay accordingly. Residents receive a rebate and after the rebate is applied, the annual charges range from \$23 for the small cart (fits about one bag of garbage) to \$420 for the extra-large cart (fits about 4.5 bags)²⁸.

The City is considering removing the rebate to develop a full user pay utility that is funded solely from the volume based user fees. Cost recovery of public service good (e.g., litter collection) would be funded from property taxes²⁹.

Waste diversion program costs are covered through the utility and are not visible to residents. Residents can choose between three sizes of recycling carts (collected bi-weekly) and one size of Green Bin (collected weekly).

City of White Rock

Prior to 2015, the City of White Rock charged for solid waste services as part of the Municipal Tax Rate. In 2015, the City of White Rock removed the cost of solid waste services from general municipal taxes for single-family and eligible multi-family properties. These residences are now charged as a separate entity in their utility bill. A rate model was developed to calculate annual rates for customers based on anticipated service usage and prior waste audits³⁰.

The City allows residents to place up to two containers of garbage every other week for curbside collection. The garbage containers can be up to four cubic feet (110 L) and cannot exceed 50 pounds. Residents must purchase and place City stickers (bag tags) if they want to set out additional garbage.

City of Surrey

The City of Surrey's (Surrey) waste collection service charges are from January to December 31 each year. The amount is based on a flat rate, collected with property taxes. For single-family households, the 2017 rate is \$287 for garbage, recycling and organics collection (a \$4 increase from the previous two-years). If single-family households have a registered secondary suite in their household an additional charge of \$144 is charged to households. Surrey services most multi-family residential buildings (apartments and townhouses) for recycling collection. Each unit is charged \$25 annually. Some multi-family buildings also receive organics collection from Surrey which is billed with recycling at a flat rate of \$35 annually per unit. Only a few multi-family buildings receive garbage collection from Surrey and must also be serviced by Surrey for recycling and organics. The total flat rate for all three services is \$287 per unit, which is the same cost as the single-family cost per household.

Surrey provides five cart sizes to residents, 80L, 120L, 180L, 240L and 360L. Cart sizes are recommended by Surrey based on the household type. For single-family households the recommended cart sizes are 240L for garbage, organics and recycling. Single-family households with a secondary suite are recommended to have a 360L cart for garbage and recyclables and a 240L cart for organics. Townhouses are recommended to have a 120L organics cart, 180L garbage cart and a 240L recycling cart. Households may select any cart size for garbage, organics and recycling; however, the City charges \$15 to \$25 per cart, per exchange.

City of Coquitlam

The City of Coquitlam (Coquitlam) provides garbage and organics collection to single-family households. Recycling was previously provided; however, Multi-Material BC took over recycling collection in July 2014. Coquitlam's 2017 utility fee includes water (\$475), organics and garbage collection. The amount that is charged for garbage and organics collection depends on a household's garbage cart size. Three cart sizes are available for selection and include 120L (\$228), 240L (\$302), and 360L (\$427).

6.1.3

Potential Advantages and Benefits

The utility model is generally considered advantageous and beneficial due to a number of factors including:

- Generally leads to stable funding for the service as it is protected from budget cuts since the utility is self-financing;
- Increases customer awareness of the cost of providing the service as the rate for the service is visible;
- Provides a method of measurement that is understood by the customer, usually cart size or bag limits with additional charges for additional service;

- Can be included with other utility-based services; and
- To switch to a full utility-style model, the City will have to remove the current cost of garbage from the property tax. When adding the cost of garbage to the utility bill, the City should ensure that the waste diversion initiatives are incentivized. This means that the base cost of the garbage collection service should be able to cover some or all of the cost of recycling or organics collection services. As a result, the City can offer cheaper rates for waste diversion programs and waste disposal is seen as a higher cost. The City may also consider offering different cart sizes for garbage and recyclables, with higher costs for the larger garbage cart size (and potentially recycling). This may increase awareness of total waste generation and create an incentive to reduce waste.

6.1.4 Potential Disadvantages and Challenges

As with all systems, there are also disadvantages which must be considered. Some of the disadvantages for a solid waste utility structure include:

- Sometimes the cost of providing the service can increase as the separate “Utility” establishes and maintains a management structure and possibly duplicates services provided by other departments;
- The mandate of a solid waste utility is to grow smaller as more diversion and improved customer practices reduce the volume of waste to be handled. This requirement to get smaller is counterintuitive for most agencies and staff as it means that the more successful the utility becomes, the smaller the utility needs to be; and
- There is the possibility that the public will perceive that they are being double billed for the service since they continue to get property tax bills together with solid waste utility bills.

6.1.5 Impact to Other Operational Areas

Removing the cost of garbage from the property tax to a utility-based approach will require engagement with the City’s Finance Department. Since there is only a utility cost currently in place for recycling, resources would be required to determine the appropriate utility cost for all waste streams. Education of the utility cost to the public will be necessary when implementing this approach.

6.2 Disposal Bans and Measures

6.2.1 City’s Current Approach

The City has been considering the use of disposal bans and incorporating measures such as changing the bylaw to mandate participation in recycling programs. In 2015, City Council endorsed a plan to phase in a disposal ban for paper and Old Corrugated Cardboard (OCC) from the ICI sector. City staff have been consulting with the ICI sector to explore options for the collection and processing of these materials to ensure that these are in place before the ban comes into effect. From the 2016 Waste Characterization Study (see **Section 3.0**), it was estimated that approximately 18% of the total ICI garbage audited (received at the City’s landfill) consisted of paper and paper packaging, which has a significant impact on the City’s waste diversion performance.

In Saskatoon, ICI waste is collected by both the public and private sector and is taken to one of the three landfills (the City's Regional Waste Management Facility and two private landfills). The planning of the landfill disposal ban needs to take into account the possibility of waste being diverted to the private landfills.

Under the City's Waste Bylaw No. 8310, Schedule B, it is stated that any load containing more than 10% by weight of material that can be recycled will be subject to a surcharge of up to 100% of the total load charge. Although the City holds the right to fine loads containing a high volume of recyclables, as noted during stakeholder interviews with City staff, it is rare for the City to ticket someone unless they have falsely declared the material.

6.2.2 Description of Alternative Approaches

In many cases, disposal bans increase waste diversion, preserve landfill capacity and support end markets of the banned material. Disposal bans are applied to specific categories of waste (e.g., paper, cardboard, organic waste). Disposal bans can be implemented in different ways such as rejecting a load or applying a surcharge on loads exceeding allowable limits at the point of collection (generator) or at disposal facilities (landfills, transfer stations).

Other approaches or measures used to increase waste diversion are to change the bylaws to have mandatory participation in recycling programs, provide more opportunities for waste diversion (e.g., implement an organics collection program), change the collection frequency and/or apply a disposal levy at the landfills to bring the cost of disposal closer to or greater than tipping fees for processing of diverted materials.

Nova Scotia

Disposal bans are enforced by the Province of Nova Scotia. From a Provincial regulatory perspective (Nova Scotia Environment), municipalities and landfill operators are responsible for meeting the requirements of the disposal bans. The officers from the Province conduct site visits where, if banned materials are observed at a landfill, the landfill site operators can be fined. The provincial authority also conducts inspections to ensure that the municipality has full diversion programs, related policies, and promotion and education initiatives in place.

As a material ban comes in effect, the landfill site operator educates the collectors. Following education, there is a period where the landfill site operator provides warnings and rejects loads that do not comply with the ban. Some landfill operators will increase, at times double, the tipping fees to cover costs for segregating contaminated loads³¹.

Materials banned from disposal sites in Nova Scotia include recyclables (e.g., paper, OCC, food and beverage containers, plastic bags and packaging), eWaste (e.g., computers, printers, TVs), used tires, batteries, post-consumer paint products, automotive antifreeze, and compostable organic material. Due

to their geographic location, Nova Scotia does not have a significant issue with waste being exported out of Province.

Halifax Regional Municipality

Halifax tackles banned materials for multi-family and ICI buildings via inspections at the processing facilities. Garbage that is not properly sorted (i.e., contains banned materials) is rejected at the landfill. When loads are rejected they are brought back to the generating building by the hauler to be properly sorted. In 2015, HRM implemented a clear bag program to improve the ability to identify instances of non-compliance (e.g., banned materials in the residuals bag) at the curbside.

Cape Breton Regional Municipality

For single-family residences, haulers enforce the regulations through curbside tagging procedures. Since, all waste must be placed into clear bags (with the exception of one tinted bag for privacy), this allows for haulers to easily determine if there are any banned materials in the waste stream. The bags that are not in compliance are tagged and these bags are not collected by the hauler. Enforcement for multi-family residential buildings with less than six units is similar to single-family residential. Any bags that are left behind must be properly sorted by either residents (or building managers for multi-family buildings with six units or less) in order for the hauler to pick up the waste the following collection day. For the ICI sector, the load can be rejected from the landfill and sent back to the generator for sorting.

Regional District of Nanaimo (RDN)

Single-family households that set out garbage bags containing banned materials are left at the curb with a tag to indicate why it was not collected and may result in the provision of educational pamphlets or follow-up calls being conducted. Currently, multi-family residential enforcement is being phased in. Approximately 85% of buildings throughout the region are now meeting the requirements of the landfill disposal bans. Waste haulers and generating buildings will be subject to fines for loads that contain banned materials. For the ICI sector, loads are screened by the RDN Zero Waste Compliance Officer at the landfill to see if there are any banned materials. If the incoming load contains more than 10% of banned materials, then the hauler receives a notice and surcharges are applied which is double the tipping fee rate for that load. Additionally, a photograph of the load is taken and provided to both the hauler and RDN.

Metro Vancouver

Metro Vancouver has banned several materials from disposal (Metro Vancouver 2017 Tipping Fee Bylaw No. 302). This includes the following types of materials:

- **Banned recyclable materials.** Materials that have reasonably accessible recycling options region-wide. The materials have been banned to drive up the regional recycling rate.

- **Banned hazardous and operational impact materials.** The materials are hazardous to the environment or workers, or have high operational impacts. Other safe disposal options for these materials exist.
- **Banned product stewardship materials.** These materials have provincially regulated recycling programs and accessible recycling options Province-wide.

A list of the banned materials has been provided in **Table 6-1**.

Table 6-1: Metro Vancouver Banned Materials

Recyclables	Hazardous and Operational Impact Materials	Stewardship Materials
<ul style="list-style-type: none"> • Corrugated cardboard • Recyclable paper • Green waste • Containers made of glass, metal or Banned Recycled Plastic (1, 2, 4 and 5) • Beverage containers (all except milk cartons) • Food waste • Clean wood 	<ul style="list-style-type: none"> • Agricultural waste • Asbestos • Automobile bodies and parts; • Barrels or drums in excess of 205 litres (full or empty) • Biomedical waste • Dead animals • Excrement • Gypsum • Hazardous waste as defined in the Hazardous Waste Regulation, B.C. Reg. 63/88 • Inert fill material • Liquids and sludge • Mattresses • Propane tanks • Refuse that is on fire, smouldering, flammable or explosive • Refuse that would cause undue risk of injury or occupational disease to any person at the Disposal Site or that would otherwise contravene the Occupational Health and Safety Regulations 	<ul style="list-style-type: none"> • Antifreeze and Antifreeze containers • Gasoline • Pesticide products • Pharmaceutical products and medications • Lead acid batteries • Oil, oil filters and oil containers • Paint products • Solvents and flammable liquids • Electronic and electrical products identified in Schedule 3 – Electronic Products Category to Recycling Regulation • Tires pursuant to Schedule 4 – Tire Product Category to the Recycling Regulation • Thermostats • Fluorescent lights • Batteries

At Metro Vancouver disposal facilities, loads are inspected for banned materials. A minimum \$50 surcharge applies if these materials are found in the garbage. Additionally, the potential cost of removal, clean-up or remediation will be applied to loads containing banned hazardous and operational impact materials or product stewardship materials. A surcharge of 50% of the tipping fee on the entire load is applied to loads containing banned recyclable materials. Instead of disposing of these items in the garbage, banned recyclable materials and product stewardship materials can be dropped off for recycling.

When Metro Vancouver added food waste to the list of banned materials there was a phasing in of the ban over a two-year period. From January 1 to June 30, 2015 the ban was enforced through education. Loads of residual waste brought to a transfer station containing over 25% food was identified and the

hauler of the load was provided with information. Financial enforcement began July 1, 2015 where waste loads with more than 25% visible food were surcharged at 50% of the cost of disposal. This primarily targeted grocery stores or large restaurants that did not have an effective food waste recycling program. On January 1, 2017, the amount of food waste allowed in the garbage was lowered to 5%. It was expected that most waste generators would have a food waste recycling program in place.

6.2.3 Potential Advantages and Benefits

Potential advantages and benefits of disposal bans and measures include:

- Increase in participation of diversion programs;
- Combination of both at the source and at the disposal facility enforcement is more effective at identifying violations;
- Extension of landfill capacity;
- Promotes creation of end markets for banned materials;
- At-source enforcement allows for easy identification of violators and can help to identify which generators require additional education on material bans;
- Garbage limits and user pay system can help reduce non-compliance; and
- To maximize community buy-in and participation, the initial focus should be on items with the greatest waste diversion potential.

6.2.4 Potential Disadvantages and Challenges

Some of the disadvantages and challenges of disposal bans and measures include:

- Higher staffing levels are required to inspect loads (either at the source, transfer stations or at landfills) and to tag customers not participating in diversion programs;
- If there are limited staffing resources staff may only be able to focus on visiting violators identified through disposal facility load rejections (rather than providing education to all waste generators);
- The disposal ban should be accompanied by enforcement measures, such as applying heavy fines or rejecting loads that contain banned materials to create disincentives to those that do not divert waste.
- Increased potential for materials to be sent to private landfills and transfer stations for disposal to avoid potential fines or rejected loads;
- Ongoing education and awareness is essential for residents/tenants and staff involved in waste collection (e.g., multi-family building superintendents, ICI janitorial staff); and
- Prior to a disposal ban coming into effect, the City needs to ensure that there is sufficient processing capacity and/or end markets/appropriate disposal facilities in place for the banned materials.

6.2.5 Impact to Other Operational Areas

Enforcing disposal bans at the source, transfer stations and disposal facilities will require additional staffing. Extensive outreach and education in all sectors will be required prior to a disposal ban or other measure coming into effect and for the initial transition period. Waste haulers and staff of the disposal

facilities will need to be trained on the enforcement procedures. The City will also need to work closely with the service providers and other landfills in the area to ensure that the banned material is properly diverted from landfill.

6.3 Influence/Enforce Diversion of ICI and C&D Waste

6.3.1 City's Current Approach

Over 80% of the ICI sector in the City is serviced by private waste haulers who have the option to take garbage to the City's landfill or to other private landfills (e.g., the two located near the City). As a result, the City currently does not have any control over privately collected waste. Waste generated from C&D and ICI activities that are disposed at the private landfills contain a large percentage of materials that could be diverted. The City does not know how much waste is landfilled; however, Condition #48 of the Waste Bylaw requires the private sector to report annual tonnes of waste managed to the City (this has not been enforced).

6.3.2 Description of Alternative Approaches

Municipalities get involved in the ICI and C&D waste issue to varying extents, from no involvement, to some service involvement, to implementing policies to encourage or force diversion. The reasons for different approaches vary locally. Haulers generally can provide diversion services to ICI customers but at an additional cost. Most ICI customers will go for the cheapest, legal option (disposal) but some ICI companies/institutions are committed to environmental goals and have diversion programs that are voluntary. The following subsections highlight municipalities who are involved in the C&D or ICI market, either through providing waste collection options, or more progressive measures such as disposal bans, and enforcement measures.

City of Calgary

The City of Calgary spent two years working with stakeholders to develop a strategy to divert more waste from the ICI sector before Council approved the changes to the Waste and Recycling Bylaw. In 2016, the City increased landfill fees for loads containing designated materials (e.g., paper and cardboard, scrap metals, asphalt, concrete) and implemented mandatory recycling. The ICI sector can dispose of their garbage at the landfill for \$113 per tonne, whereas the cost to dispose of a load of garbage containing designated materials is \$175 per tonne (2017 rate)³².

In November 2017, all businesses and organizations will be required to separate their food and yard waste from garbage and be diverted through donation of food, composting, supply management and anaerobic digestion. In the fall of 2018, the City will increase the fees on food and yard waste from the ICI sector, and a landfill disposal ban on these materials will likely come in effect in fall 2019³⁰.

City of Vancouver

In April 2016, the City introduced a regulation under the Green Demolition Bylaw which requires a company to apply for a demolition and building permit prior to commencing any demolition or building work. The permit requires a minimum of a reuse and recycling plan along with a \$14,650 deposit fee. The companies are to fill out a “Recycling and Reuse Plan” while applying for the permit and a “Recycling and Reuse Compliance Form” when the work has been completed in order to receive their deposit back.

The minimum reuse and recycling rates are determined by the City based on when the house was constructed, i.e. houses that are built before 1940 should divert a minimum of 75% of material by weight, whereas some other projects require diversion rates of 90%. In the cases where a 75% diversion rate is required, the client will receive a 100% deposit refund if 75% or higher diversion is achieved, 50% refund if diversion is between 71% and 74%, 20% refund if diversion is between 66% and 70%, and no refund if diversion is below 65%. There are similar rules for projects requiring a 90% diversion rate, where if the diversion rate is below 75%, the client will receive no refund³³.

Halifax Regional Municipality

In 2001, HRM established facility zoning provisions, bylaws and a licensing structure to support the enhanced diversion of C&D materials from disposal facilities. As defined by HRM, all C&D debris generated within the municipality must be directed to a licensed facility for initial sorting and processing. Using scale records, the operator of the licensed facility is obliged to achieve an annual diversion rate of 75% by weight. The remaining non-divertible residual must be directed to a municipally-licensed (and provincially-approved) C&D debris landfill. Notably, federally and provincially-led demolition projects are not subject to the HRM restrictions. It should be noted that a significant amount of “leakage” of non-processed C&D materials to lower cost landfill facilities outside of HRM has been observed since the establishment of their management regime.

Regional District of Nanaimo (RDN)

ICI sector loads are screened by the RDN Zero Waste Compliance Officer at the landfill to see if there are any banned recyclable materials. If the incoming load contains more than 10% of banned materials, then the hauler receives a notice and surcharges are applied which is double the tipping fee rate for that load. Additionally, a photograph of the load is taken and provided to both the hauler and RDN officer.

Portland, Oregon

Since 1996, businesses in the City of Portland, Oregon are required by City Code to recycle 50% of their waste. Metro Portland has adopted Business Recycling Requirements which require businesses in the Portland metropolitan area to recycle paper, metal cans, plastic bottles, and glass bottles/jars. In addition to the Business Recycling Requirements, Oregon state law states that a hauler cannot charge more for recycling collection than would be charged for the same quantity of waste collection.

Boston, Massachusetts

In 2008, a City ordinance was passed in Boston, Massachusetts requiring all commercial waste haulers working in the City to provide recycling services or risk losing their licenses. Failure to offer these services can result in a \$150 fine for the first violation, \$300 fine for the second violation, and on a third violation the hauler's permit will be revoked.

6.3.3 Potential Advantages and Benefits

Potential advantages and benefits to influencing and enforcing the diversion of ICI and C&D wastes include the following:

- Less ICI and C&D waste would be sent to landfill, although most of this waste currently goes to private sector landfills and does not have much impact on City of Saskatoon facilities;
- Creation of jobs associated with processing additional quantities of diverted waste and end markets;
- The City will be seen as a leader for diverting waste it is not responsible for through innovative policies and bylaws;
- Creation of new businesses which could use the diverted materials; and
- Fines could be used to fund enforcement efforts and/or new diversion programs.

6.3.4 Potential Disadvantages and Challenges

Potential disadvantages and challenges to influencing and enforcing the diversion of ICI and C&D wastes include the following:

- Businesses may see this as a burden and potentially as unnecessary City interference;
- Haulers may not be supportive of policies that mandate service levels for diversion as a requirement to haul garbage;
- Potential for new licensing requirements for haulers and processors; and
- Higher staffing needs would be required in order to ensure proper enforcement and compliance.

6.3.5 Impact to Other Operational Areas

Depending on what initiatives are implemented, Planning Division staff may need to be involved if there are changes to the permitting process and/or EPOs if there are changes to the way fines and tickets are issued. Additional staffing resources would be required in City departments which would require training on the City's C&D and ICI initiatives.

6.4 Mandatory Recycling and Enforcement of Bylaws

6.4.1 City's Current Approach

The City can issue notices and/or tickets to residents violating the bylaws. The most common offences include residents leaving a waste container on a public right-of-way for more than 24 hours and illegally dumping waste at hot spots like recycling depots. Currently, the Waste Bylaw allows the City to issue a notice for a first offence (\$100 fine), a notice for a second offence (\$200 fine), and a penalty of \$200 to \$25,000 for a third or subsequent offences. The current method to enforce the bylaw for offences such as leaving a cart out in a public right-of-way is through annual neighbourhood blitzes. Municipal bylaw inspectors (or EPOs) focus in on specific neighbourhoods over a 29-week period in order to be able to issue the three consecutive notices.

The City's current bylaws were last updated in 2004. A number of changes in the waste stream and diversion initiatives have taken place since then such as the subscription-based Green Cart program and the single-stream recycling programs. Residents currently do not have an incentive to divert waste and the landfill receives a large quantity of recyclables and organic material that could be diverted. Other potentially revenue generating materials that could be diverted such as wood waste and asphalt, are being landfilled. In 2016, approximately 22% of the waste managed by the City was diverted from disposal.

6.4.2 Description of Alternative Approaches

Many municipalities across Canada apply heavy fines and load rejections to enforce a bylaw. To achieve higher waste diversion, some municipalities have mandated participation in recycling programs in their respective waste bylaws. As part of a Mandatory Recycling Best Practices Review Report that Dillon prepared for Metro Vancouver in November 2012, ten jurisdictions that enforce mandatory recycling either at the source, at the disposal facility, or through a combination of both were reviewed. **Table 6-2** compares the different enforcement approaches taken, advantages and disadvantages and their respective diversion rates at the time of study completion.

Table 6-2: Enforcement Mechanisms in Jurisdictions with Mandatory Recycling Programs, as of November 2012

Jurisdiction Reviewed	Enforcement Mechanism	Who Enforces?	Advantages	Disadvantages	Overall Diversion Rate Achieved
Halifax Regional Municipality	<ul style="list-style-type: none"> • At the source – tagging, refusal to collect, fines for non-compliance • At the disposal facility – rejected loads returned to generating building as identified by hauler • Visits to generating buildings when identified through landfill load rejections or complaints of no recycling containers setouts 	<ul style="list-style-type: none"> • Municipal and private haulers • Landfill operators • Municipal enforcement officers 	<ul style="list-style-type: none"> • Combination of enforcement at both the source and the disposal facility • At the source enforcement allows for easy identification of generators 	<ul style="list-style-type: none"> • Higher levels of staffing required for at-source enforcement than at the disposal facility. • Because of limited staffing resources, staff focus on visiting MF and ICI buildings identified through landfill load rejections 	<ul style="list-style-type: none"> • 60% combined for SF, MF and ICI (51% SF, 66% MF/ICI)
Cape Breton Regional Municipality	<ul style="list-style-type: none"> • At the source - tagging, refusal to collect, fines for non-compliance • At the disposal facility – reject loads returned to generating building as identified by hauler 	<ul style="list-style-type: none"> • Municipal and private haulers • Landfill operators • Municipal enforcement officers 	<ul style="list-style-type: none"> • Combination of enforcement at both the source and the disposal facility • At the source enforcement allows for easy identification of generators 	<ul style="list-style-type: none"> • Higher levels of staffing required for at source enforcement than at the disposal facility. • Staff indicated there is room for improvement to enforce and ensure that all ICI buildings are recycling. 	<ul style="list-style-type: none"> • 38% all sectors (not tracked by individual sector)
City of Toronto	<ul style="list-style-type: none"> • At the source – tagging, refusal to collect • Site visits to ensure compliance • New building developments must meet requirements for service 	<ul style="list-style-type: none"> • Municipal and private haulers • Municipal enforcement officers 	<ul style="list-style-type: none"> • At the source enforcement allows for easy identification of generators • Site visits at MF buildings were regular to ensure compliance 	<ul style="list-style-type: none"> • No fine has ever been issued nor has waste collection ever been denied to single-family residents 	<ul style="list-style-type: none"> • 47% total for SF and MF (63% SF and 18% MF)

Jurisdiction Reviewed	Enforcement Mechanism	Who Enforces?	Advantages	Disadvantages	Overall Diversion Rate Achieved
City of Hamilton	<ul style="list-style-type: none"> At the source –established garbage limits, tagging, refusal to collect Site visits and follow-up letters to ensure compliance 	<ul style="list-style-type: none"> Municipal and private haulers Customer service representative Municipal enforcement officers 	<ul style="list-style-type: none"> At the source enforcement allows for easy identification of generators Site visits at SF houses were regular to ensure compliance 	<ul style="list-style-type: none"> No fine has ever been issued to a MF building as it is difficult to detect non-compliance when materials are in bags or roll off containers 	<ul style="list-style-type: none"> 49% total for SF and MF (55% SF, 21% MF)
Regional District of Nanaimo	<ul style="list-style-type: none"> At the source – established garbage limits, user pay system, tagging, refusal to collect, fines Site visits to provide information and ensure compliance At the disposal facility – notice and double tipping fee for each load 	<ul style="list-style-type: none"> Municipal and private haulers Municipal enforcement officers 	<ul style="list-style-type: none"> Combination of enforcement at both the source and the disposal facility At the source enforcement allows for easy identification of generators Garbage limits and user pay system have been effective 	<ul style="list-style-type: none"> Continuous education is essential as the turnover of staff in the local ICI sector creates a discontinuity in participation 	<ul style="list-style-type: none"> 70% total for SF, MF, ICI and C&D (55% SF - diversion rates for other sectors are unknown)

Jurisdiction Reviewed	Enforcement Mechanism	Who Enforces?	Advantages	Disadvantages	Overall Diversion Rate Achieved
City of New York	<ul style="list-style-type: none"> • At the source – random inspections, fines • Site visits are conducted when identified by random inspections or complaints to provide information and ensure compliance 	<ul style="list-style-type: none"> • Peace officers 	<ul style="list-style-type: none"> • At the source enforcement allows for easy identification of generators • Fines were proven to be effective and the regulations have been successful towards reaching diversion goals 	<ul style="list-style-type: none"> • More than just enforcement at the source may have to be implemented to ensure full compliance. • City of New York is investigating pay-as-you-throw to provide further incentives for citizens to recycle more) • Regulations have not been effective for commercial sector which could be because they are handled business-by-business through private haulers 	<ul style="list-style-type: none"> • 52% total for SF, MF and ICI (17% SF and MF, ~60% ICI)
City of San Diego	<ul style="list-style-type: none"> • At the source – random inspections, fines • Visits to provide education and assistance when sites identified as not in compliance • Fines to franchisee or recyclable materials collectors also occur • New measures phased in over two year period 	<ul style="list-style-type: none"> • Municipal enforcement officers • City Attorney's office 	<ul style="list-style-type: none"> • At the source enforcement allows for easy identification of generators • Phased in approach over two years allowed for resources to be dedicated to one sector 	<ul style="list-style-type: none"> • Higher levels of staffing required for at the source enforcement. 	<ul style="list-style-type: none"> • 68% total for SF, MF and ICI

Jurisdiction Reviewed	Enforcement Mechanism	Who Enforces?	Advantages	Disadvantages	Overall Diversion Rate Achieved
City and County of San Francisco	<ul style="list-style-type: none"> Enforcement through outreach and individual assessments when sites identified as not in compliance 	<ul style="list-style-type: none"> Municipal staff 	<ul style="list-style-type: none"> Buy-in from stakeholders (e.g., SF, MF, ICI sectors, property and building managers) was secured prior to implementing the ordinance 	<ul style="list-style-type: none"> There are no actual enforcement measures and only reliance on outreach Some residents are still not motivated to participate Suggested that increasing the cost of landfilling may create an incentive to recycle 	<ul style="list-style-type: none"> 78% total for SF, MF, ICI, gov't buildings and C&D
City of Seattle	<ul style="list-style-type: none"> At the source – tagging, refusal to collect, warning notices and fines Inspections by municipal staff at MF and ICI buildings Surcharges added to the building's annual garbage bill when not in compliance 	<ul style="list-style-type: none"> Municipal inspectors Private haulers 	<ul style="list-style-type: none"> At the source enforcement allows for easy identification of generators Enforcing the bylaw through tagging any bags not in compliance and leaving the bag behind was effective Surcharges motivated people to comply 	<ul style="list-style-type: none"> Higher levels of staffing required for at the source enforcement Surcharges added to the annual garbage bill rather than an immediate fine, which decouples the penalty from the undesirable behaviour 	<ul style="list-style-type: none"> 54% SF, MF, ICI and C&D (60% SF and MF, 70% SF, 30% MF, 59% ICI)
Metro Portland	<ul style="list-style-type: none"> Complaint driven based on employees or customers that call the local government (i.e. employee or customer calls local government to complain that there is no recycling in place) Fines for businesses that are not in compliance 	<ul style="list-style-type: none"> Metro Portland Local governments 	<ul style="list-style-type: none"> Complaint driven process allows for staff to visit only buildings that require assistance 	<ul style="list-style-type: none"> Currently no local government has implemented any enforcement actions Process relies on employees or customers to call in and make complaints 	<ul style="list-style-type: none"> 57% SF, MF, ICI, C&D

SF – Single-Family Residential ICI – Industrial, Commercial, Institutional
MF – Multi-family Residential C&D – Construction and Demolition

6.4.3 Potential Advantages and Benefits

Potential advantages and benefits of mandatory recycling include the following:

- Tagging and not collecting waste that is not in compliance has been known to change behaviour;
- Effective outreach campaigns help decrease contamination and increase participation;
- If City contracts out a collection service, the agreement could include requirements for regular enforcement of the bylaw;
- At-source enforcement (regular site visits to ensure compliance) allows for easy identification of violators;
- Issuing fines have been proven to be effective towards reaching diversion goals;
- Enforcing bylaws through tagging any bags not in compliance and leaving the bag behind has been effective at changing behaviour;
- Effective outreach campaigns are successful at increasing participation from all sectors and decreasing contamination;
- Garbage limits and user pay systems have been effective at reducing waste and increasing recycling; and
- If the City contracts out a portion or all of the collection services, the agreement could include requirements for regular enforcement of the bylaw.

6.4.4 Potential Disadvantages and Challenges

Potential disadvantages include:

- Higher levels of staffing may be required for multi-family and ICI at-source enforcement since set out is not as easy to observe as single-family waste set outs;
- Mechanisms used for compliance with mandatory recycling programs are less effective if not enforced (either through fines or providing education);
- May be challenging initially for City customers if bylaw is consistently enforced which may result in an increase in calls received at the City; and
- Occurrences of illegal dumping may increase initially and therefore, additional enforcement may be required to monitor illegal dumping activities.

6.4.5 Impact to Other Operational Areas

The ten jurisdictions that were reviewed are able to enforce and provide educational support for the mandatory recycling programs. Based on the information provided by jurisdictions, on average, mandatory recycling programs supported by education and enforcement allocate anywhere from 0.1 to 2 staff per 100,000 residents; however, it is important to note, for some jurisdictions, staff are not solely dedicated to implementing the mandatory recycling bylaw. For example, education staff may provide outreach on all solid waste management programs and initiatives or enforcement staff may also enforce other bylaws. This range also depends on the level of education and enforcement programs in place by

the respective jurisdictions. Also, note that some jurisdictions were unable to provide specific staffing numbers; therefore, the range is only based on a few jurisdictions.

6.5 Implementation of City-wide Organics Collection Program

6.5.1 City's Current Approach

In 2007, the City started a subscription based Green Cart curbside collection program to collect yard waste. The cost of subscription is \$55 on annual basis. Currently, approximately 6,300 households are enrolled for bi-weekly yard waste collection from May through October. Yard waste can also be dropped off for free by residents at the City's two compost depots. ICI facilities need to pay seasonal permit fees to allow them to drop off yard waste and non-elm tree trimmings at a compost depot.

The City encourages residents to compost their food waste via backyard composting. Approximately 39% of the single-family garbage, 44% of multi-family garbage, and 27% of the ICI garbage consists of food waste. In 2015, the City expanded the Green Cart program to allow certain food waste in their green carts. In a 2015 curbside recycling satisfaction survey, 75% of the residents indicated support of a city-wide Green Cart program.

6.5.2 Description of Alternative Approaches

Some barriers that may be preventing people from utilizing the Green Cart program include: cost, concerns with odour, pest, insects, space, inconvenience and confusion as to what materials are accepted. A study commissioned by *Bag to Earth* (April 2012) examined the impacts of paper, certified compostable plastic, biodegradable plastic and plastic bag liners on organics program performance in terms of quantity of organics collected, processing operations and quality and amount of finished compost produced (ISWMP, 2012). The study looked at organics programs across the country. Some of the findings from the study included:

- Participation and capture rates are higher in communities that collect garbage every other week, have lower garbage bag/container set out limits and bag tag charges for excessive garbage;
- Choice of liner did not significantly impact participation or capture rates in the program and the other factors mentioned above, had more influence on participation and capture rates; and
- Composting facility operators contacted expressed preference for paper bags since they compost readily in existing systems and have a residue rate of zero. They noted that certified compostable plastic bags compost more slowly than paper bags which leads to higher residue rates.

In order to maximize convenience for residences, some municipalities provide a 'kitchen catcher' - a small container which can be easily stored in the kitchen to capture food scraps. Kitchen catchers reduce the odour and insect problems associated with composting and they are easy to use (once full, residents dump contents into a bigger bin or cart located in an exterior area). Secure and animal resistant bin/carts are also effective at reducing the amount of food scraps ending up in the garbage stream since residents are often concerned that wildlife will get into the Green Cans.

Metro Vancouver

As highlighted in **Section 6.2.2**, Metro Vancouver introduced an organics disposal ban at all disposal facilities in 2015. This includes food waste and packaged food generated by all residents and businesses in the region. The overall diversion rate of Metro Vancouver in 2014 was at 61% (Metro Vancouver, 2015). Education and outreach campaigns were deemed helpful in encourage higher participation rates. Metro Vancouver developed a Love Food – Hate Waste behavioural change campaign (based on the UK's Waste and Resources Action Programme (WRAP) campaign) to support the 2015 organics ban and to reduce the quantity of wasted food. The materials developed were provided for all member municipalities' use.

The City of Surrey

The City of Surrey provided organic waste kitchen catchers (7L) to 85,500 single-family and 14,500 multi-family homes as part of their Rethink Waste Collection Program. Two years after the project initiated, the results showed a 50% drop in garbage tonnage being sent to landfill (Costanzo, 2012). The annual savings to dispose of organic waste versus garbage was estimated to be \$500,000. The program also included the integration of a three-Cart System that allows residents to choose the appropriate cart size based on their household type. The kitchen catcher and cart makes the system more user friendly and has contributed to higher participation rates resulting in less organic waste being sent to landfill.

In 2015, the City of Surrey launched a pilot program for organic waste collection in multi-family households after waste audit results indicated that waste generated in multi-family buildings was comprised of 40% organic materials. Following the pilot program the City of Surrey provided organics collection on a voluntary basis to multi-family households.

City of Richmond

In 2015, City of Richmond Council approved the expansion of the Green Cart program to provide organics recycling to multi-family complexes in anticipation of Metro Vancouver's organics disposal ban. All multi-family buildings were required to implement an organics program. If a building did not sign on to receive City collection then the City completed an inspection of the property to ensure that an organics program was in place to service building units. Participating buildings who received City collection were provided with information kits for all residents, a complimentary kitchen container and an education session in the building's lobby to educate residents.

City of Toronto

The Green Bin program was first rolled out to single-family households in the City of Toronto, starting in 2002 and completed in 2006. Toronto has been rolling out their Green Bin program to multi-family homes since 2006 (started out as a pilot program) and has seen steady increases to the multi-family sector waste diversion rate in the years since (13% diversion in 2006 and 26% diversion in 2013).

Various Canadian Municipalities

When organics collection programs (e.g., Green Bin programs) have been introduced, there has been a tendency to also shift collection frequencies for single-family households. Given that the more odorous materials are contained in organics, these are collected weekly and garbage collection moves to a bi-weekly frequency. In some cases, split collection vehicles are used where approximately a third of the compartment is used for organics and the remaining is used to alternate between garbage and single stream recyclables. Alternatively, one collection truck could be used for garbage collection and another split collection vehicle could have a third organics and the remainder alternating between dual stream recyclables (e.g., fibres, containers). Examples of municipalities that have moved to such collection measures include: The Cities of Surrey, Nanaimo and Toronto, and the Regions of Durham, Halton and Peel.

6.5.3 Potential Advantages and Benefits

The potential advantages and benefits of implementing City-wide organics collection program include the following:

- Diverts a significant portion of the waste stream from disposal and therefore reduces associated greenhouse gas impacts;
- Offers the greatest increase to the City's residential diversion rate;
- Extends the life of the landfill by diverting a significant quantity of waste sent for disposal;
- Provision of standard carts (with animal resistant latches) and/or kitchen catchers can alleviate potential barriers to participate. Delivery of the containers could provide an important touch point with residents and offer the opportunity for enhanced one-on one education;
- Creates a compost product that could be given back to residents or used for City projects.
- Enhanced education and subsidized composter sales to promote backyard composting throughout residential areas of Saskatoon. This in turn could result in less yard and select food (e.g., non-meat and dairy items only) waste for the City to manage in the waste streams and may be more convenient than the organics program for some residents; and
- Accompanied with an organics disposal ban, residents may be more encouraged to participate in the program.

6.5.4 Potential Disadvantages and Challenges

The potential disadvantages and challenges of implementing City-wide organics collection program include the following:

- Depending on how the City structures the payment for this new program, an increase in waste collection costs could be a barrier as currently garbage collection is viewed as "free";
- Resistance from residents to participate in the program because of perceived barriers (e.g., odour concerns, pests, space requirements);
- Capital costs for the provision and ongoing maintenance of standard carts and/or kitchen catchers;

- High staffing requirements leading up to and at program implementation for promotion and education, coordination of cart and kitchen catcher tender and delivery and an increase in customer calls received by the City; and
- If the program is optional, participation rates may be low. It is recommended to make the organics collection program mandatory for all residents and potentially the ICI sector.

6.5.5 Impact to Other Operational Areas

A comprehensive education and outreach campaign would be required to address perceived barriers preventing participation in the Green Cart program. Bylaw amendments and associated enforcement mechanisms would need to be completed for mandatory participation in the program. Customer service telephone lines may be inundated with calls leading up to and at the start of program implementation.

6.6 Data Management – Alternative Technologies

6.6.1 City's Current Approach

Each of the City's carts has a Radio-Frequency Identification (RFID) tag which allows for the City to link carts with owners. RFID tags are like barcodes that can transmit its identifying numbers as a radio signal making it not necessary to see an RFID tag. Small readers placed on the City's vehicles can automatically detect and read the RFID tags when the carts are tipped. Data is recorded from the active RFID tag to the reader.

Through the City's Garbage Verification project, the City was able to estimate the garbage collected from each route using the RFID tags, which assisted the City with optimizing the 94 waste collection routes. However, during the stakeholder interviews with City staff it was indicated that the City is having issues with carts getting mixed up among the houses (particularly in back lanes and cul-de-sacs), which in turn results in inaccurate data. Another challenge is with collecting waste from back lanes and how the GPS system identifies back lanes as one street instead of the two streets that share the back lane. The City is interested in identifying various alternative technologies for future pay-as-you-throw options and as such, modifications to the current RFID tags may be required.

6.6.2 Description of Alternative Approaches

On an increasing basis, jurisdictions around the world are using new and modern technology for more efficient container management, such as live tracking of waste, recycling and/or organic waste container volumes, to better manage collection needs in the residential and ICI sectors. RFID tags are gaining popularity as a method for tracking waste performance and improving waste collection services.

The use of intelligent waste compactors on waste containers which have sensors to alert when the containers are full or highly odorous allow for collection routes to be altered to collect from only full containers. These are more commonly used in public spaces but can be applied to multi-family buildings for various waste streams. One example is the Enevo system which has two components: 1) A bin

sensor, which is placed in a container to collect data, and 2) a server with software designed to analyze and report data collected by the sensor. The Enevo bin sensor is installed on waste receptacles and wirelessly transmits data to the Enevo server. The sensor can be installed in/on any receptacle for any type of waste stream (solids and liquids). The technology senses the volume of the receptacle by sending a 'wave' to the surface of the waste and measuring the return travel distance. Data is sent to the Enevo Server where real-time information (including abnormal events *e.g.*, fire or receptacle removal) can be accessed. Data is analyzed to provide optimized collection routes and all of the information is available by the user in real-time. Additionally, information from the Enevo server can be integrated into the majority of fleet management systems. As Enevo offers an ongoing service, the cost is a subscription based on the number of sensors.

Waste tracking technologies could be used with existing and new carts/bins to provide data and statistics for each customer such as waste generation rates, weight of materials collected and/or diversion rates and potentially further optimize collection frequency thereby reducing the number of collection trips in a given week. Data obtained can be used to target education campaigns and incentivize waste diversion efforts.

Monroe County, Mississippi

Monroe County rolled out RFID tagged carts to each household on their official customer list. Each household is assigned a specific bin and the given RFID tag corresponds to each household. Every single lift from the waste collector is recorded making it easier to identify bagged garbage and to know which customers do not have a cart and are not paying for service.

Peachtree and Alpharetta, Georgia

Peachtree and Alpharetta use RFID technology to track the weight of their waste and recyclables. This information was used to incentivize households to recycle through a rewards program.

Region of Peel, Ontario

The Region of Peel implemented a RFID system for waste collection reporting at multi-family residential buildings in 2013. The Region intends to track building-specific data such as weights of waste collected and diversion rates.

City of Kirkland, Washington

Recently, the City of Kirkland, Washington piloted the Enevo technology with sensor installations on ten receptacles at City Hall and the Justice Centre. The total savings amount was \$9,650 per year, through route optimization and receptacle elimination. A second pilot at Tufts University (Medford, Massachusetts), in partnership with Save that Stuff Incorporated was recently completed. Enevo bin

sensors were installed at five locations across campus. Results led to a total collection schedule from 11 times per week, on average, to seven per week, with an estimated cost savings of 45%.

Tufts University and Save That Stuff, Massachusetts

Tufts University rolled out the Enevo technology at five locations on campus to see if by reducing the number of pickups the overall collection costs would be reduced. The two month 2014 pilot program saw a reduction from 11 collections per week to 6.5 collections per week and a monthly savings of approximately 45%. The university is planning to expand the use of this technology campus-wide. The technology uses wireless sensors to measure and forecast the fill level of waste containers and automatically generates smart collection schedules and routes that can be accessed on wireless cellular devices.

6.6.3 Potential Advantages and Benefits

Some of the potential advantages and benefits of using alternative technologies include the following:

- Can provide building-specific data on waste management performance (e.g., quantities collected, building specific performance rates) and increase the accessibility for on-demand billing information;
- Allows for the City to monitor waste material generation. As a result the City may be able to geographically target education campaigns and/or provide building managers with access to data on their building performance;
- Reduction in collection costs (less trucks, fuel, labour) and traffic congestion associated with standard waste collection routes and schedules); and
- Real-time optimized collection routes that collect from only containers that are full.

6.6.4 Potential Disadvantages and Challenges

Potential disadvantages and challenges of using alternative technologies include the following:

- Capital costs to purchase, distribute and place technology on collection (e.g., RFID tags/chips, GPS geo-coding positioning, sensors) on collection containers;
- Capital costs for equipment and distribution on waste collection vehicles (or make as a requirement in a collection contract);
- Installation/start-up costs to implement the program;
- Operating costs for maintenance and any subscription fees for sensors;
- The technology is still relatively new;
- There is reliance on external cloud-based platform to manage data and automatic collection routing;
- Utility rates will need to be monitored as they may be impacted by decreased waste set out;
- Procurement of technology will need to be completed together with corporate information and technology;

- Staff time required to input collection container, scheduling and routing information into database; and
- Training waste collection drivers on how to use the system where required.

6.6.5 Impacts to Other Operational Areas

The City could require that a technology be used at properties that receive collection either through the City (through municipal or private collection forces) or become a future requirement for one or all sectors within the City. In the cases where City bins already have an RFID tag, a staff member may need to ensure that each tag is matched up to the household that it is registered to in the City's database.

6.7 Litter & Illegal Waste Management

6.7.1 City's Current Approach

The Waste Bylaw states that no waste shall be placed or disposed of in a place that is not a waste container or a Provincially-approved Waste Management Centre. However, during the stakeholder interviews, City staff indicated that litter and illegal waste is dumped at the City's unstaffed recycling depots.

6.7.2 Description of Alternative Approaches

Dillon recently developed several litter and illegal waste management strategies. As part of the strategy development, several jurisdictions that had implemented their own programs that focused on preventative versus reactive strategies for education, infrastructure and enforcement were reviewed. While each of the jurisdictions had implemented different programs, there were many commonalities between them that made them successful with their preventative strategies. A successful litter and illegal waste management strategy should include a combination of the following strategies:

Education

- **Community education:** Success comes from educating people, engaging with them, and working collaboratively with local groups to raise awareness. There is more success with this than surveillance activities which are timely and costly. Work with stakeholder groups to establish a practice of "observe, record, and report" that will help identify problem areas for illegal waste and assist with enforcement.
- **Community engagement:** Buy-in and collaboration with restaurants, brand owners, non-profits, service groups, outdoor groups, community colleges with environmental programs, as well as City staff and councillors - in the form of a task force or alliance is critical for potential funding and volunteering as well as 'brainstorming' effective solutions. Community groups, such as Business Improvement Districts, could be informed about illegal waste and litter in their areas through being supplied with information from their respective communities.
- **Campaigns:** Catchy slogans and temporary signage can also raise awareness, specifically when the slogans are bold e.g., "Don't trash Toronto", "Be a litter legend – put your rubbish in the bin",

“Illegally dumped rubbish under investigation”. RDN uses “Illegal – Offensive - Expensive – THIS IS A CRIME”. Signs should be posted at frequent illegal waste sites to educate the public on reporting and persecuting dumpers. Signs could be made available to municipalities; businesses could buy at cost. Movable signs can be considered to allow for a feeling of surveillance.

Infrastructure

- **Staffing:** Dedicated staff (full time) for surveillance and bylaw enforcement/follow-up is critical to program success. Staff also work on prevention and education as well as enforcement activities.
- **Infrastructure:** Improved and more frequent collections and an increase in garbage and recycling receptacles can reduce overflowing receptacles from becoming sources or magnets for more litter. Receptacles with an option for cigarette butt disposal have worked elsewhere.

Enforcement

- **Bylaw enforcement:** Litter and illegal waste bylaws are enforced and charges are laid against offenders. Bylaw language is reworded so that it is harder for offenders to claim that they are not responsible for litter and illegal waste. Establish a bylaw that makes the generator of waste responsible for its proper disposal.
- **Reporting:** Each of the reviewed jurisdictions has a specific number that the public can phone to report litter and illegal waste. Many jurisdictions also have a website for reporting (a telephone ‘app’ is ideal in today’s smartphone savvy world). Following up with the member of the public who has phoned in the complaint to let them know what actions were taken lets the public know that something actually happens when a complaint is made.
- **Responsibility:** Putting the responsibility back on the violator can be effective; however, this requires more investigating which also requires additional staffing resources.

City of Hamilton

In 2007, City of Hamilton started experiencing an increase in littering due to the implementation of a one container limit of curbside garbage collection for single-family households. The City has a population of over half a million located within a 1,117 km² city. In 2012, the City initiated a pilot project using surveillance equipment such as cameras, cellular devices, and electronic tools that were installed across the City. Four part-time staff were hired for surveillance, however, one enforcement officer is the only member that can issue a violation ticket.

The enforcement officer can issue a fine of \$610 or issue a summons where the violator must attend court with the Justice of the Peace. The violator can either choose to pay or choose an early resolution where the City Prosecutor can negotiate. Fines are typically \$750 and if summoned, can be up to \$10,000. If the violator does not pay directly, the unpaid fines can be added onto their property taxes.

In 2015, the City also amended the Yard Maintenance Bylaw to include a minimum \$500 fine for illegal waste, plus residents who were caught dumping residential waste into City receptacles can be fined \$125.

Since the start of the program, the City issued “Orders to Comply” to over 100 households for education purposes, and has laid 70 charges totaling between \$15,000 and \$20,000. The City has noticed that the hot spots have diminished but there is now more dumping in parks. As a result, parks became the focus of illegal waste with additional assistance on surveillance by parks students.

Metropolitan Portland, Oregon

Since 1993 Metro’s Regional Illegal Dumping (RID) Patrol has been tackling the problem of illegal waste by cleaning up dump sites, investigating evidence found at each site, issuing citations to violators, and working with local law enforcement agencies to educate people and help them reduce dumping in their neighbourhoods. Residents are encouraged to watch for and report illegal waste. Metro work crews tag bulky illegally dumped waste (e.g., mattresses, furniture) with bright orange weather-proof tags which are intended to raise awareness, warn violators, and engage the community in reporting illegal waste. After being tagged by Metro work crews if the item has not been removed within a week the item(s) is collected and disposed of properly. The program cleans up more than 2,000 illegally dumped items per year.

When RID Patrol approach violators who they have been able to find based on contact information left in the waste, typically the violator either blames a third party for stealing their garbage or indicates that they paid someone to haul it to the landfill. Metro believes that much of the illegal waste is conducted by small, private waste haulers and consequently has taken to warning residents about the risk of using “freelance” haulers. If the haulers are found then they are cited. If the haulers do not exist then the citations go to the original owner of the garbage. Violators are fined up to \$500 plus the cost of clean-up and disposal. Three weeks are provided to make a payment plan or to schedule an administrative hearing. Between 2008 and 2011 approximately 200 citations for a total of more than \$72,000 was written. Less than half of the fees are collected by Metro as most are recovered by a collection agency.

Overall, the program costs taxpayers approximately \$500,000 a year. Disposal costs have decreased from having more violators dispose of their own illegally dumped materials, yet the costs of road crews has remained the same and illegal waste incidents have not decreased. Staff feel this is only because a site can be labelled an ‘incident’ even if it is simply one illegally dumped tire. Additionally, staff reported the overall amount of dumped material not being recovered by the ‘dumper’ is decreasing.

Tagging illegally dumped materials results in the removal of 45% of items annually and is presumed to be from the person who illegally dumped it. In addition, after the items were tagged there was an upsurge in calls to Metro from people with information about the item or the violator. Each year, program detectives track down approximately 60 small-time violators imposing \$500 fines plus the cost of the clean-up and disposal.

6.7.3 Potential Advantages and Benefits

Some of the potential advantages of a litter and illegal waste management strategy include the following:

- Reduction in litter and illegal waste. Measurement of reduction can occur through regular litter audits and/or measurement of collected litter;
- Strategies are more successful when there is community engagement, specifically a strategy that is created 'with' and not 'for' stakeholders. Continuing to involve stakeholders will contribute to buy-in and a 'made-for' City strategy;
- Education programs could increase knowledge of existing programs, what is acceptable in each program, and where materials can be dropped off. Effective outreach campaigns can bring awareness to litter and illegal waste management and educate the public. The advantage to the City is creating a more conscious environmental cultural where residents might understand the importance of properly managing waste and feel empowered to make personal changes;
- Having a number of ways for the public to report offenders such as social media and a dedicated phone number may catch more offenders in the act; and
- Enforcement staff must be full-time which allows for the person to become known to the public as the face for illegal waste. The public may become more willing to report violations and violators to this individual.

6.7.4 Potential Disadvantages and Challenges

Potential disadvantages and challenges of implementing a litter and illegal waste strategy include the following:

- Cost associated with any education campaign and/or public outreach;
- Start-up costs with implementing a hotline/social media and ongoing costs with managing and following up with violators and callers;
- Fines and tickets typically do not cover the staff time associated with administering the fine/ticket, especially if the City is required to go to court;
- Staff time and associated costs required to manage litter and illegal waste management strategy;
- Surveillance efforts can be extremely time and labour intensive with limited success. Additionally, thieves may steal surveillance equipment if it is not hidden;
- Once illegal dumping "hot-spots" are cleaned up or signage is in place the dumping may move to other City areas;
- Low level education campaigns and a reactive approach to enforcing illegal waste has not been successful; and
- City may need to amend its bylaw to include a section on littering and impose heavy fines for violation.

6.7.5

Impact to Other Operational Areas

Success comes from educating people, engaging with them and working collaboratively with local groups to raise awareness. The City should ensure that there is buy-in and collaboration with businesses, brand owners, non-profit organizations, service groups, community colleges, City staff and councillors, and neighbouring municipalities throughout the implementation of a strategy. It will also be important for the City to engage local private landfills operators and haulers. Working with stakeholder groups to establish a practice of “observe, record and report” will help identify problem areas for illegal waste and assist with enforcement. The City should focus on education as a primary component of any strategy. This may also include training sessions with EPOs on the City’s programs that they can refer to onsite and/or provide to residents for easy reference. Additional City resources would be required to develop promotional materials and signage, deliver outreach materials, discuss the program with the public and complete litter audits/blitzes.

7.0 Development of Diversion Plan Components

7.1 Criteria Development

In **Section 4.0** (Needs Assessment), a long-list of potential recommended actions was developed based on findings from the background review, the 2016 Waste Characterization Study and the consulting team's experience. The next step was to rank the long-list of candidate actions in order to form a short-list and/or to indicate priority for implementation. A draft list of scoring criteria and suggested weightings were prepared and sent to the City for review. Upon receiving feedback, the scoring criteria and corresponding weightings were finalized (**Table 7-1**) and applied to the long-list of candidate actions. At the indicator level, a scoring system was established that corresponds to being the least to most preferred. In all cases, a score of "1" would indicate the least preferred outcome (e.g., highest costs, no impact to diversion). Aside from the indicator "position on the waste hierarchy" (whose rating is based on the 5Rs – reduce, reuse, recycle, recover, residual), a score of "2" would indicate moderate outcomes and a score of "3" would indicate the most preferred outcome (e.g., lowest costs, easy to implement into the existing system).

Table 7-1: Final Scoring Criteria and Weighting

Category	Weighting	Indicators	Indicator Scoring (least preferred to most preferred)
Environmental	30%	<ul style="list-style-type: none"> • Diversion impact • Position on the waste hierarchy 	<ul style="list-style-type: none"> • 1 to 3 • 1 to 5
Social/Legal	20%	<ul style="list-style-type: none"> • Political and community acceptability • Obligatory action to meet regulations or agreements 	<ul style="list-style-type: none"> • 1 to 3 • 1 to 3
Financial	30%	<ul style="list-style-type: none"> • Relative capital cost • Relative operating cost 	<ul style="list-style-type: none"> • 1 to 3 • 1 to 3
Operational	20%	<ul style="list-style-type: none"> • Compatibility with existing systems • Complexity/risk (contractual, schedule, innovation) 	<ul style="list-style-type: none"> • 1 to 3 • 1 to 3

It is noted that the criteria category "Financial" is limited to the relative capital and operating costs to implement and maintain the option. It does not include viability or funding structure.

7.2 Ranking of Candidate Action Items

The consulting team applied scores to the indicators described above. The highest possible overall score an option could receive is 3.3.

Table 7-2 presents the results of the evaluation as well as the overall ranking of each action (the red shaded cells notes the top 10 ranked actions). The highest score given was 3.0 (increased promotion and education to reduce waste) and the lowest was 1.8 (identify the preferred collection method). It is recommended to carry forward all 21 actions into the Waste Diversion Plan as most actions are linked together to ensure success in implementation.

7.3 Forecasted Waste Diversion Plan Performance

To establish an overall estimated diversion rate resulting from the implementation of the recommended actions presented in this report, the study team had to combine two sets of data for the three generating sectors (single-family, multi-family and ICI);

1. Estimated levels of diversion, by kilogram and by waste category, associated with the City's current (2016) programs; and
2. Estimated levels of diversion, by kilogram and by waste category, associated with recommendations included in the Draft Waste Diversion Plan.

Consistent with the 2016 garbage stream characterization effort, eight waste categories were selected for the data consolidation effort;

- All recyclables;
- All non-recyclables;
- Food waste;
- Yard and garden waste (YGW);
- Construction and demolition (C&D) debris;
- Waste electrical and electronic equipment (WEEE);
- Household Hazardous Waste (HHW); and
- Other materials.

Table 7-2: Results and Ranking of Candidate Action Items

No.	Category	Action	Rationale	Environmental			Social/Legal			Financial			Operational			Overall Score	Overall Ranking
				Diversion Potential	Position on Waste Hierarchy	Total Environmental Score	Political and community acceptability	Obligatory Action to Meet Anticipated Regulations and Agreements	Total Social / Legal Score	Relative Capital Cost	Relative Operating Cost	Total Financial Score	Compatibility with Existing System	Complexity / Risk	Total Operational Score		
1	1. System Governance and Management	Modify approach to financing the solid waste management system through options like user pay and a utility.	Best Practice (6.1)	3	5	4	2	1	1.5	3	2	2.5	2	2	2	2.65	8
2	1. System Governance and Management	Mandate source separation of C&D waste and have timing coincide with opening of Recovery Park. Develop necessary education/promotion required prior to Recovery Park C&D processing facility opening.	Best Practice (6.3)	3	3	3	3	3	3	3	3	3	2	3	2.5	2.9	3
3	1. System Governance and Management	Implement disposal bans and measures as tools to increase diversion from all sectors on a material by material basis with timing coinciding with having processing capacity in place (start with materials to be handled through Recovery Park).	Best Practice (6.2)	3	5	4	1	2	1.5	2	2	2	1	1	1	2.3	11
4	1. System Governance and Management	City to influence and/or enforce diversion of ICI and C&D waste at the front end (e.g., through building permits).	Best Practice (6.3)	2	3	2.5	2	2	2	3	2	2.5	1	1	1	2.1	17
5	1. System Governance and Management	Define additional Key Performance Indicators (KPIs) that could be used to measure success of waste management system such as kg of waste disposed per person.	Project Team Experience	1	3	2	3	3	3	3	3	3	3	3	3	2.7	5
6	1. System Governance and Management	Implement different methods of enforcement for residential sector that makes best use of City resources (e.g., issuing 1 notice instead of 2). Reasons for ticketing will change with new programs and policies in place.	Best Practice (6.4)	2	3	2.5	2	3	2.5	3	2	2.5	3	2	2.5	2.5	9
7	1. System Governance and Management	Update the Waste Bylaw. Recommended actions that will impact the Waste Bylaw include mandatory source-separation of C&D materials, mandatory participation in the curbside organics collection program and potentially requiring ICI sector to report on waste quantities (Condition #48).	Best Practice (6.4)	3	3	3	2	2	2	3	3	3	2	3	2.5	2.7	7

Table 7-2: Results and Ranking of Candidate Action Items

No.	Category	Action	Rationale	Environmental			Social/Legal			Financial			Operational			Overall Score	Overall Ranking
				Diversion Potential	Position on Waste Hierarchy	Total Environmental Score	Political and community acceptability	Obligatory Action to Meet Anticipated Regulations and Agreements	Total Social / Legal Score	Relative Capital Cost	Relative Operating Cost	Total Financial Score	Compatibility with Existing System	Complexity / Risk	Total Operational Score		
8	1. System Governance and Management	Select an option(s) to reduce illegally dumped waste and implement a pilot program at the hot spots such as the recycling depots. The City could also consider implementing a seasonal curbside bulky waste collection to help mitigate illegal dumping occurrences.	Best Practice (6.7)	1	1	1	3	3	3	3	2	2.5	3	3	3	2.25	12
9	2. User Education and Awareness	Implement promotion and education about ways to reduce waste. Example topics include reducing food waste, grasscycling and reducing waste during holidays.	Project Team Experience	1	5	3	3	3	3	3	3	3	3	3	3	3	1
10	2. User Education and Awareness	Refine and validate P&E efforts to launch potential new programs and improve existing programs (e.g., reduce contamination in recycling stream) which can include targeted development and distribution of education materials based on demographics.	Project Team Experience	1	5	3	3	3	3	3	3	3	3	3	3	3	1
11	2. User Education and Awareness	Standardize signage and symbols throughout the City and continue for use at new facilities and in promotion and education (P&E) materials.	Project Team Experience	2	3	2.5	3	3	3	2	3	2.5	3	3	3	2.7	5
12	3. Reuse and Recycling	Have the layout of Recovery Park be user friendly and efficient for a user to drop-off their waste for diversion and/or disposal (e.g., look at the traffic flow and number of times a car needs to be weighed). Consider allowing free drop-off of materials that the City wants to either sell to markets or for safe disposal (e.g., HHW, C&D, recyclables, scrap metal).	Project Team Experience	2	3	2.5	3	3	3	3	3	3	2	3	2.5	2.75	4
13	3. Reuse and Recycling	Have standardized public space recycling bins tying the logos to curbside programs.	Project Team Experience	1	3	2	3	2	2.5	2	3	2.5	2	2	2	2.25	12
14	3. Reuse and Recycling	Following a review of options, establish a permanent HHW depot(s) that are staffed at existing City waste facilities or partnerships with HHW recycling/disposal providers.	Project Team Experience	1	3	2	2	3	2.5	2	2	2	3	2	2.5	2.2	14
15	3. Reuse and Recycling	Develop a green procurement policy to increase beneficial reuse of waste. Proper funding should be addressed through the utility option (taken care of in Action No. 1).	Project Team Experience	1	4	2.5	2	3	2.5	3	3	3	1	2	1.5	2.45	10

Table 7-2: Results and Ranking of Candidate Action Items

[illegible]

To allocate the 2016 diverted material quantities (tonnes) to the eight categories along with a generating sector, assumptions were developed (in consultation with City staff) regarding the origin of select materials, including those arriving at recycling and compost depots. This allocation of diverted waste quantities modified the waste characterization for the three sectors as the focus of the 2016 Waste Characterization Study was on the garbage (residual) stream. When the study team was assessing the revised characterization, anomalies were identified, particularly in the single-family waste stream such as a low composition of food waste (about 20% when it is typically 25-35%) as well as high percentages of yard and garden waste and C&D materials. To address these anomalies, the study team made refinements to the estimated “as-generated” quantities, bringing Saskatoon’s estimates in line with typical values from other relevant jurisdictions.

Prior to forecasting the impacts of the recommended actions from the Waste Diversion Plan, the current participation and capture rates were estimated and validated against the 2016 waste diversion data. The same waste composition described above was used and then the per capita waste diverted in 2016 was calculated using 2016 waste tonnages and population data. Then the corresponding participation and recovery rates were applied that led to the per capita waste diverted data. This served as the starting point for forecasting future quantities of waste.

The calculation of the future estimated incremental diversion resulting from the implementation of the recommended actions focused specifically on the materials identified in the garbage stream during the 2016 characterization program. Assuming staged implementation of the recommended actions, an associated *participation rate* (percentage of generators who regularly participate in the diversion effort) and *capture efficiency* (the percentage of the time that a participant segregates the material correctly) was defined for each generating sector and each of the eight waste categories. With a participation rate and capture efficiency established (combining to provide a *cumulative recovery rate*), the team was able to calculate the future tonnages of diverted materials for the eight categories for single-family, multi-family and ICI generators.

For forecasting purposes, and linked to the proposed development of Recovery Park, two milestone years (2023 and 2027) were selected to evaluate diversion performance in the future. 2023 was selected as it is in line with the timeline of the City’s goal to achieve 70% diversion and 2027 to represent the end of the 10-year planning period. It was assumed that all three phases of Recovery Park, including the establishment of an organics processing facility, would be in place by 2020 with the organics collection program starting in 2021. By 2023, the majority of actions will be implemented. By 2027, the actions will have been operating for five years. The results of the 2023 and 2027 forecasting are presented in **Table 7-3** and reflect the material recovery rates at the initial stages of program development and after five years of implementation.

Table 7-3: Forecasted Diversion Plan Performance (2017, 2023 and 2027)*

*: incremental over current (2017) levels of diversion

Year: 2017

Waste Composition / Generation Rates (As-Generated Waste Stream (diverted plus garbage bag audit data)). Assumption: No diversion from garbage stream.

Waste Generation Rate (Single Family - Residential) (kg/person/year)				Waste Generation Rate (Multi-Family Residential) (kg/person/year)				Waste Generation Rate (ICI) (kg/person/year)			
361.3				237.9				1367.0			
2017 Tonnes Generated*: 72,818				2017 Tonnes Generated: 15,981				2017 Tonnes Generated: 160,224			
2017 Population (Total): 268,700				2017 Population (Total): 268,700				2017 Working Population: 117,210			
% of SF in population: 0.75				% of MF in population: 0.25							

MATERIAL	RESIDENTIAL - SINGLE FAMILY							RESIDENTIAL - MULTI FAMILY							ICI						
	WASTE PERCENTAGE BREAKDOWN (1)	PARTICIPATION RATE (2)	CAPTURE EFFICIENCY (3)	CUMULATIVE RECOVERY RATE (4)	Waste Generated	Waste Diverted	Waste Disposed	WASTE PERCENTAGE BREAKDOWN (1)	PARTICIPATION RATE (2)	CAPTURE EFFICIENCY (3)	CUMULATIVE RECOVERY RATE (4)	Waste Generated	Waste Diverted	Waste Disposed	WASTE PERCENTAGE BREAKDOWN (1)	PARTICIPATION RATE (2)	CAPTURE EFFICIENCY (3)	CUMULATIVE RECOVERY RATE (4)	Waste Generated	Waste Diverted	Waste Disposed
	(by weight)				(kg/capita)			(by weight)				(kg/capita)			(by weight)				(kg/capita)		
1 All Recyclables	23.78%	85.00%	80.00%	68.00%	85.9	58.4	27.5	27.04%	60.00%	75.00%	45.00%	64.3	28.9	35.4	21.30%	0.00%	0.00%	0.00%	291.2	0.0	291.2
2 All Non-Recyclables	5.81%	0.00%	0.00%	0.00%	21.0	0.0	21.0	11.05%	0.00%	0.00%	0.00%	26.3	0.0	26.3	24.98%	0.00%	0.00%	0.00%	341.4	0.0	341.4
3 Food Waste	19.56%	2.00%	40.00%	0.80%	70.7	0.6	70.1	31.01%	0.00%	0.00%	0.00%	73.8	0.0	73.8	25.82%	0.00%	0.00%	0.00%	352.9	0.0	352.9
4 Yard Waste	33.11%	40.00%	85.00%	34.00%	119.6	40.7	79.0	4.17%	0.00%	0.00%	0.00%	9.9	0.0	9.9	4.05%	90.00%	95.00%	85.50%	55.4	47.4	8.0
5 C&D	5.19%	0.00%	0.00%	0.00%	18.8	0.0	18.8	1.38%	0.00%	0.00%	0.00%	3.3	0.0	3.3	5.79%	0.00%	0.00%	0.00%	79.1	0.0	79.1
6 WEEE	0.54%	0.00%	0.00%	0.00%	1.9	0.0	1.9	1.26%	0.00%	0.00%	0.00%	3.0	0.0	3.0	0.57%	0.00%	0.00%	0.00%	7.8	0.0	7.8
7 HHW	0.71%	20.00%	80.00%	16.00%	2.6	0.41	2.2	0.58%	10.00%	80.00%	8.00%	1.4	0.11	1.3	0.15%	0.00%	0.00%	0.00%	2.1	0.0	2.1
8 Other Materials	11.30%	3.00%	50.00%	1.50%	40.8	0.6	40.2	23.51%	1.00%	40.00%	0.40%	55.9	0.22	55.7	17.35%	0.00%	0.00%	0.00%	237.1	0.0	237.1
Total	100.00%				361.3	100.7	260.6	100.00%				237.9	29.3	208.6	100.00%				1367.0	47.4	1319.6

G: Garbage
Rc: Recyclable
Or: Organics
YGW: Yard and Garden Waste
C&D: Consutruction and Demolition

Material Type Totals (SF - Residential)	R	66.3	1.0	65.3
	Rc	85.9	58.4	27.5
	Or	70.7	0.6	70.1
	LGW	119.6	40.7	79.0
	C&D	18.8	0.0	18.8

361.3 100.7 260.6
27.9%

Material Type Totals (MF - Residential)	R	86.6	0.3	86.3
	Rc	64.3	28.9	35.4
	Or	73.8	0.0	73.8
	YGW	9.9	0.0	9.9
	C&D	3.3	0.0	3.3

237.9 29.3 208.6
12.3%

Material Type Totals (ICI)	G	588.4	0.0	588.4
	Rc	291.2	0.0	291.2
	Or	352.9	0.0	352.9
	YGW	55.4	47.4	8.0
	C&D	79.1	0.0	79.1

1367.0 47.4 1319.6
3.5%

*Used 2016 Waste Characterization Audit data as starting point for 2017 (+1%)

Table 7-3: Forecasted Diversion Plan Performance (2017, 2023 and 2027)*

*: incremental over current (2017) levels of diversion

Year: 2023

Waste Generation Rate (Single Family - Residential) (kg/person/year)								Waste Generation Rate (Multi-Family Residential) (kg/person/year)							Waste Generation Rate (ICI) (kg/person/year)						
382.3								251.7							1451.1						
RESIDENTIAL - SINGLE FAMILY								RESIDENTIAL - MULTI FAMILY							ICI						
MATERIAL	WASTE PERCENTAGE BREAKDOWN (1)	PARTICIPATION RATE (2)	CAPTURE EFFICIENCY (3)	CUMULATIVE RECOVERY RATE (4)	Waste Generated	Waste Diverted	Waste Disposed	WASTE PERCENTAGE BREAKDOWN (1)	PARTICIPATION RATE (2)	CAPTURE EFFICIENCY (3)	CUMULATIVE RECOVERY RATE (4)	Waste Generated	Waste Diverted	Waste Disposed	WASTE PERCENTAGE BREAKDOWN (1)	PARTICIPATION RATE (2)	CAPTURE EFFICIENCY (3)	CUMULATIVE RECOVERY RATE (4)	Waste Generated	Waste Diverted	Waste Disposed
	(by weight)				(kg/capita)			(by weight)				(kg/capita)			(by weight)				(kg/capita)		
1 All Recyclables	23.78%	90.00%	85.00%	76.50%	90.9	69.6	21.4	27.04%	65.00%	75.00%	48.75%	68.1	33.2	34.9	21.30%	60.00%	80.00%	48.00%	309.1	148.4	160.7
2 All Non-Recyclables	5.81%	0.00%	0.00%	0.00%	22.2	0.0	22.2	11.05%	0.00%	0.00%	0.00%	27.8	0.0	27.8	24.98%	0.00%	0.00%	0.00%	362.4	0.0	362.4
3 Food Waste	19.56%	50.00%	50.00%	25.00%	74.8	18.7	56.1	31.01%	20.00%	50.00%	10.00%	78.1	7.8	70.3	25.82%	30.00%	60.00%	18.00%	374.6	67.4	307.2
4 Yard Waste	33.11%	60.00%	85.00%	51.00%	126.6	64.6	62.0	4.17%	10.00%	50.00%	5.00%	10.5	0.5	10.0	4.05%	90.00%	95.00%	85.50%	58.8	50.3	8.5
5 C&D	5.19%	40.00%	80.00%	32.00%	19.9	6.4	13.5	1.38%	20.00%	60.00%	12.00%	3.5	0.4	3.1	5.79%	70.00%	80.00%	56.00%	84.0	47.0	37.0
6 WEEE	0.54%	30.00%	80.00%	24.00%	2.0	0.5	1.6	1.26%	30.00%	80.00%	24.00%	3.2	0.8	2.4	0.57%	50.00%	80.00%	40.00%	8.2	3.3	4.9
7 HHW	0.71%	30.00%	90.00%	27.00%	2.7	0.7	2.0	0.58%	20.00%	80.00%	16.00%	1.5	0.2	1.2	0.15%	30.00%	90.00%	27.00%	2.2	0.6	1.6
8 Other Materials	11.30%	20.00%	50.00%	10.00%	43.2	4.3	38.9	23.51%	20.00%	50.00%	10.00%	59.2	5.9	53.3	17.35%	30.00%	60.00%	18.00%	251.7	45.3	206.4
Total	100.00%				382.3	164.7	217.6	100.00%				251.7	48.8	202.9	100.00%				1451.1	362.3	1088.8

G: Garbage
Rc: Recyclable
Or: Organics
YGW: Yard and Garden Waste
C&D: Construction and Demolition

Material Type Totals (SF - Residential)	G	70.2	5.5	64.6
	Rc	90.9	69.6	21.4
	Or	74.8	18.7	56.1
	YGW	126.6	64.6	62.0
	C&D	19.9	6.4	13.5
		382.3	164.7	217.6
				43.1%

Material Type Totals (MF - Residential)	G	91.6	6.9	84.7
	Rc	68.1	33.2	34.9
	Or	78.1	7.8	70.3
	YGW	10.5	0.5	10.0
	C&D	3.5	0.4	3.1
		251.7	48.8	202.9
				19.4%

Material Type Totals (ICI)	G	624.6	49.2	575.4
	Rc	309.1	148.4	160.7
	Or	374.6	67.4	307.2
	YGW	58.8	50.3	8.5
	C&D	84.0	47.0	37.0
		1451.1	362.3	1088.8
				25.0%

Table 7-3: Forecasted Diversion Plan Performance (2017, 2023 and 2027)*

*: incremental over current (2017) levels of diversion

Year: 2027

Waste Generation Rate (Single Family - Residential) (kg/person/year)								Waste Generation Rate (Multi-Family Residential) (kg/person/year)							Waste Generation Rate (ICI) (kg/person/year)						
396.8								261.3							1510.0						
MATERIAL	RESIDENTIAL - SINGLE FAMILY							RESIDENTIAL - MULTI FAMILY							ICI						
	WASTE PERCENTAGE BREAKDOWN (1)	PARTICIPATION RATE (2)	CAPTURE EFFICIENCY (3)	CUMULATIVE RECOVERY RATE (4)	Waste Generated	Waste Diverted	Waste Disposed	WASTE PERCENTAGE BREAKDOWN (1)	PARTICIPATION RATE (2)	CAPTURE EFFICIENCY (3)	CUMULATIVE RECOVERY RATE (4)	Waste Generated	Waste Diverted	Waste Disposed	WASTE PERCENTAGE BREAKDOWN (1)	PARTICIPATION RATE (2)	CAPTURE EFFICIENCY (3)	CUMULATIVE RECOVERY RATE (4)	Waste Generated	Waste Diverted	Waste Disposed
	(by weight)				(kg/capita)			(by weight)				(kg/capita)			(by weight)				(kg/capita)		
1 All Recyclables	23.78%	90.00%	90.00%	81.00%	94.4	76.4	17.9	27.04%	70.00%	75.00%	52.50%	70.6	37.1	33.6	21.30%	80.00%	80.00%	64.00%	321.7	205.9	115.8
2 All Non-Recyclables	5.81%	0.00%	0.00%	0.00%	23.1	0.0	23.1	11.05%	0.00%	0.00%	0.00%	28.9	0.0	28.9	24.98%	0.00%	0.00%	0.00%	377.2	0.0	377.2
3 Food Waste	19.56%	70.00%	80.00%	56.00%	77.6	43.5	34.1	31.01%	40.00%	60.00%	24.00%	81.0	19.4	61.6	25.82%	50.00%	70.00%	35.00%	389.8	136.4	253.4
4 Yard Waste	33.11%	80.00%	90.00%	72.00%	131.4	94.6	36.8	4.17%	40.00%	60.00%	24.00%	10.9	2.6	8.3	4.05%	90.00%	95.00%	85.50%	61.2	52.3	8.9
5 C&D	5.19%	70.00%	90.00%	63.00%	20.6	13.0	7.6	1.38%	40.00%	70.00%	28.00%	3.6	1.0	2.6	5.79%	80.00%	90.00%	72.00%	87.4	62.9	24.5
6 WEEE	0.54%	50.00%	80.00%	40.00%	2.1	0.9	1.3	1.26%	40.00%	80.00%	32.00%	3.3	1.1	2.2	0.57%	70.00%	80.00%	56.00%	8.6	4.8	3.8
7 HHW	0.71%	40.00%	90.00%	36.00%	2.8	1.0	1.8	0.58%	30.00%	80.00%	24.00%	1.5	0.4	1.2	0.15%	40.00%	90.00%	36.00%	2.3	0.8	1.5
8 Other Materials	11.30%	40.00%	60.00%	24.00%	44.8	10.8	34.1	23.51%	30.00%	60.00%	18.00%	61.4	11.1	50.4	17.35%	40.00%	70.00%	28.00%	261.9	73.3	188.6
Total	100.00%				396.8	240.1	156.7	100.00%				261.3	72.6	188.6	100.00%				1510.0	536.5	973.5

G: Garbage
Rc: Recyclable
Or: Organics
YGW: Yard and Garden Waste
C&D: Consutruction and Demolition

Material Type Totals (SF - Residential)	G	72.8	12.6	60.2
	Rc	94.4	76.4	17.9
	Or	77.6	43.5	34.1
	YGW	131.4	94.6	36.8
	C&D	20.6	13.0	7.6
		396.8	240.1	156.7
		60.5%		

Material Type Totals (MF - Residential)	G	95.1	12.5	82.6
	Rc	70.6	37.1	33.6
	Or	81.0	19.4	61.6
	YGW	10.9	2.6	8.3
	C&D	3.6	1.0	2.6
		261.3	72.6	188.6
		27.8%		

Material Type Totals (ICI)	G	649.9	79.0	571.0
	Rc	321.7	205.9	115.8
	Or	389.8	136.4	253.4
	YGW	61.2	52.3	8.9
	C&D	87.4	62.9	24.5
		1510.0	536.5	973.5
		35.5%		

Notes:

- 1) Source of Waste Characterization information: 2016 Waste Audit completed by 2cg.
- 2) Participation rate: approximate percentage of all generators regularly participating in selected strategy diversion initiatives.
Participation rate augmented in 2023 and 2027 based on implementation of new diversion programs.
- 3) Capture efficiency: approximate percentage of time that participating generators correctly complete their diversion obligations.
- 4) Cumulative recovery rate: the product of participation rate and capture efficiency.
- 5) Assumption: Waste composition (% breakdown) will not change between 2017 and 2027.

7.4 Implementation Considerations

For each recommended action, the following attributes were evaluated:

- Estimated timeline to implement;
- Diversion potential;
- Number of Full Time Equivalent (FTE) employees and associated costs for both planning/implementation and ongoing operation; and
- Qualitative considerations associated with capital costs.

The results are presented in **Table 7-4** which sorts the actions from the highest to lowest overall scores from the evaluation.

The Timing column relates to when the action would be implemented in terms of three different phases: short (Phase I), mid (Phase II) and long (Phase III) term timelines (as previously mentioned).

The diversion potential was estimated using the forecasted diversion plan waste quantities and professional judgement on the impact each option would have on diverting the forecasted quantities. The impact of each action on diversion was estimated in terms of applying percentages of the total waste diverted stream for each action and sector. Two time periods were considered: 2023 (after Recovery Park is in operation) and 2027 (year 10 in the planning period).

The City provided hourly wages plus benefits for different staffing positions related to waste management. Assumptions were made on the number of FTEs that would be required to plan/implement and for the ongoing operation of the action. The associated staffing costs were estimated.

A qualitative commentary on the relative capital cost requirements is provided. Finally, the notes and assumptions related to data presented in this table are provided.

7.5 Impact on Diversion Rates

Section 4.0 provided the waste projection results for each of the three sectors for the two time periods (2023 and 2027). **Sections 7.3 and 7.4** estimated the diversion potential of each action recommended for inclusion in the Draft Waste Diversion Plan. The resulting diversion rates achieved were estimated for each sector, all residential (single and multi-family) and overall (residential and ICI) in 2023 and 2027 (**Table 7-5**). Weighted averages based on the quantities of waste generated for each sector were developed for the combined residential and overall total.

Table 7-4: Implementation Considerations of Options

No.	Category	Action	Overall Score (highest possible score = 3.3)	Phase	Diversion Potential for all Sectors (tonnes)	Planning/Implementation		Ongoing Operation		Capital Costs	Notes/Assumptions
						FTE	Estimated Annual Staffing Cost	FTE	Estimated Annual Staffing Cost		
9	2. User Education and Awareness	Implement promotion and education about ways to reduce waste. Example topics include reducing food waste, grasscycling and reducing waste during holidays.	3	I	Negligible	0.1	\$8,800	-	-	Low	• Existing City resources may be used for this option.
10	2. User Education and Awareness	Refine and validate P&E efforts to launch potential new programs and improve existing programs (e.g., reduce contamination in recycling stream) which can include targeted development and distribution of education materials based on demographics.	3	I	430 - 680	0.25	\$22,100	0.1	\$8,800	Low	• Existing City resources may be used for this option.
2	1. System Governance and Management	Mandate source separation of C&D waste and have timing coincide with opening of Recovery Park. Develop necessary education/promotion required prior to Recovery Park C&D processing facility opening.	2.9	II	670 - 1,200	0.25	\$22,100	-	-	Low	• Phases 1A and 1B of Recovery Park opens in 2019 • Diverts from residential and ICI sectors
12	3. Reuse and Recycling	Have the layout of Recovery Park be user friendly and efficient for a user to drop-off their waste for diversion and/or disposal (e.g., look at the traffic flow and number of times a car needs to be weighed). Consider allowing free drop-off of materials that the City wants to either sell to markets or for safe disposal (e.g., HHW, C&D, recyclables, scrap metal).	2.75	I	4,300 - 7,300	0.10	\$9,700	-	-	Low	• Phases 1A and 1B of Recovery Park opens in 2019
5	1. System Governance and Management	Define additional Key Performance Indicators (KPIs) that could be used to measure success of waste management system such as kg of waste disposed per person.	2.7	I	N/A	0.25	\$22,100	-	-	Low	-
7	1. System Governance and Management	Update the Waste Bylaw. Recommended actions that will impact the Waste Bylaw include mandatory source-separation of C&D materials, mandatory participation in the curbside organics collection program and potentially requiring ICI sector to report on waste quantities (Condition #48).	2.7	II	14,900 - 8,600	0.25	\$22,100	-	-	Low	• In place before organics collection program begins
11	2. User Education and Awareness	Standardize signage and symbols throughout the City and continue for use at new facilities and in promotion and education (P&E) materials.	2.7	II	Negligible	0.25	\$14,900	-	-	Medium	• Requires design and purchase of new symbols and signs • Coordinate replacement of signage at City facilities and P&E materials • Diversion impacts covered in Actions 10, 12, 16
15	3. Reuse and Recycling	Develop a green procurement policy to increase beneficial reuse of waste. Proper funding should be addressed through the utility option (taken care of in Action No. 1).	2.45	I	N/A	0.5	\$44,100	0.1	\$8,800	Low	• Materials could include compost, asphalt, shingles • Material will be diverted through other means and then used.

Table 7-4: Implementation Considerations of Options

No.	Category	Action	Overall Score (highest possible score = 3.3)	Phase	Diversion Potential for all Sectors (tonnes)	Planning/Implementation		Ongoing Operation		Capital Costs	Notes/Assumptions
						FTE	Estimated Annual Staffing Cost	FTE	Estimated Annual Staffing Cost		
6	1. System Governance and Management	Implement different methods of enforcement for residential sector that makes best use of City resources (e.g., issuing 1 notice instead of 2). Reasons for ticketing will change with new programs and policies in place.	2.5	II	2,100 - 6,500	0.25	\$15,400	1	\$61,600	Low	• Enforcement done at the generator location
1	1. System Governance and Management	Modify approach to financing the solid waste management system through options like user pay and a utility.	2.65	II	17,000 - 31,700	0.5	\$44,100	0.1	\$8,800	Low	
13	3. Reuse and Recycling	Have standardized public space recycling bins tying the logos to curbside programs.	2.25	II	5	0.1	\$8,800	-		Medium	• Requires purchase of new bins • Installation completed by vendor
3	1. System Governance and Management	Implement disposal bans and measures as tools to increase diversion from all sectors on a material by material basis with timing coinciding with having processing capacity in place (start with materials to be handled through Recovery Park).	2.3	II	31,500 - 55,000	0.5	\$29,700	0.25	\$14,900	High	• Phases 1A and 1B of Recovery Park opens in 2021, and organics facility in 2021 • Enforcement done at the generator and facilities for multiple material streams
8	1. System Governance and Management	Select an option(s) to reduce illegally dumped waste and implement a pilot program at the hot spots such as the recycling depots. The City could also consider implementing a seasonal curbside bulky waste collection to help mitigate illegal dumping occurrences.	2.25	II	N/A	0.25	\$22,100	-	-	Medium	• Study and pilot conducted over a one-year period
14	3. Reuse and Recycling	Following a review of options, establish a permanent HHW depot(s) that are staffed at existing City waste facilities or partnerships with HHW recycling/disposal providers.	2.2	III	90 - 140	0.25	\$22,100	0.5	\$29,700	Medium	• Assumes depot is open one day a week (e.g., Saturdays) and year round. • Ongoing requires 2 staff and administrative services
19	5. Collection and Transfer	Change collection frequency to year-round bi-weekly collection of garbage and recyclables and weekly collection of organics.	2.2	II	900 - 1,100	0.0	\$0	-	-	Low	• Diversion impact also attributed to mandating participation (Action 16)
17	4. Organics Management	Study and identify the most efficient method of collecting and processing YGW from all single-family households (e.g., separate processing and collection of YGW at the existing compost facility, co-collection and processing of YGW with food scraps and household organics at Recovery Park).	2.2	II	N/A	0.1	\$8,800	-	-	High	-
20	5. Collection and Transfer	Implement data management system that may use RFID technology. Existing carts may need to be re-tagged and/or confirm addresses are linked to the carts. Coincide with the implementation of the organics collection program and the change in fee structure (e.g., pay as you throw).	2	II	N/A	0.25	\$24,300	0.1	\$9,700	Medium	• Installation completed by vendor

Table 7-4: Implementation Considerations of Options

No.	Category	Action	Overall Score (highest possible score = 3.3)	Phase	Diversion Potential for all Sectors (tonnes)	Planning/Implementation		Ongoing Operation		Capital Costs	Notes/Assumptions
						FTE	Estimated Annual Staffing Cost	FTE	Estimated Annual Staffing Cost		
16	4. Organics Management	Implement a mandatory City-wide organics collection program which includes timing (to coincide with opening of organics processing facility), an enhanced promotion and education program, tender of carts/containers and in-house/unit kitchen catchers.	2.1	II	2,200 - 2,400	0.75	\$66,200	-	-	Medium	• Requires extensive promotion and education prior to program implementation
4	1. System Governance and Management	City to influence and/or enforce diversion of ICI and C&D waste at the front end (e.g., through building permits).	2.1	II	12,700 - 17,500	0.25	\$22,100	0.1	\$8,800	High	• Requirements for C&D diversion in place once sufficient processing capacity is in place • Enforce paper and cardboard disposal ban
21	6. Processing and Disposal	Work with potential partners to find beneficial uses for the recovery of energy from waste wood that would otherwise be landfilled.	1.85	II	N/A	0.1	\$9,700	-	-	High	• Wood is already received and transferred for recovery
18	5. Collection and Transfer	Identify preferred collection method (outsourcing collection or City collection) and retain services for collection of organic waste.	1.8	II	N/A	0.25	\$24,300	-	-	Low to High (depending on method)	• Recycling collection contracts expire in 2019 and 2023

Table 7-5: Estimated Diversion Rates Achieved with Recommended Actions

Year	Residential		ICI	Residential Total (SF + MF) (Weighted Average)	Total (Weighted Average)
	Single Family	Multi-Family			
2017	27.9%	12.3%	3.5%	25.1%	11.2%
2023	43.1%	19.4%	25.0%	38.8%	36.5%
2027	60.5%	27.8%	35.5%	54.6%	42.9%

As previously mentioned, it is assumed that all three phases of Recovery Park opens in 2021 and the associated actions are also implemented at this time (e.g., mandatory organics collection program, mandatory separation of C&D waste). With the recommended options, it is estimated the City has an overall diversion of 43% by 2027. ICI and multi-family diversion rates bring the overall diversion rate down. Multi-family diversion is a major challenge around the world, even in jurisdictions that have extensive waste diversion programs available. The diversion rates for the multi-family sector are in line with other jurisdictions with established programs. The ICI garbage stream contained a significant quantity of non-recyclable materials (almost 25%). As mentioned in **Section 7.3**, the ICI composition may need to be refined to include additional C&D wastes. When looking at the single-family residential diversion rates, the results seem reasonable for the two time periods based on how other jurisdictions, with established waste diversion programs, are performing.

7.5.1 Getting to 70%

The City has set a goal to achieve 70% diversion (by weight) from disposal by 2023 through municipally operated diversion and disposal programs. The goal was initially intended to include diversion from both residential and non-residential sources. The City may want to consider elimination of ICI diversion expectations since it manages a relatively minor amount of the sector's waste. Instead, the diversion goals could be focused on the waste the City manages - which is predominately residential waste. In any event, to achieve a 70% diversion rate by either 2023 or 2027, additional actions would be required in addition to the status quo and the recommended actions presented in the Draft Waste Diversion Plan.

The City, along with the National Zero Waste Council (of which the City is a member of), believes that Energy from Waste (EfW) facilities and energy recovery initiatives do not count towards overall diversion. Therefore, options with recovery will not help the City achieve the 70% goal.

It is assumed that the current "base" diversion rate of 22% will remain constant. In 2023, the recommended actions included in the Draft Diversion Plan are estimated to achieve an additional 36.5% which totals 58.5%. For 2027, this is increased to 65%. An additional 11.5 % diversion in 2023 or an additional 5% diversion in 2027 will be required to meet the 70% diversion target. The following provides a listing of additional initiatives or programs that could support the enhanced level of diversion

required to reach the target 70% (diversion potential estimates taken from 2016 waste composition study on the single-family sector garbage stream):

- Textile recycling program (2% available);
- Increased promotion and incentives for backyard composting (at-source reduction, 7% of fruit and vegetable waste in the garbage stream – estimate 1-2% diversion potential);
- Ban on grass in the leaf and yard waste collection program with enhanced education on the benefits of grasscycling (at-source reduction, 8% available – estimate 1% diversion potential); and
- Selection of an organics processing technology that can manage diapers, sanitary and pet wastes (11% available).

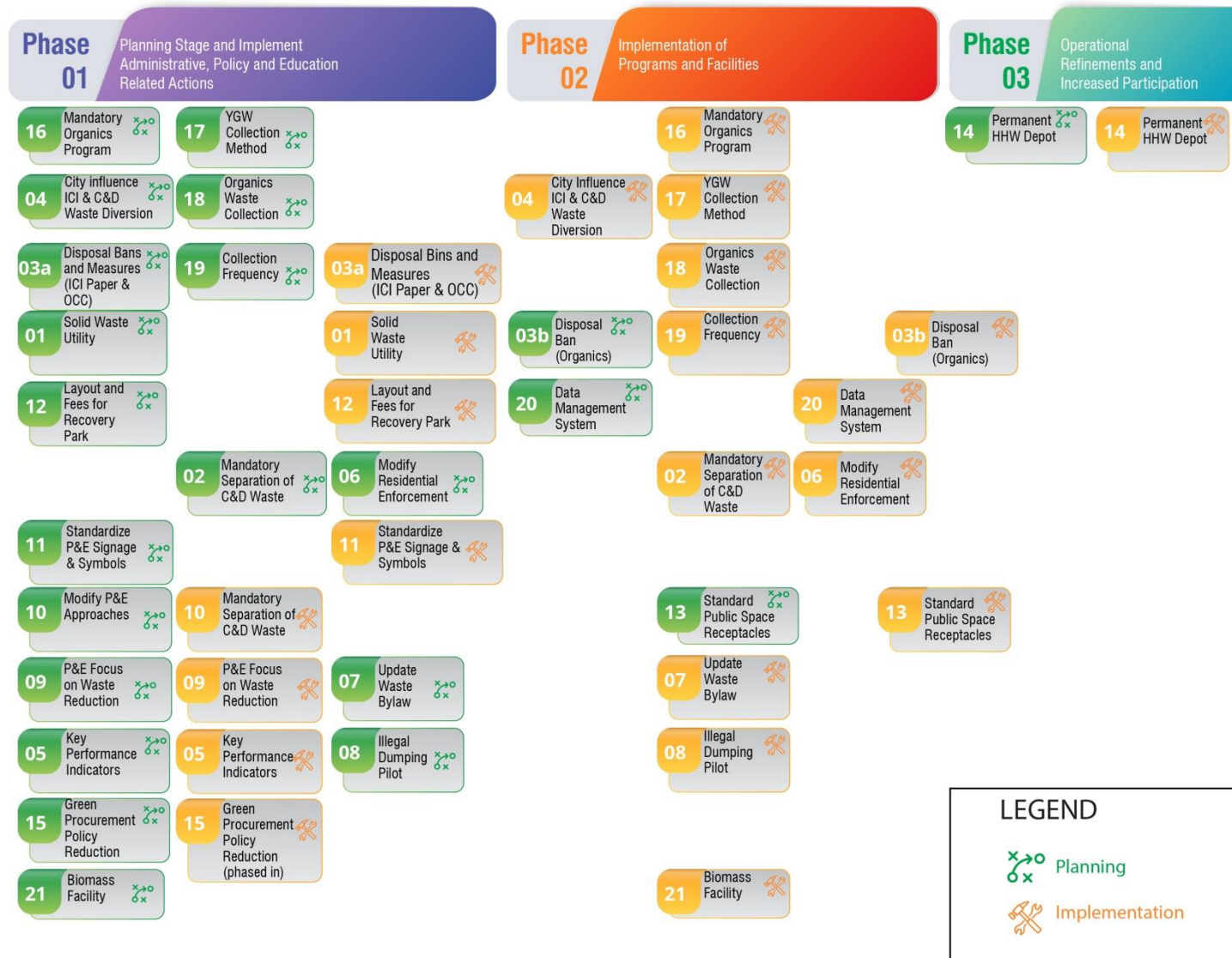
Development of an Implementation Plan

On March 3, 2017, Dillon held a workshop with City staff to develop a draft implementation plan for the recommended options. Discussions were held regarding the sequencing of planning and implementing each option and how the actions fit together. Following the workshop, the actions were arranged in one of three implementation phases, which are:

- Phase I – Planning and implementation of administrative and promotion and education options;
- Phase II – Implementation of programs and facilities; and
- Phase III – Operational refinements.

Figure 8-1 provides an implementation plan for the 21 recommended actions and the corresponding timing in terms of implementation phase.

Figure 8-1: Implementation Plan for Recommended Actions



APPENDIX A

Summary Report on 2016 Waste Characterization Study

REPORT
Waste Characterization Report

City of Saskatoon

January 2017



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Table of Contents

Executive Summary.....	i
1.0 Introduction.....	1
2.0 Methodology	1
3.0 Single Family Waste Composition.....	1
4.0 Multi Residential Waste Composition.....	4
5.0 Self Haul Waste Composition	6
6.0 Industrial, Commercial and Institutional Waste Composition	8
7.0 Construction and Demolition Waste Composition.....	11
8.0 Overall Waste Composition.....	15

Appendices are supplied as a separate Excel document:

Appendix 1- A1 Single Family Households calculations

Appendix 2- A2 Multi-Residential Households calculations

Appendix 3- A3 Self Haul calculations

Appendix 4- A4 Industrial, Commercial and Institutional (ICI) calculations

Appendix 5- A5 Construction and Demolition (C&D) calculations

Appendix 6- A6 Model to Estimate Overall Waste Composition

Acronyms

C&D- Construction and demolition waste

IC&I- Industrial, commercial and institutional waste

HHW- Household hazardous waste

WEEE- Waste electrical and electronic waste

Executive Summary

Introduction

This report is part of the Dillon Consulting led project “The City of Saskatoon Waste Characterization and Waste Diversion Plan” and presents overall residual waste composition estimates, gathered from four 2016 seasonal waste audit sampling rounds, of single family households, multi residential households, self-haul loads (to City landfill), industrial, commercial and institutional (IC&I) waste and construction and demolition (C&D) waste. The summary report includes an approximate "mass balance" of the disposed waste materials generated.

The overall estimated waste compositions are presented in **Table E.1** (Note: the “R”s in Figures and Charts mean recyclable and “NR”s mean not recyclable). The key wastes included: food waste, C&D, other materials (e.g. diapers/sanitary waste, textiles, bulky wastes) and yard waste.

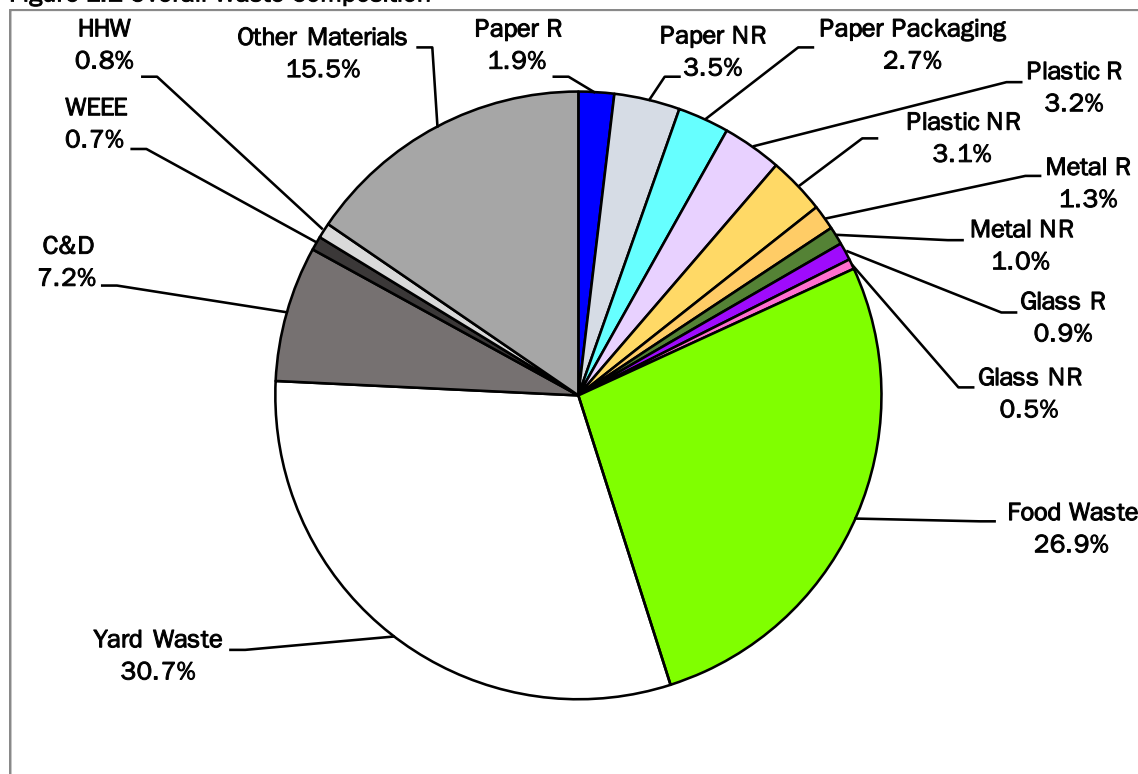
Table E.1 Estimated Waste Composition of Municipal Solid Waste Disposal Streams

	Single Family Residential	Multi Residential	IC&I	Self Haul	C&D
Waste Stream	%				
Paper R	1.9	3.1	4.8	0.2	0.3
Paper NR	3.5	5.4	12.6	0.0	0.0
Paper Packaging	2.7	5.7	12.7	0.6	1.4
Plastics R	3.2	5.1	3.3	0.2	0.1
Plastics NR	3.1	6.1	12.2	0.8	1.2
Metals R	1.3	1.4	1.0	0.1	0.0
Metals NR	1.0	0.9	0.8	1.9	0.0
Glass R	0.9	1.5	0.2	0.0	0.0
Glass NR	0.5	0.2	0.2	0.6	0.9
Food Waste	26.9	35.4	26.8	0.3	0.0
Yard Waste	30.7	4.8	0.5	17.6	0.4
C&D	7.2	1.6	6.0	57.8	91.3
WEEE	0.7	1.4	0.6	1.7	0.2
HHW	0.8	0.6	0.2	1.3	0.1
Other Materials	15.5	26.8	18.0	16.8	4.0
Total (%)	100	100	100	100	100

Single Family Waste Composition

- See Figure E.1.
- The average garbage set out was approximately 15.6 kg/hh/wk.
- Approximately 1.5 kg/hh/wk or 10%, consisted of recyclable wastes which could have been captured in the blue cart program. The recyclables consisted largely of paper packaging (2.7%), plastic (3.2%), paper (1.9%), metal (1.3%) and glass (0.9%).
- Approximately 9 kg/hh/week or 58%, consisted of organic waste, with 47% of organic waste consisting of food waste. Of the food waste, 59% was avoidable (i.e., edible at one point).
- Approximately 1 kg/hh/week or 7%, consisted of C&D waste.
- An estimated 77% of wastes could be diverted through existing and future diversion programs.
- The least waste is generated in winter (9.1 kg/hh/wk) and the most in the late spring (21.8 kg/hh/wk). Most of the seasonal differences can be attributed to yard waste.

Figure E.1 Overall Waste Composition



Note: C&D=construction and demolition waste; WEEE= waste electrical and electronic waste; HHW=household hazardous waste.

Multi Residential Waste Composition

- The average garbage set out was approximately 7.2 kg/hh/wk.
- Approximately 1.2 kg/hh/wk or 17%, consisted of recyclable wastes which could have been captured in the blue cart program. The recyclables consisted

- largely of paper packaging (5.7%), plastic (5.2%), paper (3.1%), metal (1.4%) and glass (1.5%).
- Approximately 2.9 kg/hh/week or 40% of organic waste was set out, with 88% of organic waste consisting of food waste. Of the food waste, 53% was avoidable (i.e., edible at one point).
 - An estimated 61% of wastes could be diverted through existing and future diversion programs.

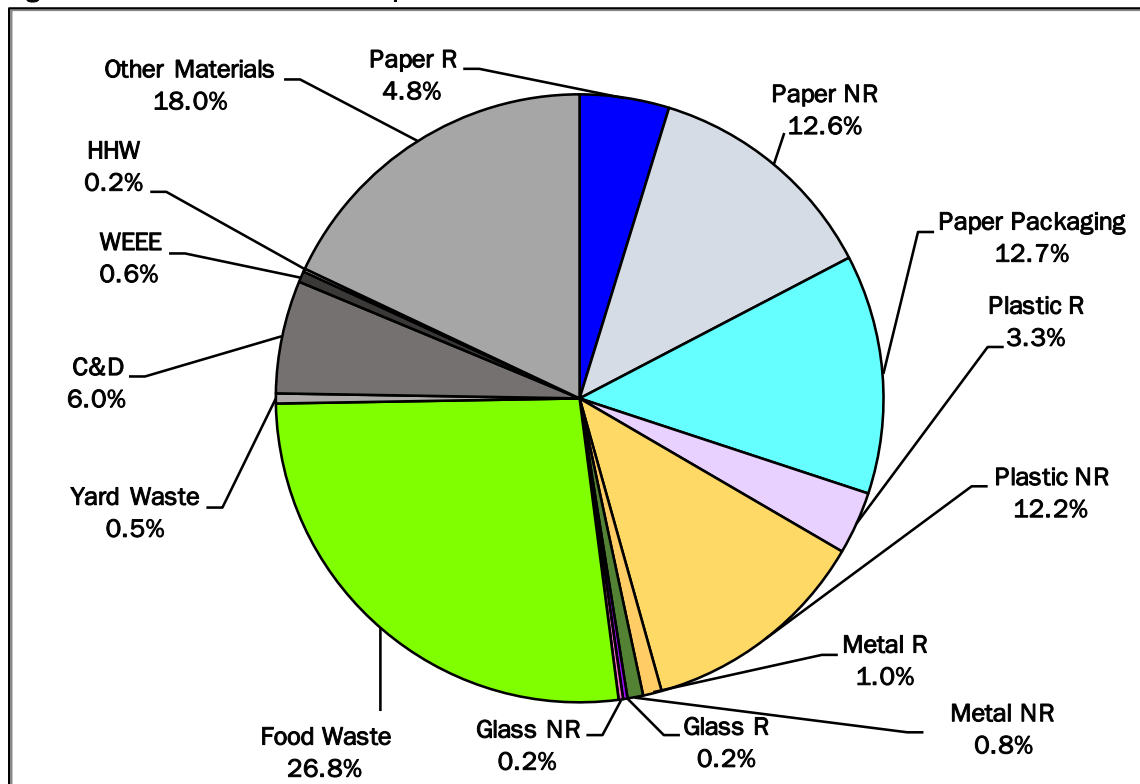
Self-Haul Waste Composition

- Residents and businesses can self-haul waste to the City landfill for disposal.
- The average load sampled was approximately 145 kg.
- Approximately 1.1% consisted of recyclable wastes which could have been captured in the blue cart program.
- Approximately 18% consisted of organic waste, with 98% of organic waste consisting of yard waste.
- Approximately 58% consisted of C&D waste
- Up to an estimated 80% of wastes could be diverted through existing and future diversion programs.

Industrial, Commercial and Institutional Waste Composition

- See **Figure E.2**.
- It appears that most IC&I waste is managed by the private sector and disposed in private landfills within (assumed but not confirmed) the City.
- It is estimated, based on waste audit and other data sources, that approximately 56% of the IC&I waste stream can be diverted. The key waste streams that could be diverted include food waste, paper/paper packaging and C&D wastes.

Figure E.2 Overall IC&I Waste Composition



Construction and Demolition Waste Composition

- Estimating C&D composition (i.e., the disposal stream) was undertaken by completing visual waste audits of loads of C&D waste received at a private landfill in Saskatoon.
- The average load sampled was approximately 2,428 kg.
- Approximately 1.8% of loads consisted of recyclable wastes which could have been captured in the blue cart program.
- Untreated wood, asphalt roofing shingles, asphalt, concrete and bricks and metals are a number of key C&D wastes that could be diverted.
- Up to an estimated 94% of wastes could be diverted (although it should be noted that some C&D waste such as treated wood is not readily recyclable).

Overall Waste Composition

The estimated weighted overall waste composition of the various municipal solid waste streams was calculated using a model. Table E.2 depicts the estimated amount of waste generated in the City. Single family, multi-residential, self-haul quantities comprises data provided by the City. IC&I data includes data provided by the City and estimated private sector quantities. Private sector managed IC&I and C&D wastes were inferred from Statistics Canada waste disposal data

Table E.2 Estimated Waste Disposal per Waste Stream

Generator	tonnes/year
Single Family Residential	51,900
Multi Residential	9,100
Self Haul	17,100
IC&I	152,900
C&D (privately managed)	16,100
Total	247,100

The overall estimated waste composition is presented in **Figure E.3** (Note: the “R”s in Figures and Charts mean recyclable and “NR”s mean not recyclable). The key wastes included: food waste, other materials, C&D and yard waste.

Figure E.3 Overall Waste Composition

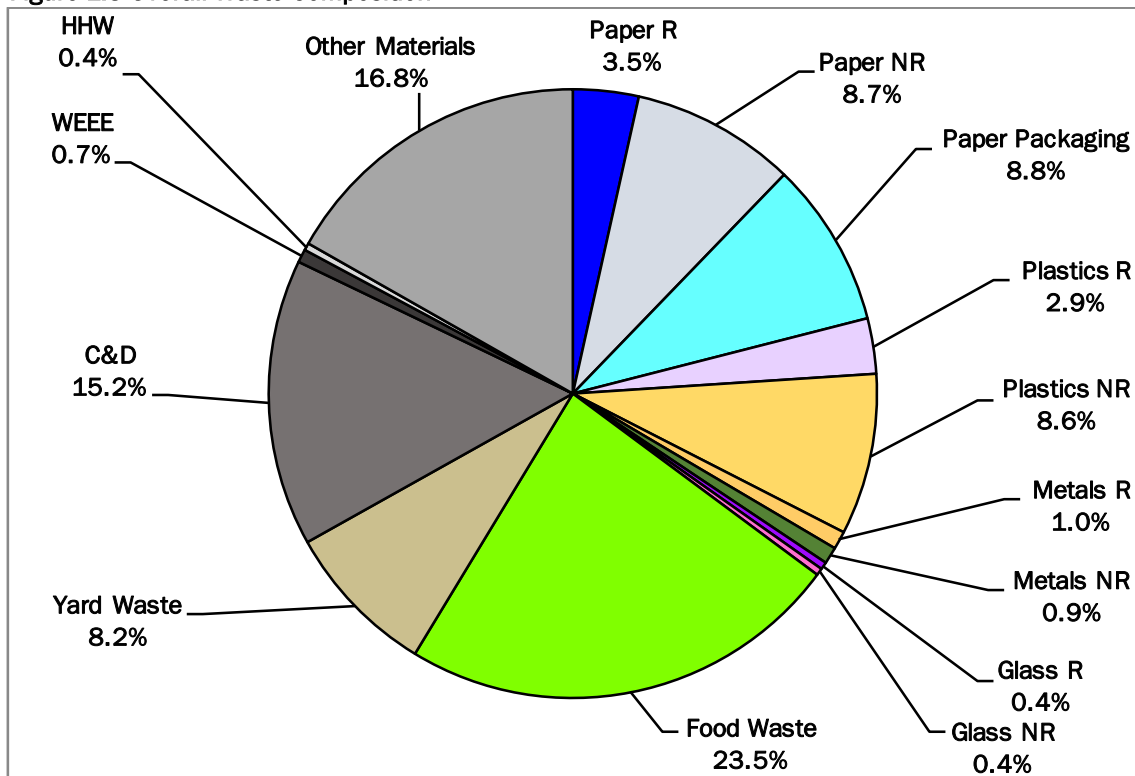


Table E.3 depicts waste streams that are recyclable with current programs (i.e. printed paper and packaging, leaf and yard waste, WEEE, HHW) and waste streams that could be recyclable with new programs (e.g. composting/anaerobic digestion and construction and demolition waste diversion). It shows that an estimated 65% of wastes could be diverted. **Table E.4** translates this into estimated tonnages. It shows that almost 7,000 tonnes of residential and 41,000 tonnes of wastes could be diverted if the blue cart program was expanded across all waste streams. There is close to 58,000 tonnes of food waste; 20,000 tonnes of yard waste; and 38,000 tonnes of C&D waste that could be reduced and/or diverted.

Table E.3 Estimated Overall Divertible Wastes- %

	Single Family Residential	Multi Residential	IC&I	Self Haul	C&D	Weighted Average
Waste Stream	%					
Paper R	1.9	3.1	4.8	0.2	0.3	3.5
Paper Packaging	2.7	5.7	12.7	0.6	1.4	8.8
Plastics R	3.2	5.1	3.3	0.2	0.1	2.9
Metals R	1.3	1.4	1.0	0.1	0.0	1.0
Glass R	0.9	1.5	0.2	0.0	0.0	0.4
Food Waste	26.9	35.4	26.8	0.3	0.0	23.5
Yard Waste	30.7	4.8	0.5	17.6	0.4	8.2
C&D	7.2	1.6	6.0	57.8	91.3	15.2
WEEE	0.7	1.4	0.6	1.7	0.2	0.7
HHW	0.8	0.6	0.2	1.3	0.1	0.4
Total (%)	76.5	60.6	56.1	79.8	93.9	64.6
Tonnes/year	39,683	5,516	85,782	13,649	15,111	159,740

Table E.4 Estimated Overall Divertible Wastes- tonnes/year

	Single Family Residential	Multi Residential	IC&I	Self Haul	C&D	Total
Waste Stream	tonnes/year					
Paper R	987	284	7,266	27	56	8,619
Paper Packaging	1,425	516	19,449	110	232	21,733
Plastics R	1,640	469	5,114	39	9	7,271
Metals R	692	129	1,519	18	0	2,358
Glass R	490	133	350	1	0	974
Food Waste	13,977	3,224	40,940	46	0	58,187
Yard Waste	15,919	433	822	3,010	64	20,247
C&D	3,745	144	9,179	9,881	14,701	37,650
WEEE	386	131	900	290	38	1,745
HHW	424	54	242	227	10	956
Tonnes/year	39,683	5,516	85,782	13,649	15,111	159,740

1.0 Introduction

This report is part of the Dillon Consulting led project “The City of Saskatoon Waste Characterization and Waste Diversion Plan”, and presents an estimate of overall and generator type (e.g. residential) waste composition developed from the results of the four seasonal waste characterization studies undertaken during 2016. The focus of this report is on wastes that are currently disposed in City or private landfills. **Table 1.1** presents an overview of the four seasonal waste characterization studies undertaken as part of the project. The waste frequency and season of each waste stream was selected with the City to maximize use of available resources.

Table 1.1 Overview of Seasonal Waste Characterization Studies

	Winter	Spring	Summer	Fall
Single Family	✓	✓		✓
Multi Residential	✓	✓	✓	
Industrial, Commercial and Institutional (IC&I)			✓	✓
Construction and Demolition (C&D)				✓
City Landfill Self-Haul		✓	✓	
Depot Based Recycling Program		✓	✓	

Additional detail on each of the four waste characterization studies was presented in four seasonal waste characterization study reports, submitted to the City after each seasonal study.

2.0 Methodology

The waste characterization results from the single family, multi residential, self-haul, IC&I and C&D waste streams were further analyzed to develop an estimated average waste composition for each waste stream.

These average waste compositions were then applied to the various estimated waste flows in the City to:

- Develop an overall average City wide waste composition estimate; and
- Develop an estimate of various waste streams that could be diverted from landfills.

See seasonal reports (submitted previously to the City) for the methodology of each waste characterization waste stream.

3.0 Single Family Waste Composition

Essentially all single family residual waste is disposed at the City landfill.

The waste of 100 single family households, in ten sampling areas (each with ten homes) were characterized in winter, spring and fall sampling rounds. The waste

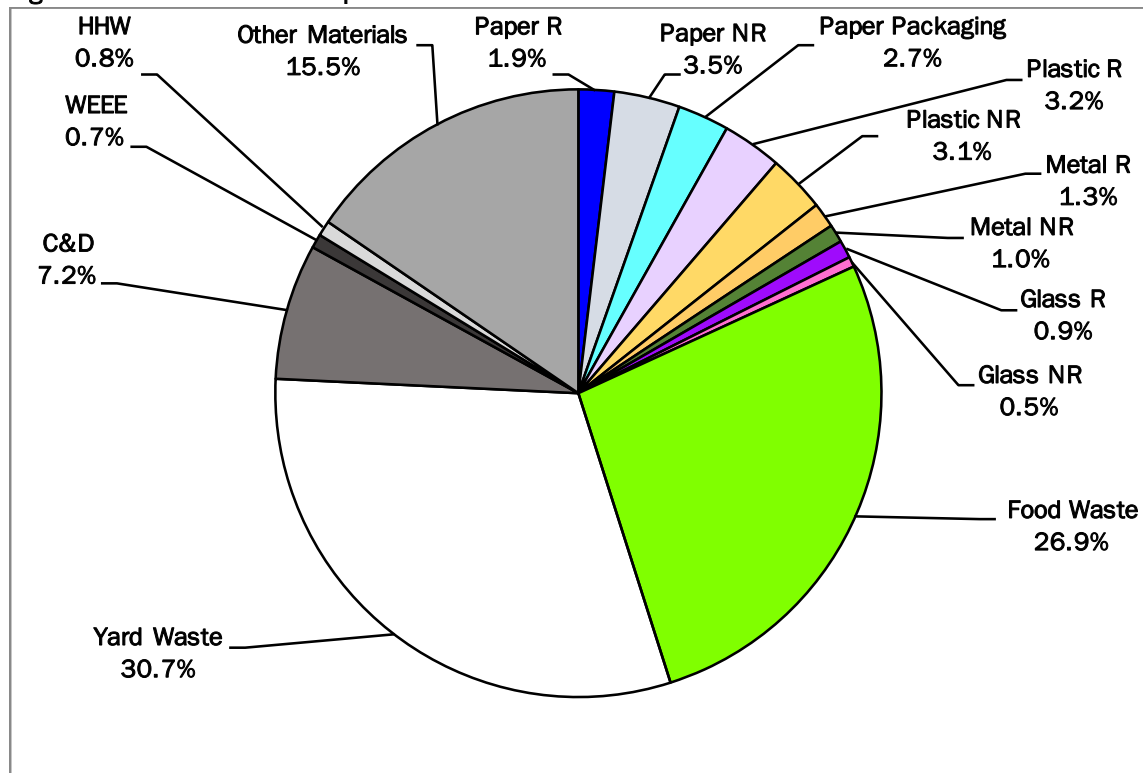
characterization results of these households were averaged to develop an overall estimate of single family waste composition. The results are presented in **Table 3.1** and **Figure 3.1** (Note: the “R”s in Figures and Charts mean recyclable and “NR”s mean not recyclable). Detailed results are included in **Appendix 1**. The key wastes included: yard waste, food waste and other materials.

The average garbage set out rate was approximately 15.6 kg/hh/wk. Approximately 1.5 kg/hh/wk or 10.1%, consisted of recyclable wastes which could have been captured in the blue cart program. The recyclables consisted largely of paper packaging (2.7%), plastic (3.2%), paper (1.9%), metal (1.3%) and glass (0.9%). Approximately 9 kg/hh/week or 58% of organic waste was set out, with 47% of organic waste consisting of food waste. Of the food waste, 59% was avoidable (i.e., edible at one point). Approximately 1 kg/hh/week or 7% of C&D waste was set out.

Table 3.1 Estimated Weekly Waste Generation-Single Family Households

	Garbage	
	kg/hshld/week	%
Paper R	0.3	1.9
Paper NR	0.5	3.5
Paper Packaging	0.4	2.7
Plastic R	0.5	3.2
Plastic NR	0.5	3.1
Metal R	0.2	1.3
Metal NR	0.2	1.0
Glass R	0.1	0.9
Glass NR	0.1	0.5
Food Waste	4.2	26.9
Yard Waste	4.8	30.7
C&D	1.1	7.2
WEEE	0.1	0.7
HHW	0.1	0.8
Other Materials	2.4	15.5
Total	15.6	100.0

Figure 3.1 Overall Waste Composition



Note: C&D=construction and demolition waste; WEEE= waste electrical and electronic waste; HHW=household hazardous waste.

Table 3.2 depicts waste streams that are recyclable with current programs (i.e. printed paper and packaging, leaf and yard waste, WEEE, HHW) and waste streams that could be recyclable with new programs (e.g. food waste, C&D waste). It shows that an estimated 77% of wastes could be diverted.

Table 3.2 Wastes Streams that could be Diverted

	Garbage	
	kg/hshld/week	%
Paper R	0.3	1.9
Paper Packaging	0.4	2.7
Plastics R	0.5	3.2
Metals R	0.2	1.3
Glass R	0.1	0.9
Food Waste	4.2	26.9
Yard Waste	4.8	30.7
C&D	1.1	7.2
WEEE	0.1	0.7
HHW	0.1	0.8
	11.9	76.5

4.0 Multi Residential Waste Composition

Multi residential residual waste is disposed at the City landfill and at private sector landfills.

The waste of ten multi residential (i.e. apartment) buildings, with 410 units or households were characterized. Five buildings were characterized in the winter, four in the spring and one in the summer. The waste characterization results of these buildings were averaged to develop an overall estimate of multi residential waste composition, which are presented in **Table 4.1** and **Figure 4.1** (Note: the “R”s in Figures and Charts mean recyclable and “NR”s mean not recyclable). Detailed results are included in **Appendix 2**. The key wastes included: food waste, other materials (diapers/sanitary, textiles, bulky waste) and non-recyclable plastics.

The average garbage set out rate was approximately 7.2 kg/hh/wk. Approximately 1.2 kg/hh/wk or 16.8%, consisted of recyclable wastes which could have been captured in the blue cart program. The recyclables consisted largely of paper packaging (5.7%), plastic (5.1%), paper (3.1%), metal (1.4%) and glass (1.5%). Approximately 2.9 kg/hh/week or 40% of organic waste was set out, with 88% of organic waste consisting of food waste. Of the food waste, 53% was avoidable (i.e., edible at one point).

Table 4.1 Estimated Weekly Waste Generation-Multi-Residential Households

	Garbage	
	kg/hshld/week	%
Paper R	0.2	3.1
Paper NR	0.4	5.4
Paper Packaging	0.4	5.7
Plastic R	0.4	5.1
Plastic NR	0.4	6.1
Metal R	0.1	1.4
Metal NR	0.1	0.9
Glass R	0.1	1.5
Glass NR	0.0	0.2
Food Waste	2.5	35.4
Yard Waste	0.3	4.8
C&D	0.1	1.6
WEEE	0.1	1.4
HHW	0.0	0.6
Other Materials	1.9	26.8
Total	7.2	100.0

Figure 4.1 Overall Waste Composition- Multi Residential

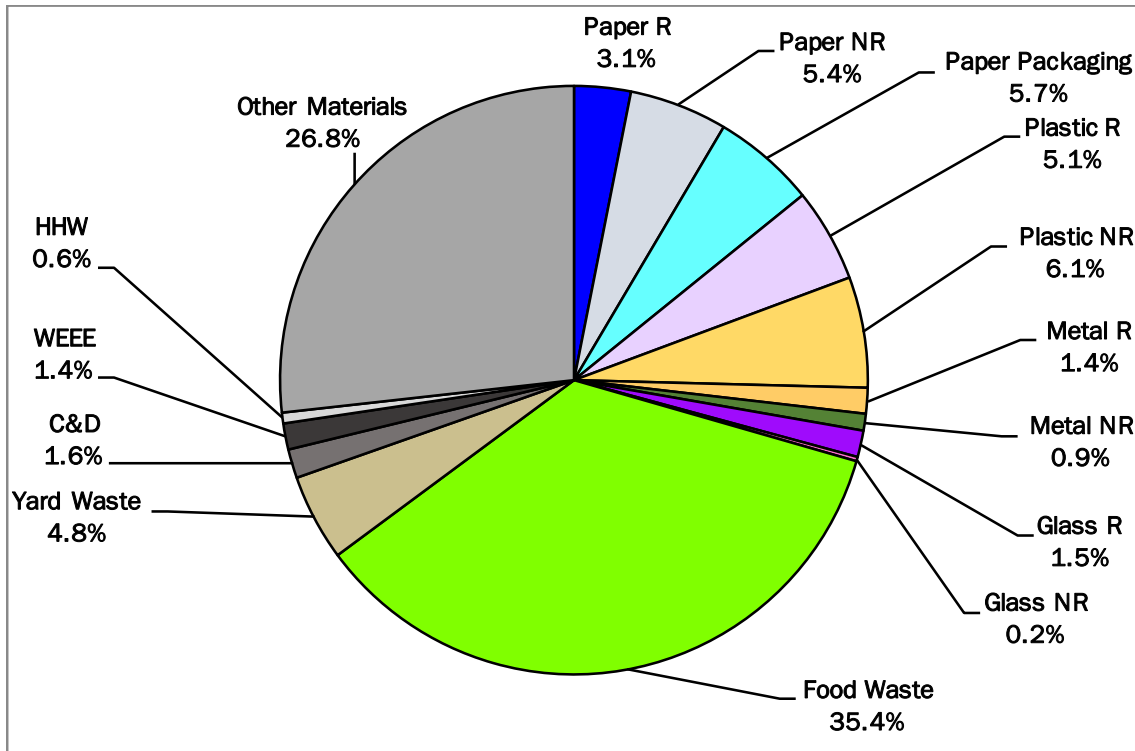


Table 4.2 depicts waste streams that are recyclable with current programs (i.e. printed paper and packaging, leaf and yard waste, WEEE, HHW) and waste streams that could be recyclable with new programs (e.g. food waste, C&D waste)). It shows that an estimated 61% of wastes could be diverted.

Table 4.2 Estimated Divertible Wastes for the Multi-Residential Households

	Garbage	
	kg/hshld/week	%
Paper R	0.2	3.1
Paper Packaging	0.4	5.7
Plastics R	0.4	5.1
Metals R	0.1	1.4
Glass R	0.1	1.5
Food Waste	2.5	35.4
Yard Waste	0.3	4.8
C&D	0.1	1.6
WEEE	0.1	1.4
HHW	0.0	0.6
	4.3	60.6

5.0 Self-Haul Waste Composition

Residents and businesses can self-haul small quantities of residual waste to the City landfill for disposal.

The waste of 38 randomly selected self-haul loads was characterized over the spring and summer sampling periods. The waste characterization results of self-haul loads were averaged to develop an overall estimate of self-haul waste composition, which are presented in **Table 5.1** and **Figure 5.1** (Note: the “R”s in Figures and Charts mean recyclable and “NR”s mean not recyclable). Detailed results are included in **Appendix 3**. The key wastes included: C&D waste, yard waste and other materials (e.g. textiles, bulky waste).

The average load was approximately 145 kg. Approximately 1.1% consisted of recyclable wastes which could have been captured in the blue cart program. Approximately 18% of organic waste was hauled, with 98% of organic waste consisting of yard waste.

Table 5.1 Estimated Weekly Waste Generation-Self-Haul Loads

	kg/load	%
Paper R	0.2	0.2
Paper NR	0.1	0.0
Paper Packaging	0.9	0.6
Plastic R	0.3	0.2
Plastic NR	1.2	0.8
Metal R	0.2	0.1
Metal NR	2.8	1.9
Glass R	0.0	0.0
Glass NR	0.9	0.6
Food Waste	0.4	0.3
Yard Waste	25.5	17.6
C&D	83.8	57.8
WEEE	2.5	1.7
HHW	1.9	1.3
Other Materials	24.3	16.8
	145.0	100.0

Figure 5.1 Overall Waste Composition- Self-Haul

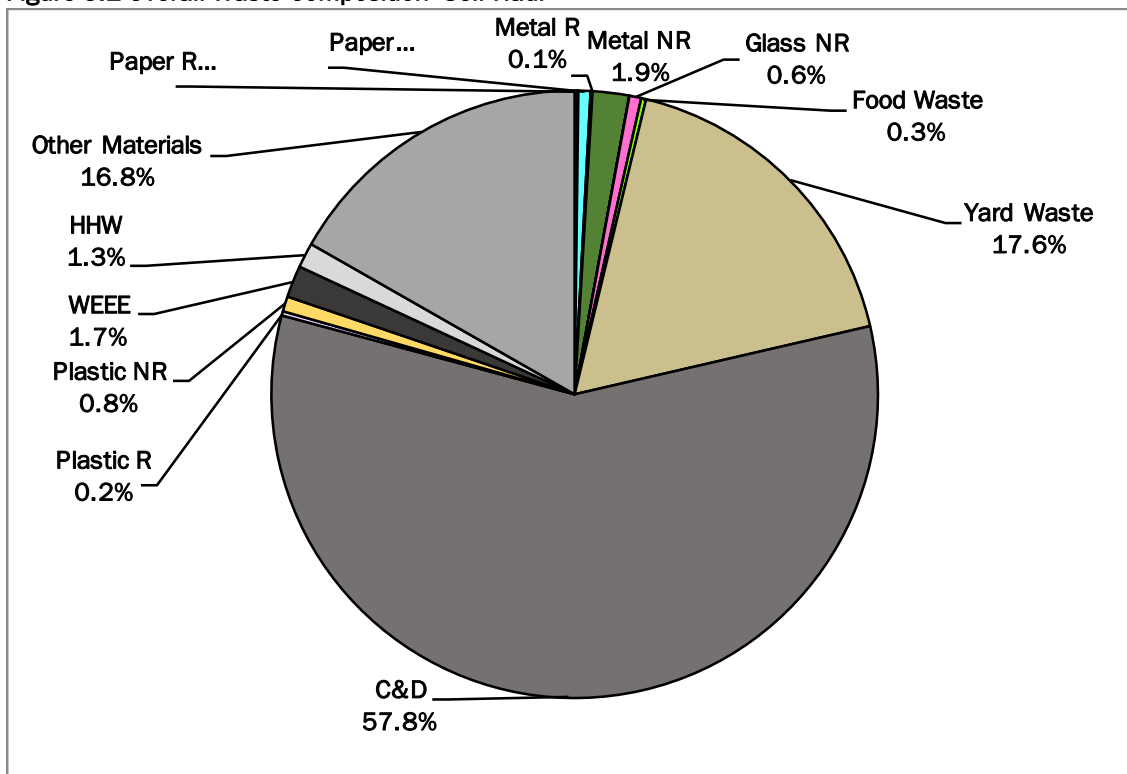


Table 5.2 depicts waste streams that are recyclable with current programs (i.e. printed paper and packaging, leaf and yard waste, WEEE, HHW) and waste streams that could be recyclable with new programs (e.g. food waste, C&D waste). It shows that an estimated 80% of wastes could be diverted.

Table 5.2 Estimated Divertible Wastes for Self-Haul Loads

	kg/load	%
Paper R	0.2	0.2
Paper Packaging	0.9	0.6
Plastics R	0.3	0.2
Metals R	0.2	0.1
Glass R	0.0	0.0
Food Waste	0.4	0.3
Yard Waste	25.5	17.6
C&D	83.8	57.8
WEEE	2.5	1.7
HHW	1.9	1.3
	115.8	79.8

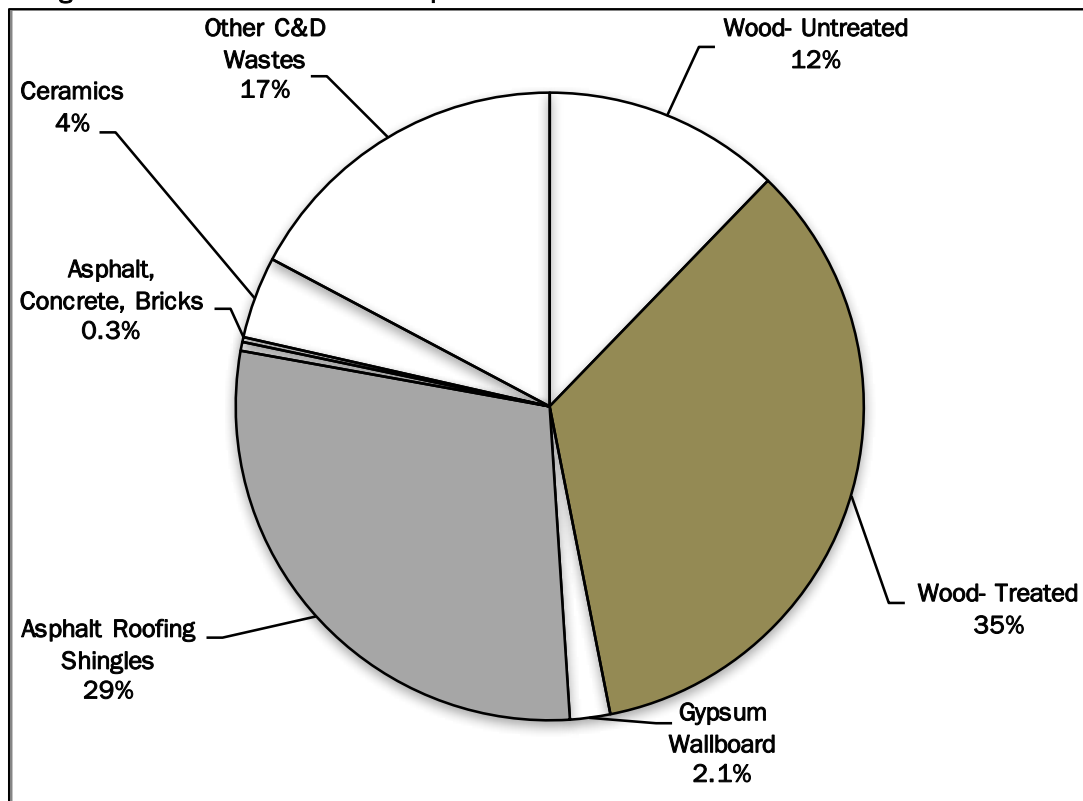
C&D waste is a key waste stream that could be diverted from self-haul loads. Some additional detail on C&D wastes is presented in Table 5.3 and Figure 5.2. Untreated

wood and asphalt roofing shingles are two key C&D wastes that could be diverted. Examples of other C&D waste include textiles, tires and furniture.

Table 5.3 Estimated Divertible C&D Wastes for the Self Haul Loads

	Average	
	kg/load	%
Wood- Untreated	10.2	12.2
Wood- Treated	29.1	34.7
Gypsum Wallboard	1.7	2.1
Asphalt Roofing Shingles	24.2	28.9
Metals	0.4	0.5
Asphalt, Concrete, Bricks	0.2	0.3
Ceramics	3.5	4.2
Other C&D Wastes	14.4	17.2
Total	83.8	100.0

Figure 5.2 Overall C&D Waste Composition- Self Haul



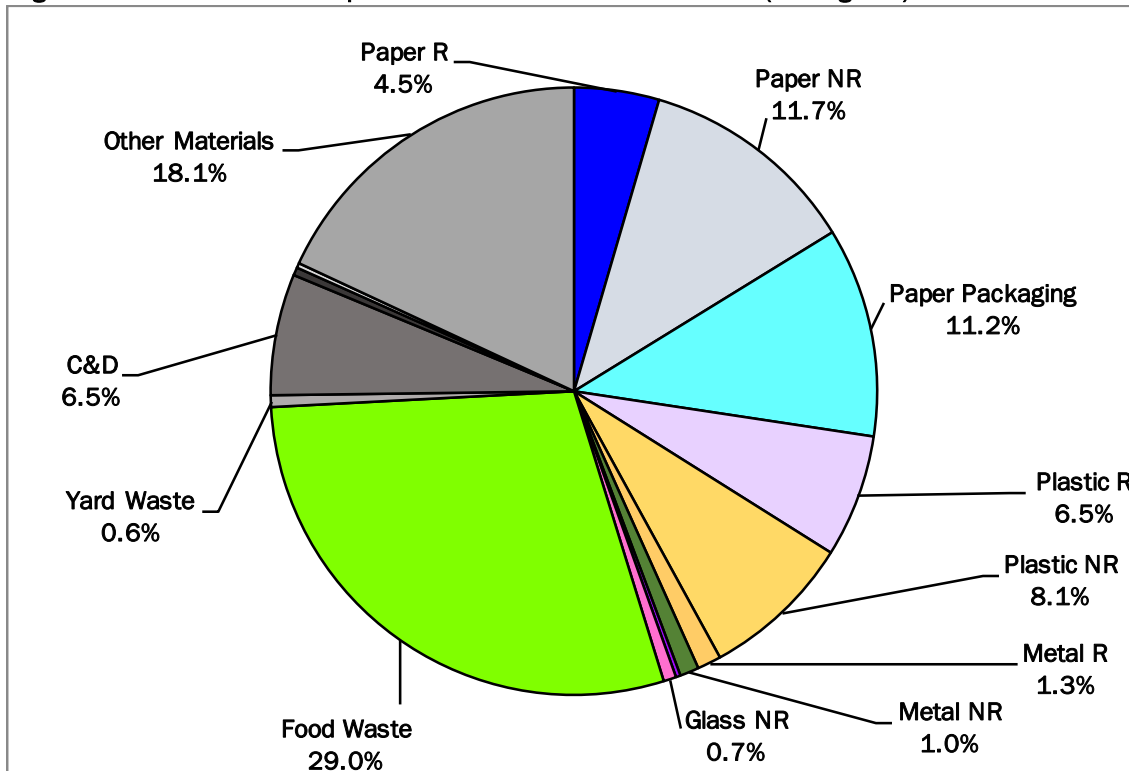
6.0 Industrial, Commercial and Institutional Waste Composition

It appears that most IC&I waste is managed by the private sector and disposed in private landfills in the City.

Estimating IC&I composition (i.e., the disposal stream) was undertaken by completing waste audits of the top six estimated waste generator types by North American Industry Classification System (NAICS) codes (manufacturing, retail trade, health care

and social assistance, accommodation and food services, other services, and public administration). Waste samples from 29 IC&I locations, from these top six estimated waste generator types were characterized and their overall unweighted composition is presented in **Figure 6.1**. These waste audits covered an estimated 62% of employment and 75% of IC&I waste generation in the City. Wastes consisted largely of food waste, paper/paper packaging and other materials (e.g. textiles, bulky wastes). Detailed results are included in **Appendix 4**.

Figure 6.1 Overall Waste Composition from Waste Audit Data- IC&I (unweighted)



The overall IC&I waste composition was estimated in two ways: 1. Using waste composition for unaudited NAICS generators from another study (City of Calgary, 2013); and 2. Slotting unaudited NAICS generators to the waste composition of the nearest estimated audited NAICS categories. This approach was taken to facilitate comparisons between essentially backfilling Saskatoon data with data from another City with the more preferable and detailed backfilling Saskatoon data.

Figure 6.2 depicts estimated overall waste composition by combining waste audit data and waste composition data (for unaudited waste generator NAICS sectors) from the above noted study. This data was not split into recyclable and non-recyclable streams for printed paper and packaging (i.e. as was done in **Figure 6.1**) Most waste categories are fairly similar between **Figures 6.1** and **6.2**. Construction and demolition waste was included with “other” waste in **Figure 6.2**.

Figure 6.2 Overall Waste Composition using Waste Audit + Other Data - IC&I (weighted)

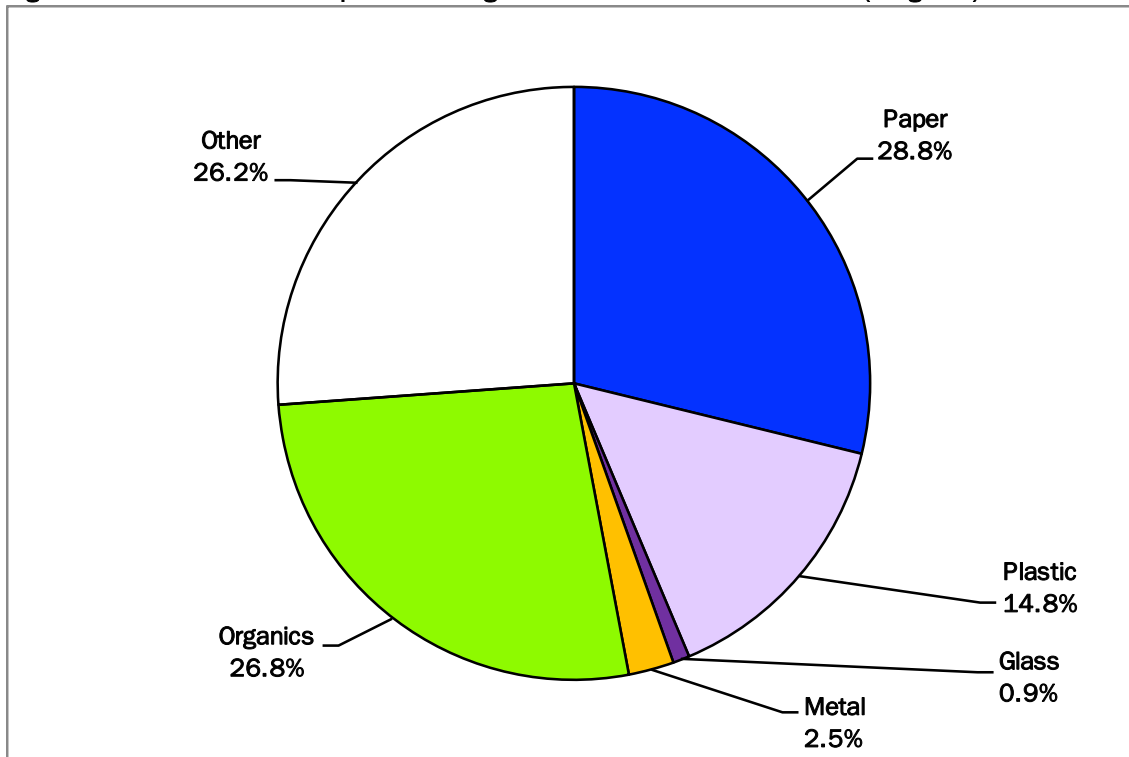


Figure 6.3 depicts estimated overall waste composition by slotting unaudited NAICS generators to use the waste composition of the nearest estimated audited NAICS categories (i.e. using waste audit data from Saskatoon waste audits as surrogate data for unaudited sectors). Most waste categories are fairly similar to **Figure 6.1** and **Figure 6.2**. It is reasonable to use this as an estimate of overall IC&I waste composition for the City of Saskatoon. **Table 6.1** depicts the estimated percentages of various waste streams that could be diverted with current or future waste diversion programs. It is estimated that approximately 56% of the IC&I waste to landfill stream could be diverted. The key waste streams that could be diverted include food waste, paper/paper packaging and C&D wastes.

Figure 6.3 Overall Waste Composition using Waste Audit + Slotted Data - IC&I (weighted)

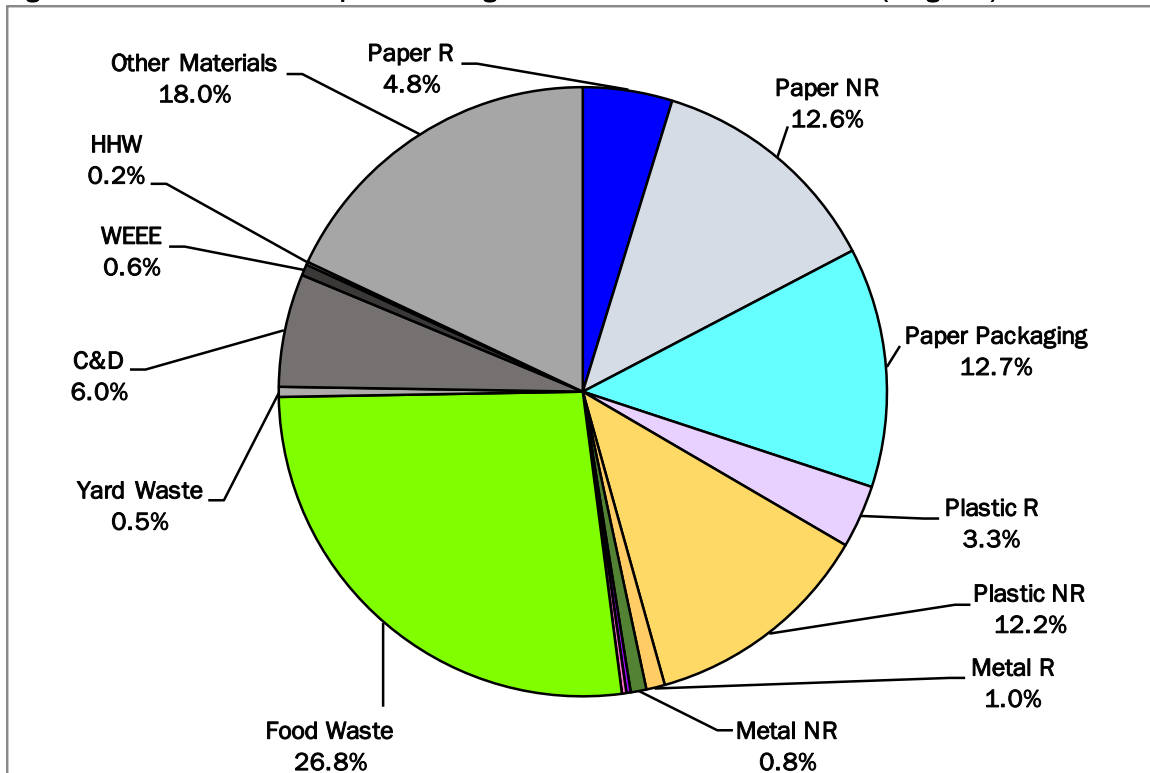


Table 6.1 Estimated Divertible Wastes for the IC&I Sector

	%
Paper R	4.8
Paper Packaging	12.7
Plastics R	3.3
Metals R	1.0
Glass R	0.2
Food Waste	26.8
Yard Waste	0.5
C&D	6.0
WEEE	0.6
HHW	0.2
	56.1

7.0 Construction and Demolition Waste Composition

It appears that most C&D waste is managed by the private sector and disposed in private landfills in or near Saskatoon.

Estimating C&D composition (i.e., the disposal stream) was undertaken by completing visual waste audits of loads of C&D waste received at a private landfill facility.

Visual waste audits were completed for 54 C&D waste samples. This data was then converted to weight based data using standard waste densities for the various C&D waste types and the weight of each sample.

The waste characterization results of C&D loads were averaged to develop an overall estimate of C&D waste composition, which are presented in **Table 7.1** and **Figure 7.1** (Note: the “R”s in Figures and Charts mean recyclable and “NR”s mean not recyclable). Detailed results are included in **Appendix 5**. The key wastes, using the categories used for all other waste types included: C&D waste and other materials (e.g. textiles, bulky waste, furniture). Additional detail is provided on the C&D waste later in this section.

The average load was approximately 2,428 kg. Approximately 1.8% consisted of recyclable wastes which could have been captured in the blue cart program. Approximately 91% of each load consisted of C&D waste.

Table 7.1 Estimated Weekly Waste Generation-C&D Loads

Waste Stream	kg/load	%
Paper R	8.5	0.3
Paper NR	0.0	0.0
Paper Packaging	35.0	1.4
Plastics R	1.4	0.1
Plastics NR	29.4	1.2
Metals R	0.0	0.0
Metals NR	0.0	0.0
Glass R	0.0	0.0
Glass NR	22.8	0.9
Food Waste	0.0	0.0
Yard Waste	9.6	0.4
C&D	2,217.3	91.3
WEEE	5.8	0.2
HHW	1.5	0.1
Other Materials	97.0	4.0
Total	2,428.3	100.00

Figure 7.1 Overall Waste Composition- C&D

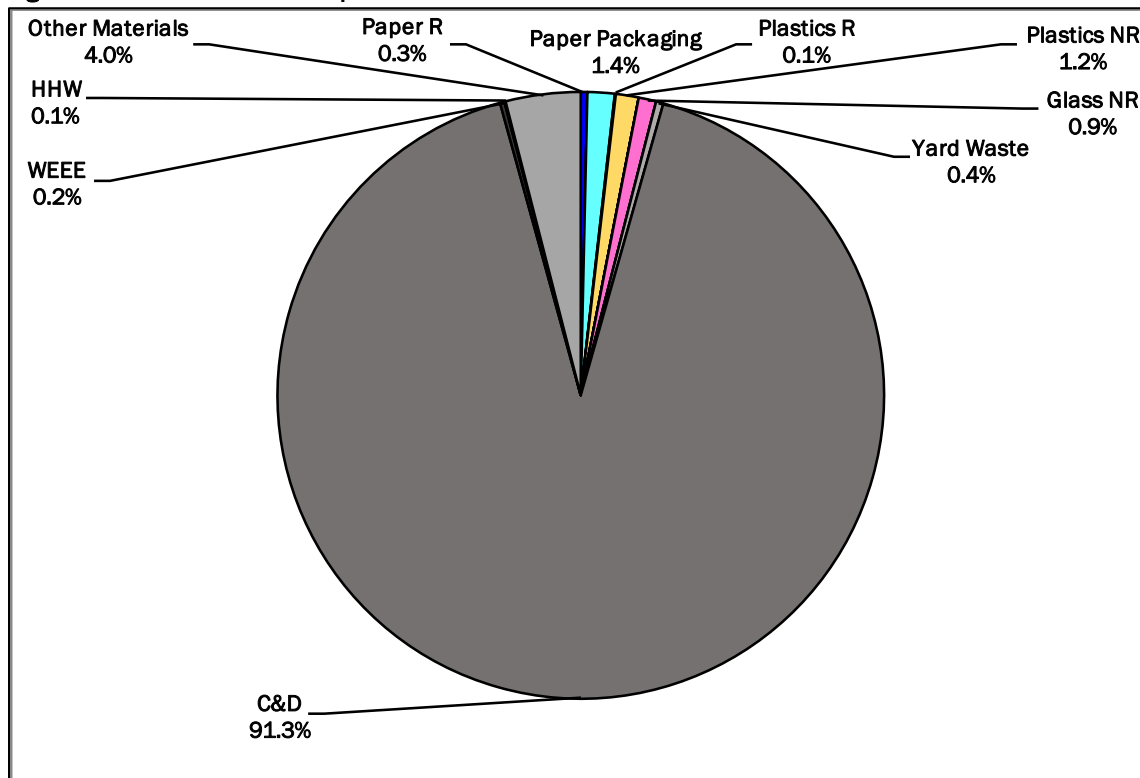


Table 7.2 depicts waste streams that are recyclable with current programs (i.e. printed paper and packaging, leaf and yard waste, WEEE, HHW) and waste streams that could be recyclable with new programs (e.g. C&D waste). It shows that an estimated 94% of wastes could be diverted (although it should be noted that some C&D waste such as treated wood is not readily recyclable).

Table 7.2 Estimated Divertible Wastes for C&D Loads

	kg/load	%
Paper R	8.5	0.3
Paper Packaging	35.0	1.4
Plastics R	1.4	0.1
Metals R	0.0	0.0
Glass R	0.0	0.0
Food Waste	0.0	0.0
Yard Waste	9.6	0.4
C&D	2,217.3	91.3
WEEE	5.8	0.2
HHW	1.5	0.1
	2,279.1	93.9

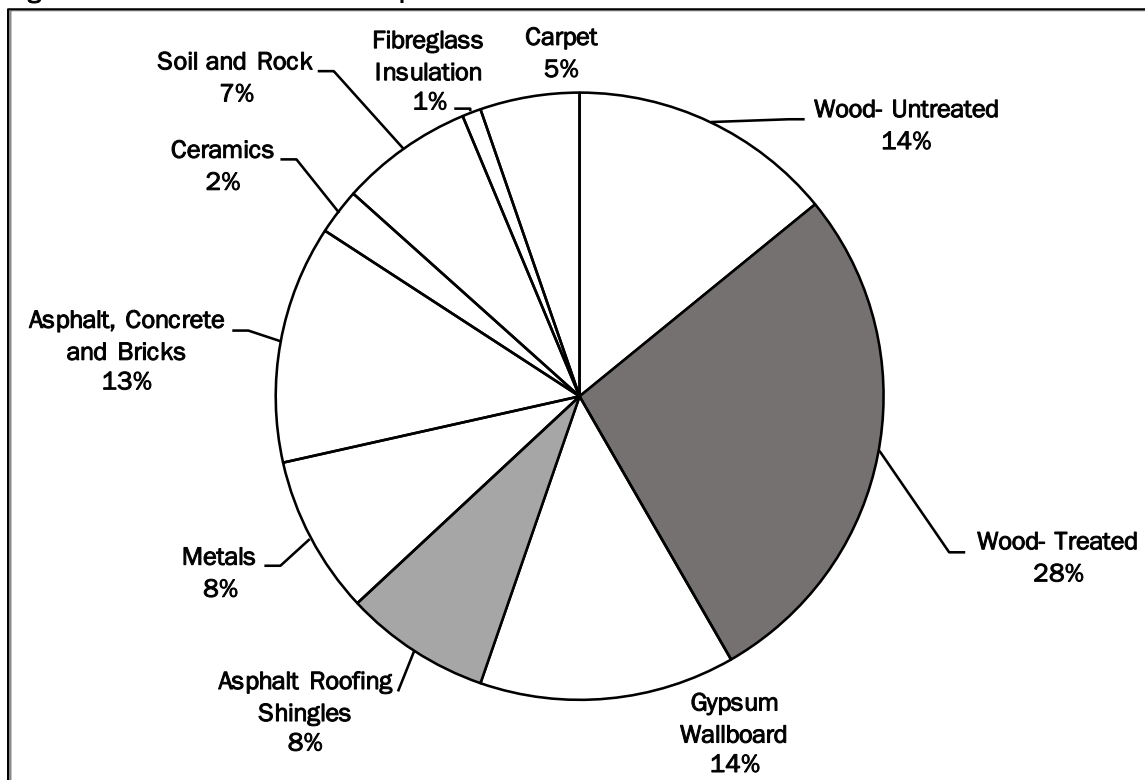
Obviously, C&D waste is a key waste stream that could be diverted from these loads. Some additional detail on C&D wastes is presented in Table 7.3 and Figure 7.2.

Untreated wood, asphalt roofing shingles, asphalt, concrete and bricks and metals are a number of key C&D wastes that could be diverted.

Table 7.3 C&D Waste Composition of Estimated Divertible Wastes

Waste Stream	kg/load	%
Wood- Untreated	311.3	14.1
Wood- Treated	608.9	27.6
Gypsum Wallboard	299.9	13.6
Asphalt Roofing Shingles	171.6	7.8
Metals	185.9	8.4
Asphalt, Concrete and Bricks	279.9	12.7
Ceramics	54.1	2.4
Soil and Rock	156.1	7.1
Fibreglass Insulation	22.2	1.0
Carpet	116.7	5.3
Total	2,206.6	100.0

Figure 7.2 Overall C&D Waste Composition- C&D



8.0 Overall Waste Composition

The estimated weighted overall waste composition of the various municipal solid waste streams was calculated using a model. **Table 8.1** depicts the estimated amount of waste generated in the City. Single family, multi-residential, self-haul quantities were provided by the City. IC&I data includes data provided by the City and estimated private sector quantities. Private sector managed IC&I and C&D wastes were inferred from Statistics Canada waste disposal data.

Table 8.1 Estimated Waste Disposal per Waste Stream

Generator	tonnes/year
Single Family Residential	51,900
Multi Residential	9,100
Self Haul	17,100
IC&I	152,900
C&D (privately managed)	16,100
Total	247,100

The overall estimated waste composition, are presented in **Table 8.2** and **Figure 8.1** (Note: the “R”s in Figures and Charts mean recyclable and “NR”s mean not recyclable). The key wastes included: food waste, other materials, C&D and yard waste.

Table 8.2 Estimated Waste Composition of Municipal Solid Waste Disposal Streams

	Single Family Residential	Multi Residential	IC&I	Self Haul	C&D	Weighted Average
Waste Stream	%					
Paper R	1.9	3.1	4.8	0.2	0.3	3.5
Paper NR	3.5	5.4	12.6	0.0	0.0	8.7
Paper Packaging	2.7	5.7	12.7	0.6	1.4	8.8
Plastics R	3.2	5.1	3.3	0.2	0.1	2.9
Plastics NR	3.1	6.1	12.2	0.8	1.2	8.6
Metals R	1.3	1.4	1.0	0.1	0.0	1.0
Metals NR	1.0	0.9	0.8	1.9	0.0	0.9
Glass R	0.9	1.5	0.2	0.0	0.0	0.4
Glass NR	0.5	0.2	0.2	0.6	0.9	0.4
Food Waste	26.9	35.4	26.8	0.3	0.0	23.5
Yard Waste	30.7	4.8	0.5	17.6	0.4	8.2
C&D	7.2	1.6	6.0	57.8	91.3	15.2
WEEE	0.7	1.4	0.6	1.7	0.2	0.7
HHW	0.8	0.6	0.2	1.3	0.1	0.4
Other Materials	15.5	26.8	18.0	16.8	4.0	16.8
Total (%)	100	100	100	100	100	100.0
Tonnes/year	51,900	9,100	152,900	17,100	16,100	247,100

Figure 8.1 Overall Waste Composition

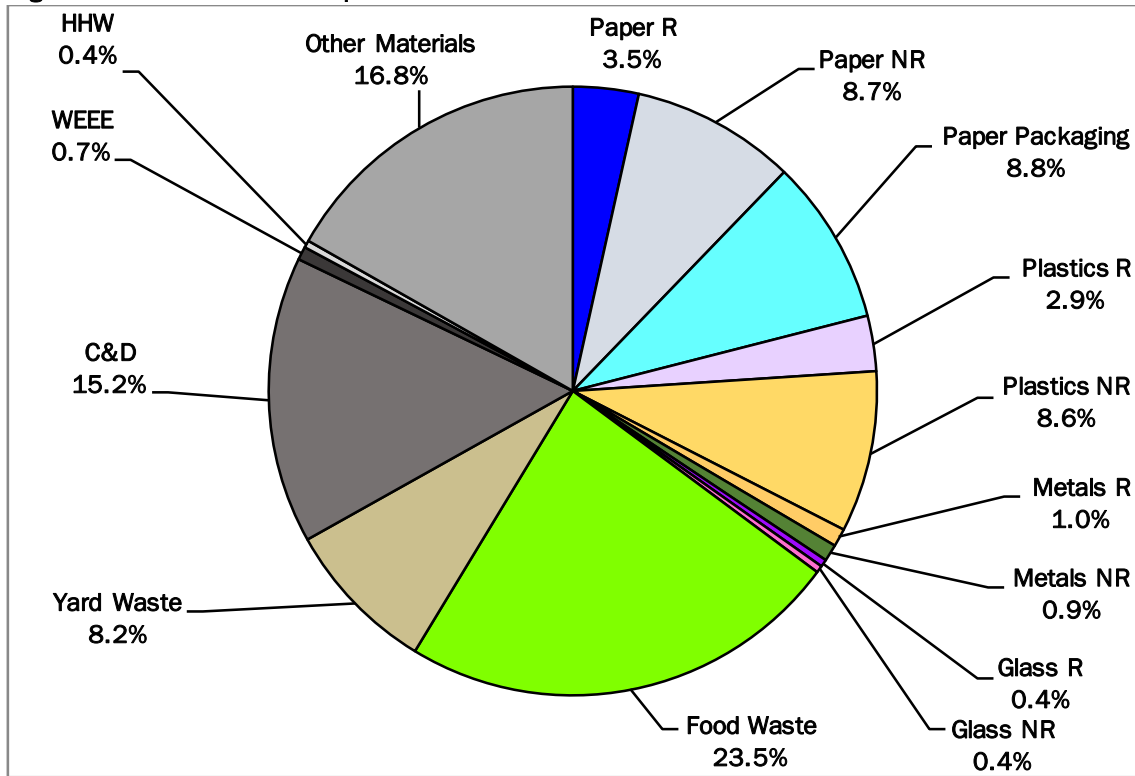


Table 8.3 depicts waste streams that are recyclable with current programs (i.e. printed paper and packaging, leaf and yard waste, WEEE, HHW) and waste streams that could be recyclable with new programs (e.g. food waste, C&D waste). It shows that an estimated 65% of wastes could be diverted. **Table 8.4** translates this into estimated tonnages. It shows that almost 7,000 tonnes of residential and 41,000 tonnes of wastes could be diverted if the blue cart program was expanded across all waste streams. There is close to 58,000 tonnes of food waste; 20,000 tonnes of yard waste; and 38,000 tonnes of C&D waste that could be reduced and/or diverted.

Table 5.3 and **Figure 5.2** for self-haul loads and **Table 7.3** and **Figure 7.2** for C&D waste provide some additional detail on the nature of C&D waste. **Table 8.5** uses this data to estimate tonnes of various C&D wastes that may be available for diversion. The C&D waste total also includes C&D wastes found in single family, multi residential and IC&I waste streams. This shows that there are considerable pools of wood (untreated and treated), asphalt roofing shingles, gypsum wall board and asphalt, concrete and bricks available for diversion.

Table 8.3 Estimated Overall Divertible Wastes- %

	Single Family Residential	Multi Residential	IC&I	Self Haul	C&D	Weighted Average
Waste Stream	%					
Paper R	1.9	3.1	4.8	0.2	0.3	3.5
Paper Packaging	2.7	5.7	12.7	0.6	1.4	8.8
Plastics R	3.2	5.1	3.3	0.2	0.1	2.9
Metals R	1.3	1.4	1.0	0.1	0.0	1.0
Glass R	0.9	1.5	0.2	0.0	0.0	0.4
Food Waste	26.9	35.4	26.8	0.3	0.0	23.5
Yard Waste	30.7	4.8	0.5	17.6	0.4	8.2
C&D	7.2	1.6	6.0	57.8	91.3	15.2
WEEE	0.7	1.4	0.6	1.7	0.2	0.7
HHW	0.8	0.6	0.2	1.3	0.1	0.4
Total (%)	76.5	60.6	56.1	79.8	93.9	64.6
Tonnes/year	39,683	5,516	85,782	13,649	15,111	159,740

Table 8.4 Estimated Overall Divertible Wastes- tonnes/year

	Single Family Residential	Multi Residential	IC&I	Self Haul	C&D	Total
Waste Stream	tonnes/year					
Paper R	987	284	7,266	27	56	8,619
Paper Packaging	1,425	516	19,449	110	232	21,733
Plastics R	1,640	469	5,114	39	9	7,271
Metals R	692	129	1,519	18	0	2,358
Glass R	490	133	350	1	0	974
Food Waste	13,977	3,224	40,940	46	0	58,187
Yard Waste	15,919	433	822	3,010	64	20,247
C&D	3,745	144	9,179	9,881	14,701	37,650
WEEE	386	131	900	290	38	1,745
HHW	424	54	242	227	10	956
Tonnes/year	39,683	5,516	85,782	13,649	15,111	159,740

Table 8.5 Estimated Overall C&D Wastes- tonnes/year

Waste Stream	C&D		Self Haul		Total
	%	tonnes/year	%	tonnes/year	tonnes/year
Wood- Untreated	14.1	3,918	12.2	1,208	5,126
Wood- Treated	27.6	7,663	34.7	3,427	11,089
Gypsum Wallboard	13.6	3,774	2.1	205	3,979
Asphalt Roofing Shingles	7.8	2,160	28.9	2,851	5,011
Metals	8.4	2,339	0.5	45	2,384
Asphalt, Concrete and Bricks	12.7	3,523	0.3	25	3,547
Ceramics	2.4	680	4.2	417	1,097
Soil and Rock	7.1	1,964		0	1,964
Fibreglass Insulation	1.0	280		0	280
Carpet	5.3	1,469	0.0	0	1,469
Other			17.2	1,702	1,702
Total	100.0		100.0		
Tonnes/year	27,769	27,769	9,881	9,881	37,650

Appendices are supplied as a separate Excel document:

Appendix 1- A1 Single Family Households calculations

Appendix 2- A2 Multi-Residential Households calculations

Appendix 3- A3 Self Haul calculations

Appendix 4- A4 Industrial, Commercial and Institutional (ICI) calculations

Appendix 5- A5 Construction and Demolition (C&D) calculations

Appendix 6- A6 Model to Estimate Overall Waste Composition

Appendix 1 – A1 Single Family Households Calculations

Residential Calculations

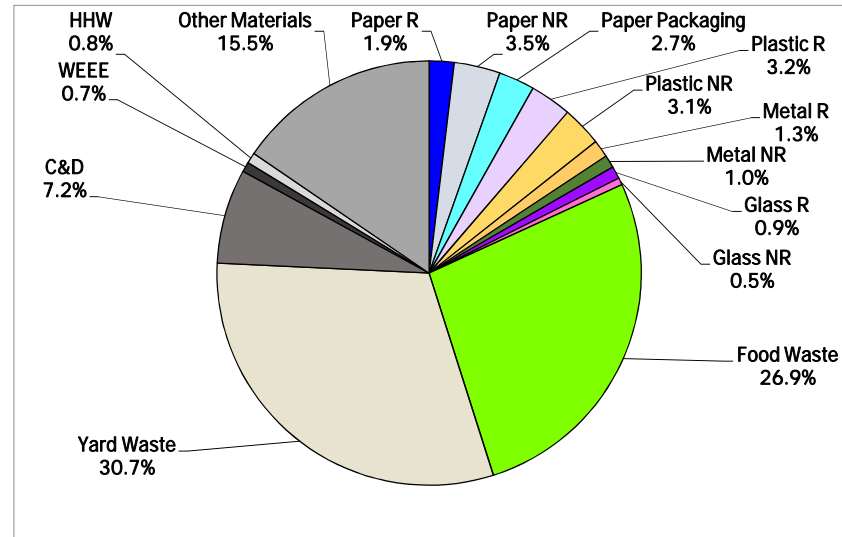
	Garbage			
	kg/hshld/week			
	Winter	Spring	Fall	Average
Paper R	0.2	0.3	0.3	0.3
Paper NR	0.5	0.6	0.6	0.5
Paper Packaging	0.4	0.4	0.5	0.4
Plastic R	0.6	0.4	0.4	0.5
Plastic NR	0.3	0.6	0.5	0.5
Metal R	0.1	0.2	0.3	0.2
Metal NR	0.1	0.2	0.2	0.2
Glass R	0.1	0.2	0.2	0.1
Glass NR	0.1	0.1	0.1	0.1
Food Waste	4.0	3.9	4.7	4.2
Yard Waste	0.1	10.3	3.9	4.8
C&D	0.8	1.7	0.9	1.1
WEEE	0.1	0.0	0.2	0.1
HHW	0.1	0.2	0.2	0.1
Other Materials	1.7	2.7	2.8	2.4
Total	9.1	21.8	15.9	15.6

	Recycling		Overall	
	kg/hshld/week			
	Winter	Spring	Winter	Spring
Paper R	0.9	1.3	1.1	1.6
Paper NR	0.0	0.1	0.5	0.6
Paper Packaging	0.9	1.1	1.3	1.6
Plastic R	0.2	0.2	0.8	0.7
Plastic NR	0.1	0.2	0.4	0.9
Metal R	0.1	0.1	0.2	0.2
Metal NR	0.0	0.0	0.1	0.2
Glass R	0.1	0.2	0.2	0.4
Glass NR	0.0	0.0	0.1	0.1
Food Waste	0.0	0.1	4.0	3.9
Yard Waste	0.0	0.0	0.1	10.3
C&D	0.0	0.0	0.8	1.7
WEEE	0.0	0.0	0.1	0.0
HHW	0.0	0.0	0.1	0.2
Other Materials	0.0	0.0	1.7	2.8
Total	2.4	3.4	11.5	25.2

Winter avoidable for 60.8
 Spring avoidable for 54.1
 Fall avoidable food 62.2
Average 59.1

NOTE: DEVELOPED AN OVERALL PERCENTAGE OF EACH WASTE TYPE FROM SINGLE FAMILY RESIDENTIAL COMPOSITION DATA.

	Garbage	
	kg/hshld/week	%
Paper R	0.3	1.9
Paper NR	0.5	3.5
Paper Packaging	0.4	2.7
Plastic R	0.5	3.2
Plastic NR	0.5	3.1
Metal R	0.2	1.3
Metal NR	0.2	1.0
Glass R	0.1	0.9
Glass NR	0.1	0.5
Food Waste	4.2	26.9
Yard Waste	4.8	30.7
C&D	1.1	7.2
WEEE	0.1	0.7
HHW	0.1	0.8
Other Materials	2.4	15.5
Total	15.6	100.0



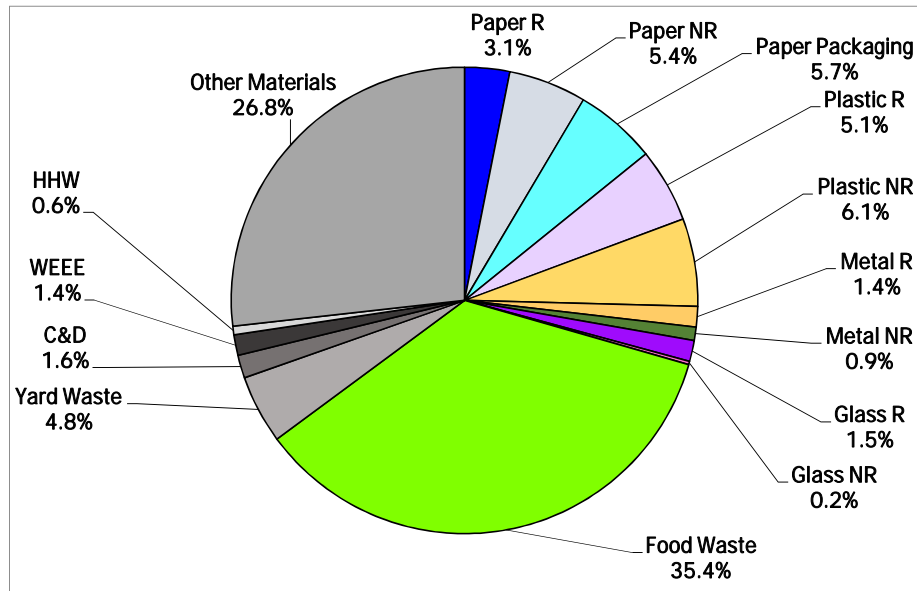
Critical SF Res Table. Percent of various materials recyclable with current programs "R" and potential new programs

	Garbage	
	kg/hshld/week	%
Paper R	0.3	1.9
Paper Packaging	0.4	2.7
Plastics R	0.5	3.2
Metals R	0.2	1.3
Glass R	0.1	0.9
Food Waste	4.2	26.9
Yard Waste	4.8	30.7
C&D	1.1	7.2
WEEE	0.1	0.7
HHW	0.1	0.8
	11.9	76.5

Appendix 2 – A2 Multi-Residential Households Calculations

NOTE: DEVELOPED AN OVERALL PERCENTAGE OF EACH WASTE TYPE FROM MULTI RESIDENTIAL COMPOSITION DATA.

	Garbage	
	kg/hshld/week	%
Paper R	0.2	3.1
Paper NR	0.4	5.4
Paper Packagin	0.4	5.7
Plastic R	0.4	5.1
Plastic NR	0.4	6.1
Metal R	0.1	1.4
Metal NR	0.1	0.9
Glass R	0.1	1.5
Glass NR	0.0	0.2
Food Waste	2.5	35.4
Yard Waste	0.3	4.8
C&D	0.1	1.6
WEEE	0.1	1.4
HHW	0.0	0.6
Other Materials	1.9	26.8
Total	7.2	100.0



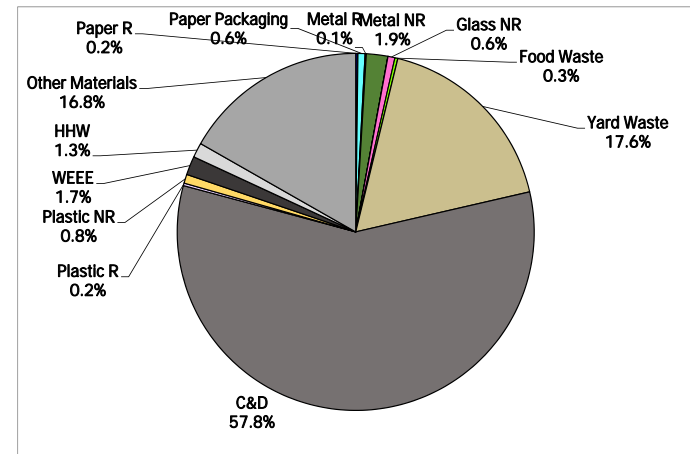
Critical Multi Res Table. Percent of various materials recyclable with current programs "R" and potential new programs

	Garbage	
	kg/hshld/week	%
Paper R	0.2	3.1
Paper Packagin	0.4	5.7
Plastics R	0.4	5.1
Metals R	0.1	1.4
Glass R	0.1	1.5
Food Waste	2.5	35.4
Yard Waste	0.3	4.8
C&D	0.1	1.6
WEEE	0.1	1.4
HHW	0.0	0.6
	4.3	60.6

Appendix 3 – A3 Self Haul Calculations

NOTE: DEVELOPED AN OVERALL PERCENTAGE OF EACH WASTE TYPE FROM SELF HAUL COMPOSITION DATA.

	Average		
	kg/load	%	
Paper R	0.2	0.2	
Paper NR	0.1	0.0	
Paper Packaging	0.9	0.6	
Metal R	0.2	0.1	
Metal NR	2.8	1.9	
Glass R	0.0	0.0	
Glass NR	0.9	0.6	
Food Waste	0.4	0.3	
Yard Waste	25.5	17.6	
C&D	83.8	57.8	
Plastic R	0.3	0.2	Moved plastic lower in this table so that data labels worked better 0916
Plastic NR	1.2	0.8	Moved plastic lower in this table so that data labels worked better 0917
WEEE	2.5	1.7	
HHW	1.9	1.3	
Other Materials	24.3	16.8	
Total	145.0	100.0	



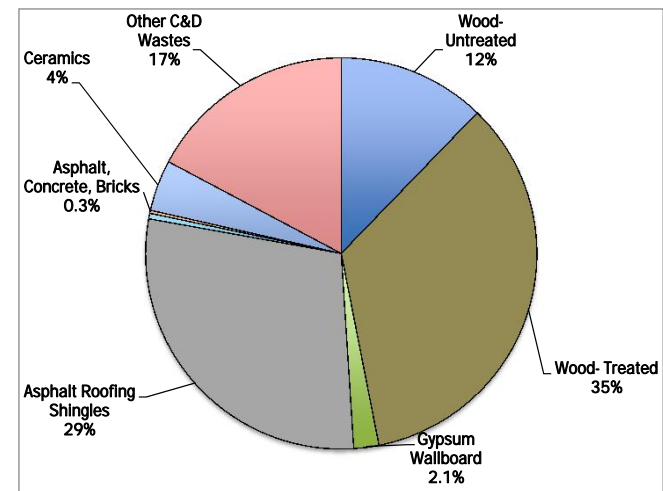
Critical table linked to above in usual order

	Average	Field	Revised	
	kg/load	%	%	
Paper R	0.2	0.2	0.4	
Paper NR	0.1	0.0	0.1	
Paper Packaging	0.9	0.6	1.5	
Plastic R	0.3	0.2	0.5	
Plastic NR	1.2	0.8	1.9	
Metal R	0.2	0.1	0.3	
Metal NR	2.8	1.9	4.6	
Glass R	0.0	0.0	0.0	
Glass NR	0.9	0.6	1.5	
Food Waste	0.4	0.3	0.6	
Yard Waste	25.5	17.6	41.7	
C&D	83.8	57.8		
WEEE	2.5	1.7	4.0	
HHW	1.9	1.3	3.1	
Other Materials	24.3	16.8	39.7	
Total	145.0	100.0	60.3	

Note: City had own estimate of C&D in Self Haul and we backed out of Self Haul calculations for model. We revised per cent based on remaining waste streams in self haul loads. 0117

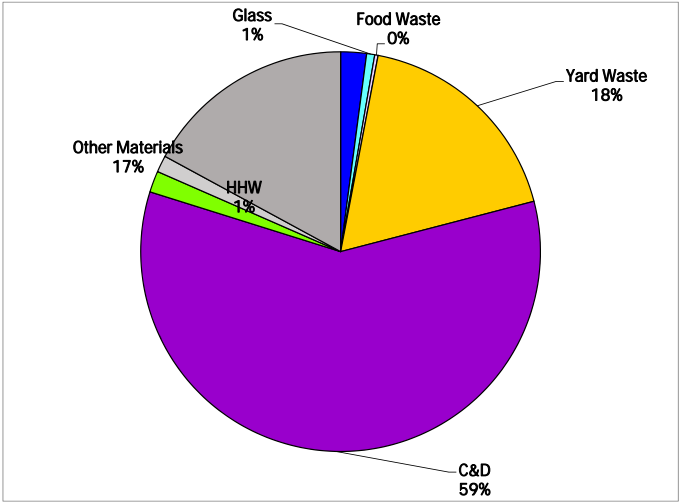
	Average	
	kg/load	%
Wood- Untreated	10.2	12.2
Wood- Treated	29.1	34.7
Gypsum Wallboard	1.7	2.1
Asphalt Roofing Shingles	24.2	28.9
Metals	0.4	0.5
Asphalt, Concrete, Bricks	0.2	0.3
Ceramics	3.5	4.2
Other C&D Wastes	14.4	17.2
Total	83.8	100.0

Construction and Demolition Waste Detail



	kg/load	%
Paper R	0.2	0.2
Paper Packaging	0.9	0.6
Plastics R	0.3	0.2
Metals R	0.2	0.1
Glass R	0.0	0.0
Food Waste	0.4	0.3
Yard Waste	25.5	17.6
C&D	83.8	57.8
WEEE	2.5	1.7
HHW	1.9	1.3
	115.8	79.8

	Total kg	%
Metals	112.84	2.05
Glass	35.14	0.64
Food Waste	14.74	0.27
Yard Waste	970.21	17.60
C&D	3,184.84	57.78
WEEE	93.34	1.69
HHW	73.16	1.33
Other Materials	924.10	16.77
	5,511.87	100.00



Appendix 4 – A4 Industrial, Commercial and Institutional (ICI) Calculations

NOTE: THIS TAB WAS USED TO DEVELOP OVERALL ICI ESTIMATE. USED DATA FROM SASKATOON AUDITS, USED PROF, SCI& TECHNICAL SERVICES FROM CALGARY AND THEN BACKFILLED REST WITH CALGARY WAM DATA

From Calgary Report

			Paper	Plastic	Glass	Metal	Organics	Other	Wood	Sum
11	Agriculture, Forestry, Fishing & Hunting		26.8%	10%	3%	3%	18%	40%		100.2%
21	Mining, Oil & Gas Extraction		39.9%	10%	3%	10%	19%	20%		100.6%
221	Utilities		33.7%	11%	2%	7%	20%	28%		101.0%
31-33	Manufacturing		33.9%	14%	4%	9%	8%	10%	21%	100.1%
41	Wholesale Trade		27.4%	13%	1%	6%	21%	33%		99.7%
44-45	Retail Trade		38.4%	11%	2%	8%	22%	19%		100.3%
48-49	Transportation & Warehousing		35.9%	8%	5%	3%	13%	35%		99.8%
51	Information & Cultural Industries		41.7%	14%	3%	5%	20%	17%		100.1%
52	Finance, Insur, Real Estate, Rent/Lease		56.5%	10%	2%	4%	19%	8%		100.0%
54	Professional, Scientific & Technical Services		36.6%	10%	3%	13%	20%	17%		99.6%
56 (31)	Administration & Support, Waste Mgmt & Remediation		52.9%	12%	4%	5%	16%	11%		100.2%
61	Education Services		35.2%	12%	3%	7%	37%	5%		99.9%
62	Health Care & Social Assistance		33.9%	17%	1%	8%	23%	18%		101.2%
71	Arts, Entertainment & Recreation		17.4%	10%	2%	4%	32%	34%		99.9%
72	Accommodation & Food Services		30.3%	10%	5%	2%	45%	7%		100.0%
81	Other Services (except public admin)		33.4%	13%	3%	8%	32%	11%		100.5%
91	Public Administration		38.3%	11%	3%	4%	25%	19%		100.0%

SASKATOON

ORANGE LINES FROM SASKATOON WASTE AUDITS

PINK LINE FROM CALGARY WASTE AUDITS

UNHIGHLIGHTED FROM CALGARY REPORT (FROM WAM NOT AUDITS)

Made some minor manual adjustments to "other "so that they all summed to 100

		Estimated Tonnage	Paper	Plastic	Glass	Metal	Organics	Other	Sum	Employment
11	Agriculture, Forestry, Fishing & Hunting	160.2	26.8%	10%	3%	3%	18%	40%	100.0%	137
21	Mining, Oil & Gas Extraction	1,342.6	39.9%	10%	3%	10%	19%	19%	100.0%	1474
221	Utilities	136.4	33.7%	11%	2%	7%	20%	27%	100.0%	282
31-33	Manufacturing	11,382.1	24.1%	12%	0%	1%	40%	23%	100.0%	9163
41	Wholesale Trade	6,247.9	27.4%	13%	1%	6%	21%	33%	100.0%	5222
44-45	Retail Trade	23,839.1	35.4%	18%	0%	2%	22%	23%	100.0%	18057
48-49	Transportation & Warehousing	5,514.7	35.9%	8%	5%	3%	13%	36%	100.0%	4326
51	Information & Cultural Industries	1,233.4	41.7%	14%	3%	5%	20%	17%	100.0%	1488
52	Finance, Insur, Real Estate, Rent/Lease	1,801.1	56.5%	10%	2%	4%	19%	8%	100.0%	6216
54	Professional, Scientific & Technical Services	5,202.6	17.8%	14%	0%	1%	56%	11%	100.0%	7847
56 (31)	Administration & Support, Waste Mgmt & Remedia	1,554.3	52.9%	12%	4%	5%	16%	11%	100.0%	2458
61	Education Services	5,384.7	35.2%	12%	3%	7%	37%	5%	100.0%	13052
62	Health Care & Social Assistance	26,481.8	26.0%	20%	0%	0%	4%	49%	100.0%	17607
71	Arts, Entertainment & Recreation	3,361.5	17.4%	10%	2%	4%	32%	34%	100.0%	3254
72	Accommodation & Food Services	23,048.5	24.6%	12%	0%	3%	46%	14%	100.0%	13405
81	Other Services (except public admin)	6,268.9	14.3%	13%	4%	6%	32%	32%	100.0%	6681
91	Public Administration	6,334.3	39.8%	13%	1%	2%	34%	11%	100.0%	10776

129294.036

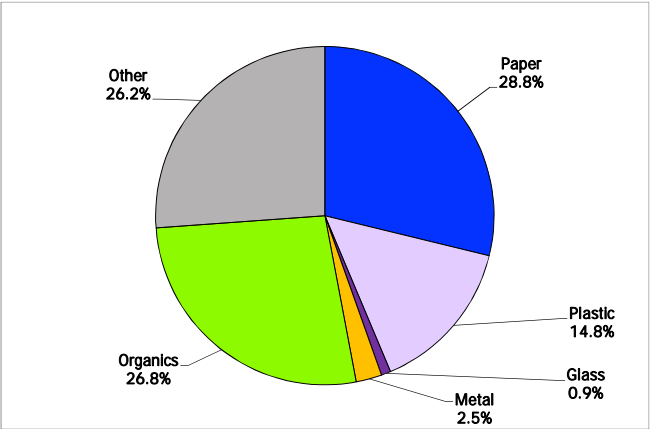
121445

Saskatoon Overall (from above table)

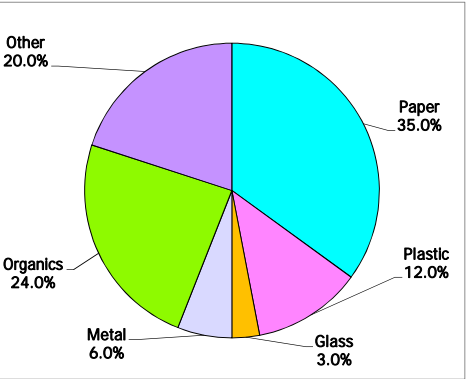
Uses composition from waste audits and composition from WAM

Paper	28.8
Plastic	14.8
Glass	0.9
Metal	2.5
Organics	26.8
Other	26.2
	100.0

Saskatoon Overall (Weighted)



From Calgary Overall ICI estimate (WAM)



Note: Saskatoon Overall compares well to my assessment by slotting unaudit NAICS to closest audited category. See next tab. 1016

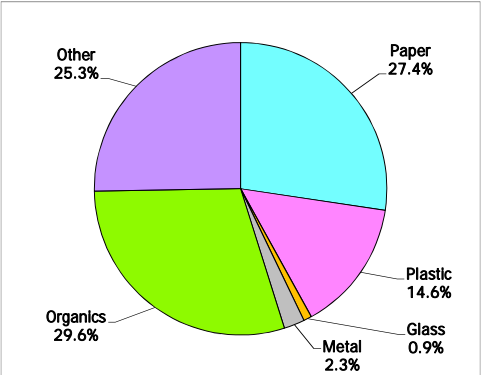
Saskatoon Overall FROM SUMMER 2016 AUDIT See pie chart below

Paper	27.4
Plastic	14.6
Glass	0.9
Metal	2.3
Organics	29.6
Other	25.3
	100.1

Explains this weight 97,354.8
% 75.3

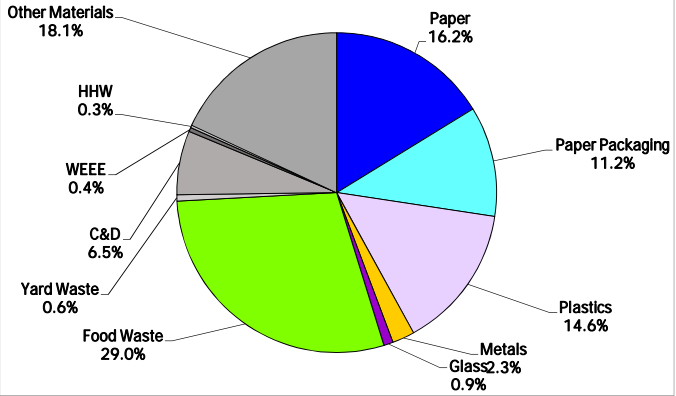
Saskatoon Overall FROM SUMMER 2016 AUDITS

Unweighted

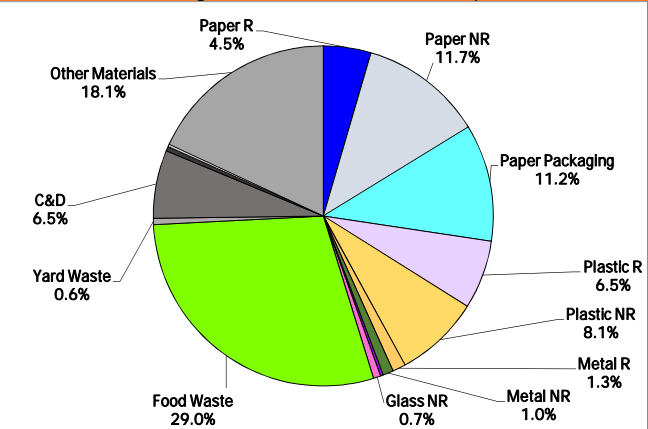


Overall ICI Waste Audits- Saskatoon (using some Calgary data)

from ICI Waste Auditing Sheets Saskatoon NC 190916 pvdw Unweighted

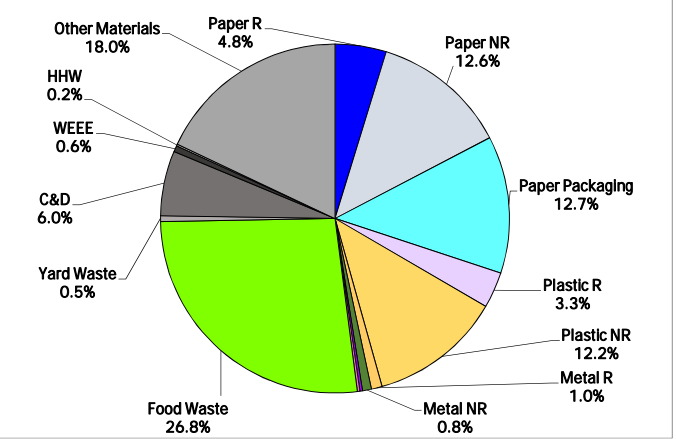


from ICI Waste Auditing Sheets Saskatoon NC 190916 pvdw Unweighted



Weighted

This is weighted estimate of ICI. Includes data from audits and slotted data.



NOTE: DEVELOPED A WEIGHTED PERCENTAGE OF EACH WASTE TYPE FROM ICI COMPOSITION DATA. FULL AVERAGE INCLUDES NON AUDITED SECTORS BEING SLOTTED INTO AUDITED SECTORS

Note: These are the average % from ICI waste audits undertaken in the Summer of 2016.

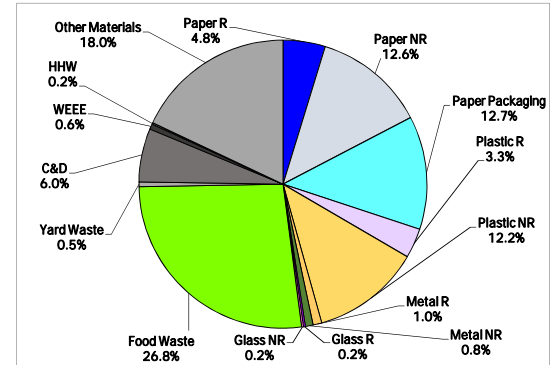
	Manufacturing	Retail	Health Care	Accommodation/Food	Other Services	Admin	Average	AUDITED	FULL
								Weighted Average	Weighted Average
							%		
Paper R	2.8	5.6	4.9	1.6	4.4	8.0	4.5	4.2	4.8
Paper NR	6.0	7.8	17.8	10.3	6.9	21.5	11.7	11.7	12.6
Paper Packaging	15.4	22.0	3.3	12.8	3.0	10.4	11.2	12.0	12.7
Plastics R	2.7	4.2	2.8	4.3	2.3	2.1	3.1	3.4	3.3
Plastics NR	8.8	14.0	17.6	8.0	10.4	10.4	11.5	12.5	12.2
Metals R	1.4	0.3	0.2	2.5	2.6	0.6	1.3	1.1	1.0
Metals NR	0.1	1.4	0.1	0.4	2.9	1.1	1.0	0.7	0.8
Glass R	0.3	0.0	0.0	0.2	0.1	0.8	0.2	0.1	0.2
Glass NR	0.0	0.1	0.1	0.1	3.8	0.0	0.7	0.3	0.2
Food Waste	40.0	21.2	3.8	45.3	30.4	33.1	29.0	25.7	26.8
Yard Waste	0.0	0.5	0.5	0.2	1.5	1.0	0.6	0.5	0.5
C&D	18.2	10.7	0.0	6.2	3.6	0.0	6.5	6.5	6.0
WEEE	0.0	1.8	0.0	0.3	0.4	0.0	0.4	0.5	0.6
HHW	0.0	0.1	0.1	0.3	1.0	0.0	0.3	0.2	0.2
Other Materials	4.3	10.3	48.7	7.5	26.5	11.0	18.1	20.5	18.0
	100	100	100	100	100	100		100	100
Total									
Estimated Tonnage	11,382.1	23,839.1	26,481.8	23,048.5	6,268.9	6,334.3	97,354.8		

Added the estimated tonnages from sectors that were not sampled.

							NAICS
Wholesale trade	6,247.9						41
Transportation & Warehousing	5,514.7						48-49
Education Services					5,384.7		61
Professional, Scientific & Technical Services					5,202.6		54
Arts, Entertainment & Recreation			3,361.5				71
Finance, Insurance, Real Estate, Rent/Lease					1,801.1		52
Administration & Support, Waste Mgmt & Remediation					1,554.3		56 (31)
Mining, Oil & Gas Extraction					1,342.6		21
Information & Cultural Industries					1,233.4		51
Agriculture, Forestry, Fishing & Hunting					160.2		11
Utilities					136.4		221
	11,382.1	35,601.8	26,481.8	26,410.0	6,268.9	23,149.4	129,294.0

Critical ICI Table. Percent of various materials recyclable with current programs "R" and potential new programs

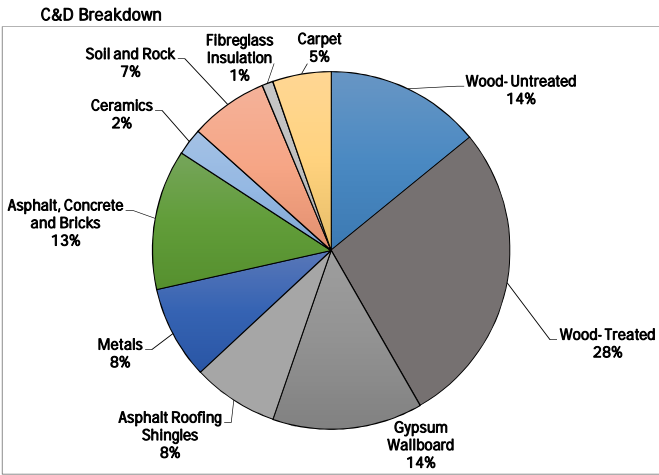
	%
Paper R	4.8
Paper Packaging	12.7
Plastics R	3.3
Metals R	1.0
Glass R	0.2
Food Waste	26.8
Yard Waste	0.5
C&D	6.0
WEEE	0.6
HHW	0.2
	56.1



Appendix 5 – A5 Construction and Demolition (C&D) Calculations

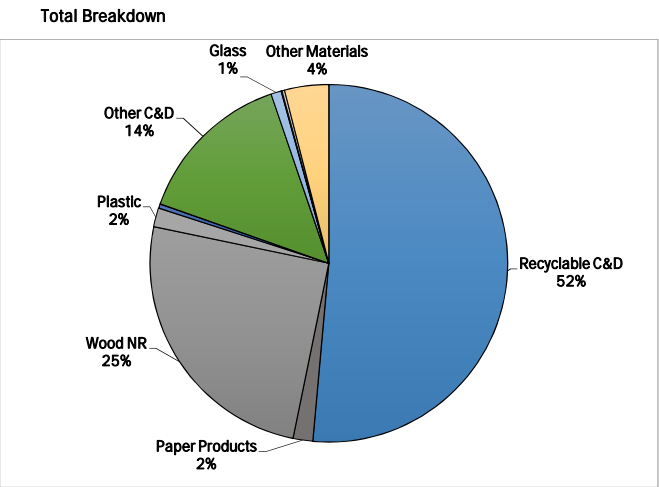
Breakdown of C&D Materials. Does not include other materials, WEEE, HHW etc. and therefore does not total 100%

Waste Stream	kg/load	%	%
Wood- Untreated	311.3	14.1	12.8
Wood- Treated	608.9	27.6	25.1
Gypsum Wallboard	299.9	13.6	12.3
Asphalt Roofing Shingles	171.6	7.8	7.1
Metals	185.9	8.4	7.7
Asphalt, Concrete and Bricks	279.9	12.7	11.5
Ceramics	54.1	2.4	2.2
Soil and Rock	156.1	7.1	6.4
Fibreglass Insulation	22.2	1.0	0.9
Carpet	116.7	5.3	4.8
Total	2,206.6	100.0	90.9



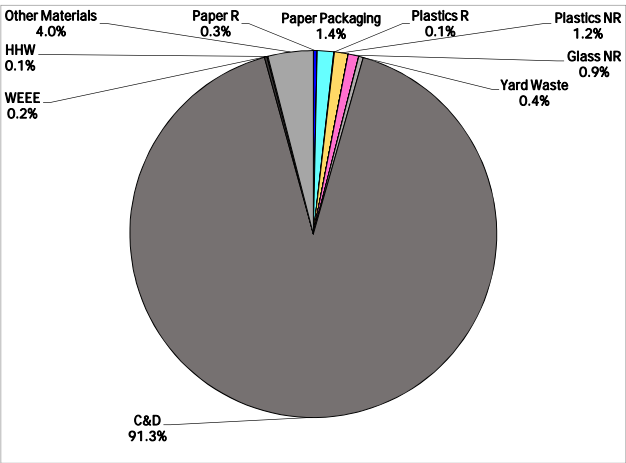
Breakdown of all materials

Waste Stream	%	Avg. kg/load
Recyclable C&D	51.4	1248.6
Paper Products	1.8	43.5
Wood NR	25.1	608.9
Plastic	1.7	41.5
Organics	0.4	9.6
Other C&D	14.4	349.1
Glass	0.9	22.8
HHW	0.1	1.5
Electronics	0.2	5.8
Other Materials	4.0	97.0
Total	100.0	2,428.3



Breakdown of all materials to match Res, ICI streams

Waste Stream	kg/load	%
Paper R	8.5	0.3
Paper NR	0.0	0.0
Paper Packaging	35.0	1.4
Plastics R	1.4	0.1
Plastics NR	29.4	1.2
Metals R	0.0	0.0
Metals NR	0.0	0.0
Glass R	0.0	0.0
Glass NR	22.8	0.9
Food Waste	0.0	0.0
Yard Waste	9.6	0.4
C&D	2,217.3	91.3
WEEE	5.8	0.2
HHW	1.5	0.1
Other Materials	97.0	4.0
Total	2,428.3	100.00



Appendix 6 – A6 Model to Estimate Overall Waste Composition

Model to Estimate Overall Waste Composition

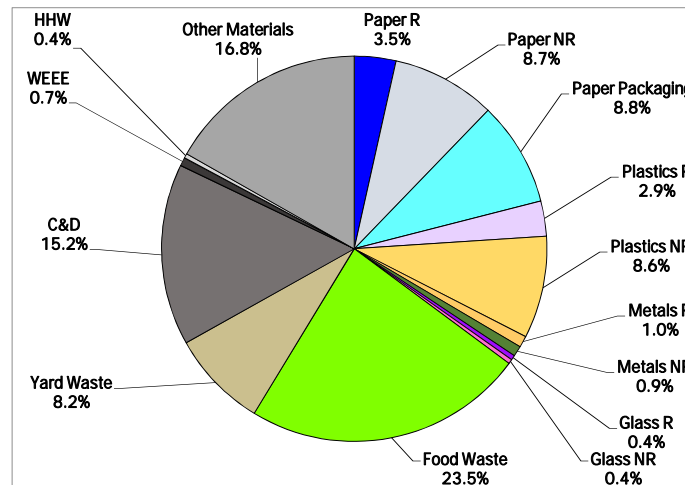
Tonnage Model

Generator	tonnes/year
Single Family Residential	51,900
Multi Residential	9,100
Self Haul	17,100
IC&I	152,900
C&D (privately managed)	16,100
Total	247,100

Overall composition

	Single Family Residential	Multi Residential	IC&I	Self Haul	C&D	Weighted Average
Waste Stream	%					
Paper R	1.9	3.1	4.8	0.2	0.3	3.5
Paper NR	3.5	5.4	12.6	0.0	0.0	8.7
Paper Packaging	2.7	5.7	12.7	0.6	1.4	8.8
Plastics R	3.2	5.1	3.3	0.2	0.1	2.9
Plastics NR	3.1	6.1	12.2	0.8	1.2	8.6
Metals R	1.3	1.4	1.0	0.1	0.0	1.0
Metals NR	1.0	0.9	0.8	1.9	0.0	0.9
Glass R	0.9	1.5	0.2	0.0	0.0	0.4
Glass NR	0.5	0.2	0.2	0.6	0.9	0.4
Food Waste	26.9	35.4	26.8	0.3	0.0	23.5
Yard Waste	30.7	4.8	0.5	17.6	0.4	8.2
C&D	7.2	1.6	6.0	57.8	91.3	15.2
WEEE	0.7	1.4	0.6	1.7	0.2	0.7
HHW	0.8	0.6	0.2	1.3	0.1	0.4
Other Materials	15.5	26.8	18.0	16.8	4.0	16.8
Total (%)	100	100	100	100	100	100.0
Tonnes/year	51,900	9,100	152,900	17,100	16,100	247,100

Overall Waste Composition



Critical Table. Percent of various materials recyclable with current programs "R" and potential new programs (weighted)

Divertible streams %

	Single Family Residential	Multi Residential	IC&I	Self Haul	C&D	Weighted Average
Waste Stream	%					
Paper R	1.9	3.1	4.8	0.2	0.3	3.5
Paper Packaging	2.7	5.7	12.7	0.6	1.4	8.8
Plastics R	3.2	5.1	3.3	0.2	0.1	2.9
Metals R	1.3	1.4	1.0	0.1	0.0	1.0
Glass R	0.9	1.5	0.2	0.0	0.0	0.4
Food Waste	26.9	35.4	26.8	0.3	0.0	23.5
Yard Waste	30.7	4.8	0.5	17.6	0.4	8.2
C&D	7.2	1.6	6.0	57.8	91.3	15.2
WEEE	0.7	1.4	0.6	1.7	0.2	0.7
HHW	0.8	0.6	0.2	1.3	0.1	0.4
Total (%)	76.5	60.6	56.1	79.8	93.9	64.6
Tonnes/year	39,683	5,516	85,782	13,649	15,111	159,740

Divertible streams tonnes

	Single Family Residential	Multi Residential	IC&I	Self Haul	C&D	Total
Waste Stream	tonnes/year					
Paper R	987	284	7,266	27	56	8,619
Paper Packaging	1,425	516	19,449	110	232	21,733
Plastics R	1,640	469	5,114	39	9	7,271
Metals R	692	129	1,519	18	0	2,358
Glass R	490	133	350	1	0	974
Food Waste	13,977	3,224	40,940	46	0	58,187
Yard Waste	15,919	433	822	3,010	64	20,247
C&D	3,745	144	9,179	9,881	14,701	37,650
WEEE	386	131	900	290	38	1,745
HHW	424	54	242	227	10	956
Tonnes/year	39,683	5,516	85,782	13,649	15,111	159,740

C&D analysis

Waste Stream	C&D		Self Haul		Total
	%	tonnes/year	%	tonnes/year	tonnes/year
Wood- Untreated	14.1	3,918	12.2	1,208	5,126
Wood- Treated	27.6	7,663	34.7	3,427	11,089
Gypsum Wallboard	13.6	3,774	2.1	205	3,979
Asphalt Roofing Shingles	7.8	2,160	28.9	2,851	5,011
Metals	8.4	2,339	0.5	45	2,384
Asphalt, Concrete and Brick	12.7	3,523	0.3	25	3,547
Ceramics	2.4	680	4.2	417	1,097
Soil and Rock	7.1	1,964		0	1,964
Fibreglass Insulation	1.0	280		0	280
Carpet	5.3	1,469	0.0	0	1,469
Other			17.2	1,702	1,702
Total	100.0		100.0		
Tonnes/year	27,769	27,769	9,881	9,881	37,650

Data provided by City of Saskatoon in email dated: 9 January 2017

City of Saskatoon Landfill

	2014	2015	2016	Average
	tonnes/year			
Single Family	52,800	51,500	51,500	51,900
Multi Residential	9,500	8,800	9,100	9,100
Industrial, Commercial and Institutional (IC&I)	45,800	34,700	23,900	34,800
City Landfill Self-Haul	18,100	17,400	15,900	17,100
Total Waste	126,200	112,400	100,400	113,000
Clean Fill	43,400	44,700	54,700	47,600
Total Waste & Clean Fill	169,600	157,100	146,000	157,500

*C&D waste tonnages are included in the above table

**The table below identifies the breakdown of C&D waste tonnages that are included in the above table

Construction and Demolition (C&D)	7,900 total (2,600 self-haul + 5,300 ICI)	7,900 total (2,200 self-haul + 5,700 ICI)	7,100 total (3,000 self-haul + 4,100 ICI)	
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- Landfill scale data obtained from Geoware
- Single family residential = all waste hauled by City side loaders and rear loaders
- Multi-family residential = percentage of waste hauled by City fork trucks
- ICI = percentage of waste hauled by City fork trucks plus all Cash Commercial loads plus all Commercial account loads
- Self-haul = all loads coded as Cash Residential
- C&D waste includes all loads coded as Concrete (Material Type 20), Building Material (Type 21), Rubble (Type 22), Shingles (Type 23), Clean Wood Waste (Type 66)

2cg Reworking Data

City Gross Data

Averaged three years of data

	2014	2015	2016	Average
	tonnes/year			
Single Family	52,800	51,500	51,500	51,900
Multi Residential	9,500	8,800	9,100	9,100
Industrial, Commercial and Institutional (IC&I)	45,800	34,700	23,900	34,800
City Landfill Self-Haul	18,100	17,400	15,900	17,100
Total Waste	126,200	112,400	100,400	113,000
Clean Fill	43,400	44,700	54,700	47,600
Total Waste & Clean Fill	169,600	157,100	155,100	160,600

Nets out City estimate of C&D brought in via IC&I and Self Haul

Incorporated C&D and subtracted relevant amounts from ICI and C&D

	2014	2015	2016	Average
	tonnes/year			
Single Family	52,800	51,500	51,500	51,900
Multi Residential	9,500	8,800	9,100	9,100
Industrial, Commercial and Institutional (IC&I)	40,500	29,000	23,900	31,100
City Landfill Self-Haul	15,500	15,200	15,900	15,500
Construction and Demolition (C&D)	7,900	7,900	7,100	7,600
Total Waste	126,200	112,400	100,400	113,000
Clean Fill	43,400	44,700	54,700	47,600
Total Waste & Clean Fill	169,600	157,100	155,100	160,600

subtracted C&D coming from IC&I sector per City estimates

subtracted C&D coming from self haul per City estimates

From Sheri Praski 12 December 2016

Private Facility ‘Materials Managed’ Summary

In response to discussions with the City of Saskatoon, Dillon contacted local private waste facilities in the greater Saskatoon area in an effort to acquire data on the types and amounts of materials managed. This information is to be used to supplement privately managed waste information assembled as part of Waste Characterization Study.

The data collection effort included engagement of five facilities;

- Titan Clean Energy
- PSI Technologies Inc.
- Loraas Disposal/Loraas Recycle
- Green Prairie Environmental
- Lafarge Northwest

Dillon developed a confidentiality agreement for use with the contacted facilities to commit to consolidating collected information to prevent the linking of data with specific facilities/operators in project deliverables.

Contact with these facilities included a discussion on the Waste Diversion Plan project, the information required and the intended use of their facility data (including confidentiality considerations) and confirmation of their desire to participate.

All facilities expressed a willingness to share information. One facility provided detailed information that provided a high level of confidence in the data (due to the detail provided) but after several follow up attempts with all of the facilities, much of the information was verbal, incomplete or no information was provided. Discussion with the Ministry of Environment have indicated that additional information could be found on the total waste going into the two private landfills but the detail of how much was from City sources would likely not be provided through this means.

A rounded summary of information from the 5 private facilities (which combines detailed and verbal information) includes:

No usable data was obtained from this process

11 January 2017

Statistics Canada data was consulted

http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/envir25a-eng.htm

http://www.statcan.gc.ca/pub/16f0023x/2010001/part-partie1-eng.htm

Overivew of Saskatoon waste DISPOSAL data

Of that 65% is IC&I, which includes C&D

The population of Saskatoon is approximately 310,000

Per capita waste generation is 839 kg/capita/year, 2014

Residential 35

Commercial 65

Therefore :

Residential waste disposal estimate 91,032

IC&I waste disposal estimate 169,059
260,090

City data suggests about 78,000 tonnes of residential waste managed by the City.

Difference in A6 MODEL tab from City estimates of residential waste managed by the City (see above)

IC&I managed by the City 34,800

Includes embedded C&D waste

C&D waste is included in IC&I total

C&D comprises approximately 12 % of total waste stream, according to Statistics Canada

This does not account for any current diversion (i.e. 12% multiplied against total disposal; likely over estimate on this basis; given Saskatoon population growth C&D likely higher than national average)

Therefore C&D waste disposal 31,211 tonnes/year

Estimated total C&D from all sources

Therefore IC&I managed by private sector is 16,111 tonnes/year, total managed by private sector

This is total ICI multiplied by 12%

Therefore IC&I waste disposal 152,947 tonnes/year

Therefore IC&I managed by private sector is 118,147 tonnes/year, total- public sector IC&I management

APPENDIX B

Long-List of Potential Actions

APPENDIX B
City of Saskatoon Waste Diversion Opportunities Report - Final
Long-List of Potential Actions

No.	Category	Issue	Action	Reference/Source
1	1. System Governance and Management	The waste management system is running a deficit. Tipping fees are not required for all facilities and funds allocated towards certain programs do not cover the true costs. User pay is for recycling (utility fee) but garbage is covered through property taxes which does not create an incentive to divert if garbage is viewed as "free".	Modify approach to financing the solid waste management system through options like user pay and a utility.	2016 City rates and fees. Consulting team observations. Stakeholder interviews.
2	1. System Governance and Management	Almost 18% of the overall garbage stream is C&D material that is being landfilled instead of being diverted. Recovery Park will process the C&D waste but to ensure success, will need supporting tools in place prior to the opening.	Mandate source separation of C&D waste and have timing coincide with opening of Recovery Park. Develop necessary education/promotion required prior to Recovery Park C&D processing facility opening.	2016 waste audit results - 18% weighted average from all customer types is C&D (majority brought by self-haul to landfill is C&D (84%))
3	1. System Governance and Management	A significant amount of divertable materials are contained in the residual waste stream for all sectors that could be recovered for reuse or recycling through existing and/or future programs (e.g., food waste, C&D waste, ICI recyclables).	Implement disposal bans and measures as tools to increase diversion from all sectors on a material by material basis with timing coinciding with having processing capacity in place (start with materials to be handled through Recovery Park).	Stakeholder interviews. 2016 waste audit results.
4	1. System Governance and Management	ICI and C&D waste is mostly hauled by the private sector and disposed of in private landfills that contain a large percentage of materials that could be diverted. The City does not know how much waste is landfilled although Condition #48 of The Waste Bylaw requires the private sector to report annual tonnes of waste managed to the City (however, this has never been enforced).	City to influence and/or enforce diversion of ICI and C&D waste at the front end (e.g., through building permits).	2016 waste audit results - ~55% of ICI waste could be diverted (paper packaging, food waste) 94% of C&D loads (untreated wood, gypsum, asphalt/concrete/bricks, metals)
5	1. System Governance and Management	City Council adopted Waste Diversion Rate Performance Target of 70% by 2023. Diversion rates do not account for waste reduction and reuse initiatives as well as changes in how waste is packaged (lighter materials).	Define additional Key Performance Indicators (KPIs) that could be used to measure success of waste management system such as kg of waste disposed per person.	2015 Current State of Waste Diversion Consulting team experience
6	1. System Governance and Management	Current enforcement measures for cart placement bylaw infractions is to issue two warning notices before a ticket is issued. Current method is to conduct neighbourhood blitzes. Illegal dumping infractions are ticketed immediately if evidence of the perpetrator(s) can be obtained.	Implement different methods of enforcement for residential sector that makes best use of City resources (e.g., issuing 1 notice instead of 2). Reasons for ticketing will change with new programs and policies in place.	2015 State of Waste Diversion. 2016 Neighbourhood Blitz Report
7	1. System Governance and Management	The Waste Bylaw came into effect in 2004. Since then, additional programs have been implemented and more are anticipated. With the proposed changes to the waste management system, an update to the Waste Bylaw will be necessary.	Update the Waste Bylaw. Recommended actions that will impact the Waste Bylaw include mandatory source-separation of C&D materials, mandatory participation in the curbside organics collection program and potentially requiring ICI sector to report on waste quantities (Condition #48).	Workshop with City staff in March 2017.
8	1. System Governance and Management	City has hot spots for illegal dumping activities.	Select an option(s) to reduce illegally dumped waste and implement a pilot program at the hot spots such as the recycling depots. The City could also consider implementing a seasonal curbside bulky waste collection to help mitigate illegal dumping occurrences.	Stakeholder interviews. March 2017 workshop with City staff.
9	2. User Education and Awareness	Recycling is a good step in waste diversion however, residents need to remain aware that waste set out for collection is expensive and therefore, efforts should be made to reduce waste.	Implement promotion and education about ways to reduce waste. Example topics include reducing food waste, grasscycling and reducing waste during holidays.	Observations from consulting team
10	2. User Education and Awareness	With younger generations preferring apps and social media to get their information and older generations preferring traditional methods to stay informed (e.g., newspaper, calendar), develop varying types of promotion and education methods to reach the diverse geography.	Refine and validate P&E efforts to launch potential new programs and improve existing programs (e.g., reduce contamination in recycling stream) which can include targeted development and distribution of education materials based on demographics.	2016 CBSM Report Curbside Recycling Satisfaction Survey
11	2. User Education and Awareness	Better signage needed at City depots and at collection points.	Standardize signage and symbols throughout the City and continue for use at new facilities and in promotion and education (P&E) materials.	Stakeholder interviews
12	3. Reuse and Recycling	In order for Recovery Park to be successful, it has to be easy for residents to bring waste there for diversion in terms of using the Park and affording it.	Have the layout of Recovery Park be user friendly and efficient for a user to drop-off their waste for diversion and/or disposal (e.g., look at the traffic flow and number of times a car needs to be weighed). Consider allowing free drop-off of materials that the City wants to either sell to markets or for safe disposal (e.g., HHW, C&D, recyclables, scrap metal).	Stakeholder interviews
13	3. Reuse and Recycling	Dual stream (recyclables, garbage) waste receptacles are available at busy, pedestrian-orientated areas and parks contain baskets for beverage containers. Not all garbage bins have a recycling bin next to it.	Have standardized public space recycling bins tying the logos to curbside programs.	Observations from consulting team

APPENDIX B
City of Saskatoon Waste Diversion Opportunities Report - Final
Long-List of Potential Actions

No.	Category	Issue	Action	Reference/Source
14	3. Reuse and Recycling	HHW drop-off events are costly and are only available to residents in different parts of the City around eight times a year. The HHW depot at landfill (Eco-Centre or future Recovery Park) is the only permanent HHW depot. The use of the unstaffed recycling depots has been decreasing since the implementation of single and multi-family residential recycling programs. With a mandatory recycling program, this trend will likely continue.	Following a review of options, establish a permanent HHW depot(s) that are staffed at existing City waste facilities or partnerships with HHW recycling/disposal providers.	Stakeholder interviews Observations from consulting team Historical tonnage data.
15	3. Reuse and Recycling	There are opportunities to reuse diverted waste such as compost and C&D materials. Finished compost is being stockpiled. This decline in end markets is in part attributed to underfunding of the compost facility and the Parks Department not using it in their projects. C&D reuse opportunities are being developed by private sector (e.g., concrete, asphalt).	Develop a green procurement policy to increase beneficial reuse of waste. Proper funding should be addressed through the utility option (taken care of in Action No. 1).	Stakeholder interviews. Observations from consulting team.
16	4. Organics Management	The City's promotion of backyard composting and provision of composting through the depots and the subscription organics collection program is capturing a small percentage of the available organics generated while the remaining is sent for disposal. City-wide organics collection offers the potential for greatest increase in diversion and cost recovery.	Implement a mandatory City-wide organics collection program which includes timing (to coincide with opening of organics processing facility), an enhanced promotion and education program, tender of carts/containers and in-house/unit kitchen catchers.	2016 customer information on subscription service. Curbside Recycling Satisfaction Survey (1000 residents, 3/4 support city-wide organics program). Stakeholder interviews. 2016 survey results indicate that almost 60% of SF garbage is compostable (27% food, 31% LYW). MF - 40%, ICI - 27%.
17	4. Organics Management	The yard and garden waste compost facility is not suitable to handle food waste in terms of capacity and potential nuisance impacts. Funding is not sufficient to allow for necessary processing and therefore compost quality suffers and finished product is stockpiled.	Study and identify the most efficient method of collecting and processing YGW from all single-family households (e.g., separate processing and collection of YGW at the existing compost facility, co-collection and processing of YGW with food scraps and household organics at Recovery Park).	Stakeholder interviews. Observations from consulting team.
18	5. Collection and Transfer	When City-wide organics program is implemented, there will be a need for additional collection service. The City outsources recycling collection and contracts expire in 2019 and 2023 for single-family and multi-family, respectively. The City has 24 collection vehicles that are on 15-year replacement cycles for garbage collection.	Identify preferred collection method (outsourcing collection or City collection) and retain services for collection of organic waste.	Tied to implementation of City-wide SSO collection program Stakeholder interviews
19	5. Collection and Transfer	Weekly garbage collection from May to September contributes to the City's budget deficit. When a new organics collection program is introduced, a new collection approach will be required.	Change collection frequency to year-round bi-weekly collection of garbage and recyclables and weekly collection of organics.	Best practices Consulting team's experience.
20	5. Collection and Transfer	Garbage bins and green carts (for subscription organics collection program) had RFID tags installed that corresponded to an address however, some tags were not installed, are faulty or were improperly assigned therefore, the data is unreliable.	Implement data management system that may use RFID technology. Existing carts may need to be re-tagged and/or confirm addresses are linked to the carts. Coincide with the implementation of the organics collection program and the change in fee structure (e.g., pay as you throw).	Stakeholder interviews
21	6. Processing and Disposal	A large portion of the waste received at the landfill for disposal is waste wood (including elm) which could be used to generate electricity. There are interested partners who would assist the City.	Work with potential partners to find beneficial uses for the recovery of energy from waste wood that would otherwise be landfilled.	2016 Waste Characterization Study (14% is untreated wood, 28% is treated wood in C&D stream). Landfill operations estimates approximately 1,600 tonnes of waste wood is landfilled each year. Stakeholder interviews (Titan)

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