

Composition of Queenstown Lakes District Kerbside Rubbish and Recycling Collections

Prepared for
Queenstown Lakes District Council
December 2019



Document quality control

Date	Status	Written by	Distributed to
4 August 2020	Final 1.0	BM	QLDC
17 April 2020	Draft 0.2	BM	QLDC
22 January 2020	Draft 0.1	BM	QLDC

Contact details

Queenstown Lakes District Council

Property & Infrastructure
Private Bag 50072
Queenstown 9348

Waste Not Consulting Ltd.

Bruce Middleton
Director
Email: bruce@wastenot.co.nz

Contents

1	INTRODUCTION	1
1.1	COUNCIL WASTE SERVICES IN QUEENSTOWN LAKES DISTRICT	1
1.2	NOTE ON PRESENTATION OF DATA IN TABLES AND FIGURES.....	1
2	METHODOLOGY	2
2.1	OVERVIEW	2
2.2	SAMPLE SIZE	2
2.3	SAMPLING STRATEGY AND EXECUTION.....	2
2.4	AUDIT EXECUTION.....	3
2.5	CLASSIFICATION OF KERBSIDE RUBBISH AND RECYCLING	3
3	KERBSIDE RUBBISH AUDIT	6
3.1	KERBSIDE RUBBISH - PRIMARY COMPOSITION.....	6
3.1.1	<i>Organic matter in kerbside rubbish wheelie bins</i>	7
3.1.2	<i>Plastics in kerbside rubbish wheelie bins</i>	8
3.2	KERBSIDE RUBBISH - SECONDARY COMPOSITION.....	10
3.3	DISTRIBUTION OF KERBSIDE RUBBISH BIN WEIGHTS.....	11
3.4	DIVERSION POTENTIAL OF KERBSIDE RUBBISH	11
4	MIXED RECYCLING AUDIT	13
4.1	APPROVED MATERIALS IN MIXED RECYCLING WHEELIE BINS.....	14
4.2	DISTRIBUTION OF KERBSIDE MIXED RECYCLING BIN WEIGHTS.....	16
5	GLASS RECYCLING AUDIT	17
5.1	APPROVED MATERIALS IN GLASS RECYCLING WHEELIE BINS	18
5.2	DISTRIBUTION OF KERBSIDE GLASS RECYCLING BIN WEIGHTS	19
6	DISCUSSION	20
6.1	PRECISION OF AUDIT RESULTS.....	20
6.2	EFFECTS OF CONTAINER RETURN SCHEME	21
6.2.1	<i>Beverage containers in kerbside recycling wheelie bins</i>	21
6.2.2	<i>Beverage containers in kerbside rubbish wheelie bins</i>	22
6.2.3	<i>Beverage containers in kerbside collections - weekly</i>	22
6.2.4	<i>Beverage containers in kerbside collections - per week</i>	23
6.2.1	<i>Recovery rate of beverage containers in kerbside collections</i>	23
	APPENDIX 1 - KERBSIDE RUBBISH CLASSIFICATIONS	24
	APPENDIX 2 - RECYCLING CLASSIFICATIONS	25

1 Introduction

Waste Management NZ Ltd (WMNZL) is contracted to Queenstown Lakes District Council (Council) to collect kerbside rubbish and recycling throughout Queenstown Lakes District, manage the Frankton and Wanaka transfer stations, and operate the materials recovery facility in Queenstown, which processes the kerbside recycling.

Included in the contract between WMNZL and Council is a requirement for WMNZL to undertake, on behalf of Council, three-yearly surveys of waste disposed of at the District's transfer stations and Victoria Flats landfill and compositional audits of kerbside rubbish and recycling. The contract stipulates that these audits and surveys be based on the methodologies recommended by the Ministry for the Environment's Solid Waste Analysis Protocol 2002 (SWAP).

In November 2019, Waste Not Consulting Ltd was engaged to conduct a six-day sort-and-weigh audit of kerbside rubbish and recycling in the District. The audit took place from 4-11 December 2019. Visual surveys of the composition of waste being disposed of at the transfer stations and landfill are scheduled to take place in 2020. This document provides the results of the December 2019 sort-and-weigh audits of kerbside rubbish and recycling. These results will be combined with the results of the visual surveys, when completed, and a single report will be prepared.

1.1 Council waste services in Queenstown Lakes District

From 1 July 2019, Council introduced new residential kerbside rubbish and recycling collection services, based on a rates funded model. Only properties that include a residential dwelling are eligible for the services. Properties rates as 'commercial' or 'accommodation' are required to engage a commercial waste collector. Every residential property in the District is supplied with:

- A 240-litre mixed recycling bin, collected fortnightly, for cardboard, paper, cans, plastic bottles, and plastic containers #1-7
- A 140-litre glass recycling bin, collected fortnightly, which is to be used for glass bottles and jars only
- A 140-litre rubbish bin, collected weekly, which is to be used for anything that can't be recycled.

The kerbside rubbish and recycling audit included samples of materials from all three services.

1.2 Note on presentation of data in tables and figures

Subtotals in tables and figures do not always add to the total due to rounding. This is illustrated in the equations below. In the equation on the left, the subtotals are expressed to three decimal points and add up to the total, as shown. When the three decimal points are rounded to two, one, and no decimal points, the subtotals do not add up to the totals.

1.264	1.26	1.3	1
+ 1.264	+ 1.26	+ 1.3	+ 1
<hr/>	<hr/>	<hr/>	<hr/>
= 2.528	= 2.53	= 2.5	= 3

2 Methodology

2.1 Overview

The kerbside rubbish and recycling audit involved the collection and sorting of materials over a six-day period, from 4-11 December 2019. Each weekday, a sample of kerbside rubbish and either mixed recycling or glass recycling was collected. The samples were collected in Queenstown, Arrowtown, and Wanaka. Samples of both mixed recycling and glass recycling were collected in Queenstown and Wanaka.

All materials were taken to Frankton transfer station in Queenstown for sorting. The kerbside rubbish, mixed recycling, and glass recycling, were sorted separately into classifications determined in consultation with WMNZL and Council. A total of 4,065 kg of materials were sorted during the course of the audit, an average of 678 kg per day.

2.2 Sample size

A 'standard' kerbside rubbish SWAP audit is usually three to five days in length, with the equivalent of 60 x 140-litre wheelie bins (about 700kg) of waste being sorted and weighed each day. Such an audit usually gives results of a reasonable level of precision for three to five of the twelve primary categories recommended by the SWAP.

However, as the Queenstown Lakes District audit was designed to include three different materials (rubbish, mixed recycling, and glass recycling), a longer, six-day audit was undertaken. Both kerbside rubbish and either glass or mixed recycling were collected each day.

While the productivity of a team of four at sorting kerbside rubbish is known, prior to the audit it was uncertain how long it would take to sort and weigh mixed recycling or glass recycling. As an initial guideline, it was proposed that each day of auditing would include:

- the contents of 40 x 140-litre rubbish wheelie bins
- the contents of 30 mixed recycling or glass recycling wheelie bins

Based on these initial estimates, over the course of the six-day audit the following would have been sorted and weighed:

- the contents of 240 waste wheelie bins (229 were actually sorted)
- the contents of 90 mixed recycling wheelie bins (76 were actually sorted)
- the contents of 90 glass recycling wheelie bins (72 were actually sorted).

2.3 Sampling strategy and execution

The composition of residential kerbside rubbish and recycling, and the quantity generated per household, can vary according to a number of factors, including the socio-economic status of the householders, the occupancy rate per household, the nature of the housing stock, the size of the property, and the range of disposal and recycling services available.

Accordingly, to obtain a representative sample of residential kerbside rubbish and recycling from Queenstown Lakes District, the sample was collected from a range of communities in

Queenstown, Arrowtown, and Wanaka. The sample was collected only from residential properties. Commercial properties were not included in the sample.

Each day's sample was collected from a range of streets in that day's Council collection area. The sample is usually collected from 8-10 streets each day, selected at random while driving through the area. However, due to the size of the vehicle used for the collection, it was difficult to locate safe sites to load the sample, and the sample was taken from a smaller number of streets.

The sample was collected on six weekdays, from Wednesday 4 December through Wednesday 11 December. The Wanaka sample was collected on Friday 6 December and Tuesday 10 December. This allowed for mixed recycling to be collected in Wanaka in the first week and glass recycling to be collected in the second week.

The sample collection started at 7:00 each morning and took approximately 2-2.5 hours.

The sampling was undertaken by a team of two in a box truck provided by WMNZL. The truck driver, also provided by WMNZL, assisted a Waste Not supervisor with the collection. The contents of all wheelie bins sampled were emptied individually into large plastic bags and labelled to identify whether the material was waste or recycling. The empty wheelie bins were left on the kerbside with the lid open.

2.4 Audit execution

The collected sample was transported to Frankton transfer station each morning for sorting. A team of four, comprising one supervisor from Waste Not and three casual staff (supplemented by Council staff), was used for the sorting process.

The contents of rubbish and mixed recycling wheelie bins were sorted in sampling units of four bins. Each bag of material in each sampling unit of four was weighed individually, opened, the contents spread on a sorting table, and the items sorted into the appropriate categories. When all of the items were sorted, the individual classifications were weighed out and the material disposed of.

The contents of glass recycling bins were sorted as a single unit. All bags were weighed in and then all glass beverage bottles were separated from other materials. The other materials were then sorted into the remaining categories and weighed out. The weight of glass beverage bottles was calculated by subtracting the weight of the other categories from the incoming weights.

2.5 Classification of kerbside rubbish and recycling

Council had requested that the classifications used for sorting rubbish and recycling would assist with assessing the impact that a container return scheme could have on Council's kerbside collections. Appropriate classifications were included in both sets of classifications (one set for rubbish, the other for recycling). The definition that was used for containers that might be included in a container return scheme was "All 'ready-to-drink' beverage containers (including milk) over 300ml and under 3 litres".¹

¹ Envision New Zealand (2015) The InCENTive to Recycle - The Case for a Container Deposit System in New Zealand

The kerbside rubbish sample was sorted into the 12 primary categories identified in the SWAP and 26 secondary categories. The secondary categories used for the rubbish sorting are presented in Appendix 1. The classifications were chosen to identify the different types of recyclable and compostable materials present in the rubbish. The definitions for each classification were based on what materials were described in Council's educational material and/or were acceptable to WMNZL's materials recovery facility. These definitions were finalised in consultation with WMNZL and Council.

The classifications for sorting mixed recycling and glass recycling are provided in Appendix 2.

As all data was collected by weight, to assess the potential effects of a container return scheme it was necessary to determine average weights per item for each of the relevant classifications. Data for these conversion factors was gathered by counting and weighing an appropriate number of containers. This data was augmented with data from other, unreleased research previously undertaken by Waste Not Consulting.



Photo 2.1 - One day's sample from Council kerbside rubbish wheelie bins



Photo 2.2 - Audit equipment set up in marquee



Photo 2.3 - Sorting rubbish from Council kerbside rubbish wheelie bins

3 Kerbside rubbish audit

A total of 229 kerbside rubbish wheelie bins were sorted for the audit. The sorted rubbish weighed 2,607 kg.

3.1 Kerbside rubbish - Primary composition

The primary composition of kerbside rubbish wheelie bins is presented in Table 3.1 below and Figure 3.1 on the following page. The secondary composition, which includes all 26 categories and a statistical analysis of the results, is given in section 3.2.

Table 3.1 - Primary composition of kerbside rubbish wheelie bins - 4-11 December 2019

Queenstown Lakes District - Kerbside rubbish - December 2019 (margins of error for 95% confidence level)	Proportion of total	Mean wt. per wheelie bin
Paper	7.8% (±2.1%)	0.89 kg (±0.23 kg)
Plastics	10.6% (±0.8%)	1.20 kg (±0.10 kg)
Organics	54.3% (±5.6%)	6.18 kg (±0.63 kg)
Ferrous metals	1.9% (±0.6%)	0.21 kg (±0.07 kg)
Non-ferrous metals	1.2% (±0.4%)	0.14 kg (±0.04 kg)
Glass	2.4% (±0.6%)	0.27 kg (±0.07 kg)
Textiles	4.8% (±1.2%)	0.54 kg (±0.14 kg)
Sanitary paper	7.5% (±2.2%)	0.86 kg (±0.25 kg)
Rubble	5.0% (±2.9%)	0.57 kg (±0.33 kg)
Timber	3.2% (±1.9%)	0.37 kg (±0.22 kg)
Rubber	0.3% (±0.2%)	0.03 kg (±0.02 kg)
Potentially hazardous	1.0% (±0.3%)	0.12 kg (±0.03 kg)
TOTAL	100.0%	11.38 kg (±0.71 kg)

Organic material, primarily kitchen waste, was the largest single component of kerbside rubbish wheelie bins, comprising 54.3% of the total of 11.38 kg in the average wheelie bins. The average wheelie bin contained 6.18 kg of organic materials.

Plastics, representing 10.6% of the total, was the second largest component. Paper was the third largest component, at 7.8%, and Sanitary paper the fourth largest, at 7.5%.

The two largest components of kerbside rubbish are discussed in greater detail in the following sections.

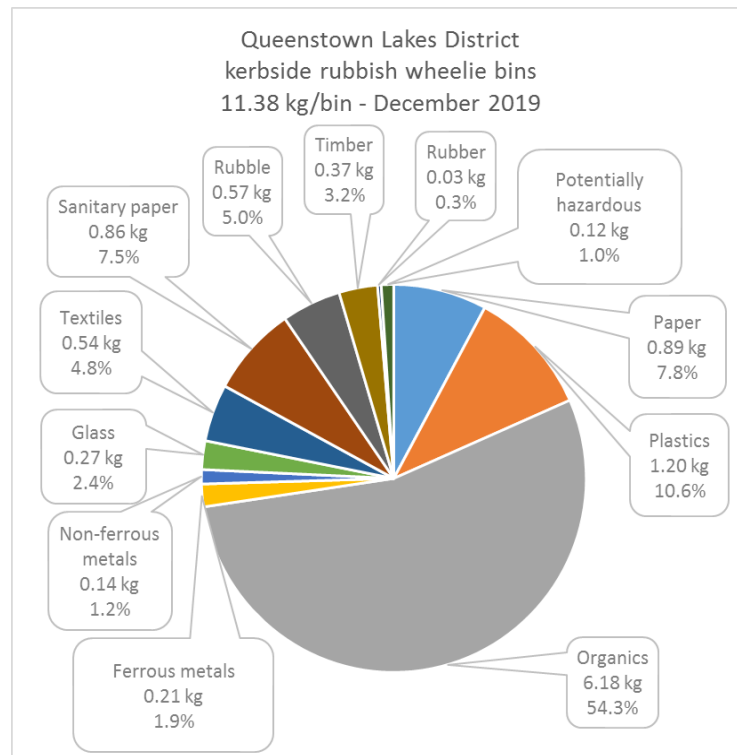


Figure 3.1 - Primary composition of kerbside rubbish - 4-11 December 2019

3.1.1 Organic matter in kerbside rubbish wheelie bins

Organic matter comprised 54.3% of the weight of all kerbside rubbish. The composition of the organic constituent of the rubbish is shown in Figure 3.2 below. 'Kitchen waste' comprised 62% of the organic material, an average of 3.85 kg per wheelie bin. Kitchen waste included food preparation waste, left-over food waste, and substantial quantities of perished goods. Greenwaste comprised 34% of organic material, or 2.07 kg per wheelie bin.

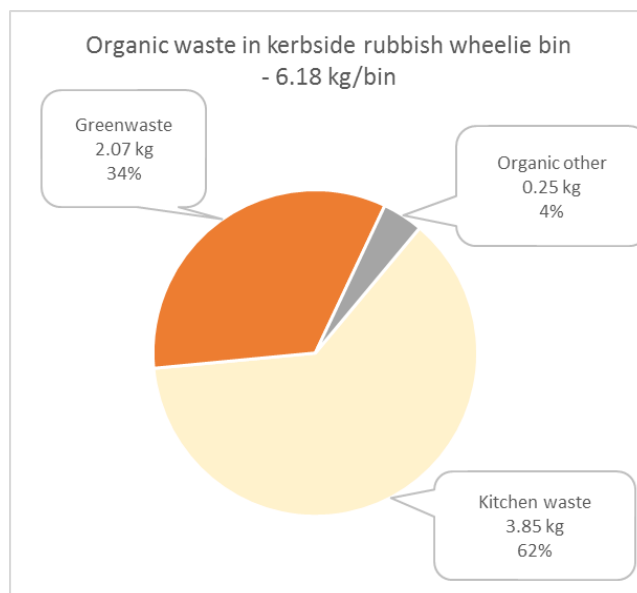


Figure 3.2 - Organic component of kerbside rubbish wheelie bins

The 'Other organic' material (4%) included vacuum cleaner dust, animal faeces, candles, fireplace ash, and human hair. Much of this material would be suitable for composting.



Photo 3.1 - Kitchen waste from four wheelie bins



Photo 3.2 - Greenwaste from a single wheelie bin

3.1.2 Plastics in kerbside rubbish wheelie bins

Plastics comprised 10.6% of material in the kerbside rubbish wheelie bins. Each bin contained an average of 1.20 kg of plastics. The composition of the plastics constituent of the rubbish is shown in Figure 3.3.

Plastic bags & film (soft plastics), shown in Photo 3.3 on the next page, were the major component of plastics in kerbside rubbish, comprising 51% of all plastics. Other types of non-recyclable plastic were the second largest component, comprising 33% of all plastics.

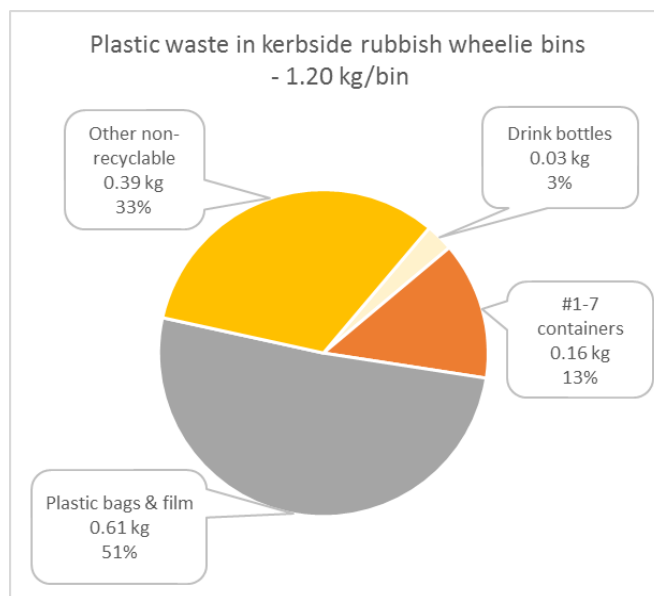


Figure 3.3 - Plastics component of kerbside rubbish wheelie bins



Photo 3.3 - Plastic bags & film from four rubbish wheelie bins

3.2 Kerbside rubbish - Secondary composition

Queenstown Lakes District - Kerbside rubbish - December 2019 (margins of error for 95% confidence level)		% of total weight	Kg per rubbish wheelie bin
Paper	Drink containers	0.2% (±0.1%)	0.02 kg (±0.01 kg)
	Recyclable	5.9% (±2.1%)	0.68 kg (±0.23 kg)
	Non-recyclable	1.7% (±0.2%)	0.20 kg (±0.02 kg)
	Subtotal	7.8% (±2.1%)	0.89 kg (±0.23 kg)
Plastics	Drink bottles	0.3% (±0.1%)	0.03 kg (±0.01 kg)
	# 1-7 containers	1.4% (±0.2%)	0.16 kg (±0.02 kg)
	Plastic bags & film	5.4% (±0.5%)	0.61 kg (±0.05 kg)
	Other non-recyclable	3.4% (±0.6%)	0.39 kg (±0.07 kg)
	Subtotal	10.6% (±0.8%)	1.20 kg (±0.10 kg)
Organics	Kitchen waste	33.9% (±3.3%)	3.85 kg (±0.37 kg)
	Greenwaste	18.2% (±5.5%)	2.07 kg (±0.63 kg)
	Other organic	2.2% (±1.3%)	0.25 kg (±0.15 kg)
	Subtotal	54.3% (±5.6%)	6.18 kg (±0.63 kg)
Ferrous metals	Steel cans	0.5% (±0.1%)	0.05 kg (±0.01 kg)
	Other steel	1.4% (±0.6%)	0.16 kg (±0.07 kg)
	Subtotal	1.9% (±0.6%)	0.21 kg (±0.07 kg)
Non ferrous metals	Drink cans	0.2% (±0.0%)	0.02 kg (±0.00 kg)
	Other aluminium cans	0.0% (±0.0%)	0.00 kg (±0.00 kg)
	Other non-ferrous	1.0% (±0.4%)	0.11 kg (±0.04 kg)
Subtotal	1.2% (±0.4%)	0.14 kg (±0.04 kg)	
Glass	Beverage bottles	1.1% (±0.5%)	0.12 kg (±0.05 kg)
	Other bottles/jars	0.8% (±0.4%)	0.09 kg (±0.04 kg)
	Non-recyclable glass	0.5% (±0.2%)	0.06 kg (±0.02 kg)
	Subtotal	2.4% (±0.6%)	0.27 kg (±0.07 kg)
Textiles	Clothing/textiles	2.7% (±0.8%)	0.30 kg (±0.09 kg)
	Other textiles	2.1% (±0.7%)	0.24 kg (±0.08 kg)
	Subtotal	4.8% (±1.2%)	0.54 kg (±0.14 kg)
Sanitary paper		7.5% (±2.2%)	0.86 kg (±0.25 kg)
Rubble		5.0% (±2.9%)	0.57 kg (±0.33 kg)
Timber		3.2% (±1.9%)	0.37 kg (±0.22 kg)
Rubber		0.3% (±0.2%)	0.03 kg (±0.02 kg)
Potentially hazardous	Household	0.8% (±0.2%)	0.09 kg (±0.03 kg)
	Other	0.2% (±0.2%)	0.03 kg (±0.02 kg)
	Subtotal	1.0% (±0.3%)	0.12 kg (±0.03 kg)
TOTAL		100.0%	11.38 kg (±0.71 kg)

3.3 Distribution of kerbside rubbish bin weights

A total of 229 kerbside rubbish wheelie bins were sorted for the audit. The sorted rubbish weighed 2,607 kg. The average weight of rubbish in Council’s 140-litre rubbish wheelie bins was 11.38 kg.

The median rubbish wheelie bin weight was 9.64 kg. The lightest bin was 0.34 kg and the heaviest, 42.04 kg. The distribution of wheelie bin weights is shown in Figure 3.4.

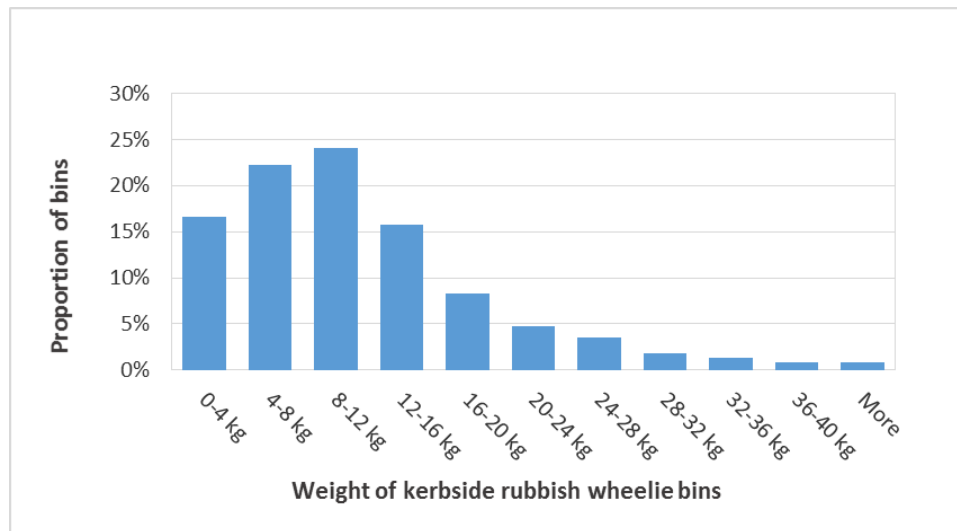


Figure 3.4 - Distribution of kerbside rubbish wheelie bin weights - December 2019

Nearly 17% of wheelie bins contained less than four kilograms of rubbish. Nearly two-thirds (62%) weighed between four and 16 kg. Thirteen percent weighed over 20 kilograms.

3.4 Diversion potential of kerbside rubbish

To minimise waste to landfill, Queenstown Lakes District Council provides households in the District with kerbside collections of mixed recycling and glass, alternating fortnightly, using 240-litre wheelie bins for mixed recycling and 140-litre bins for glass recycling. Recycling facilities are also available to the public at Wakatipu Recycling Centre in Frankton and Wastebusters Recycling Centre in Wanaka.

To further reduce waste to landfill, residents are able to dispose of greenwaste separately at Frankton and Wanaka transfer stations, the privately-owned Wanaka Greenwaste and Landscaping Supplies, and community-run facilities at Glenorchy, Kingston, Lake Hawea, Luggate, and Makarora. A greenwaste kerbside collection service is available in Wanaka only. Greenwaste can also be home-composted.

Although food waste collection services are not available in the District, residents are able to home compost their food waste. Council encourages home composting with an educational programme and subsidies for Bokashi bins and worms.

Table 3.2 on the next page shows the proportion of rubbish in Queenstown Lakes District Council’s kerbside 140-litre rubbish wheelie bins that could have been diverted from landfill disposal using these methods. The average quantity per wheelie bin is also shown.

Table 3.2 - Diversion potential of kerbside rubbish wheelie bins - December 2019

Divertible materials in Council kerbside rubbish - December 2019	Proportion of total	Kg per rubbish wheelie bin
RECYCLABLE MATERIALS		
Paper - Recyclable	5.9%	0.68 kg
Plastic - Drink bottles	0.3%	0.03 kg
Plastic - #1-7 containers	1.4%	0.16 kg
Steel cans	0.5%	0.05 kg
Aluminium drink cans	0.2%	0.02 kg
Other aluminium cans	0.0%	0.00 kg
Glass - Beverage bottles	1.1%	0.12 kg
Glass - Other bottles/jars	0.8%	0.09 kg
Subtotal	10.2%	1.16 kg
COMPOSTABLE MATERIALS		
Kitchen waste	33.9%	3.85 kg
Greenwaste	18.2%	2.07 kg
Subtotal	52.0%	5.92 kg
TOTAL DIVERTIBLE	62.2%	7.08 kg

Approximately 10.2% of the materials in Council's 140-litre rubbish wheelie bins could have been recycled through Council's kerbside recycling collections or at the other recycling facilities. This equates to 1.16 kg in the average rubbish wheelie bin.

A further 52% of materials could have been composted, either at home or, in the case of the greenwaste, by being disposed of at the greenwaste drop-off points at transfer stations and community facilities.

Overall, 62.2%, by weight, of materials in Council's 140-litre rubbish wheelie bins could have been recycled or composted. Other materials, such as clothing and other metals, are also recyclable but have not been included in these calculations.

4 Mixed recycling audit

A total of 76 kerbside mixed recycling wheelie bins were sorted for the audit. The mixed recycling that was sorted weighed 606 kg. The results of the audit of Council's mixed recycling wheelie bins are shown, in Table 4.1 below, in terms of percentage composition and average weight per wheelie bin.

Table 4.1 - Composition of mixed recycling wheelie bins - December 2019

Queenstown Lakes District - Mixed recycling - December 2019 (margins of error for 95% confidence level)		% of total weight	Kg per mixed recycling wheelie bin
Paper	Drink containers	0.4% (±0.2%)	0.03 kg (±0.02 kg)
	Recyclable paper	67.4% (±19.2%)	5.38 kg (±1.54 kg)
	Non-recyclable paper	1.7% (±0.7%)	0.14 kg (±0.05 kg)
	Subtotal	69.5% (±19.4%)	5.54 kg (±1.54 kg)
Plastics	Drink bottles	5.4% (±1.2%)	0.43 kg (±0.10 kg)
	# 1-7 containers	3.7% (±0.6%)	0.30 kg (±0.05 kg)
	Unrinsed containers	1.6% (±0.7%)	0.13 kg (±0.06 kg)
	Other non-recyclable	3.2% (±0.9%)	0.25 kg (±0.07 kg)
	Subtotal	13.9% (±2.5%)	1.11 kg (±0.20 kg)
Organics		1.9% (±1.4%)	0.15 kg (±0.11 kg)
Ferrous metals	Steel cans	3.6% (±0.9%)	0.29 kg (±0.07 kg)
	Other steel	0.9% (±0.5%)	0.07 kg (±0.04 kg)
	Subtotal	4.5% (±1.3%)	0.36 kg (±0.10 kg)
Non ferrous metals	Aluminium drink cans	1.5% (±0.4%)	0.12 kg (±0.04 kg)
	Other aluminium cans	0.0% (±0.0%)	0.00 kg (±0.00 kg)
	Other non-ferrous	0.1% (±0.1%)	0.01 kg (±0.01 kg)
	Subtotal	1.6% (±0.5%)	0.13 kg (±0.04 kg)
Glass	Beverage bottles	3.5% (±2.4%)	0.28 kg (±0.19 kg)
	Other recyclable glass	1.2% (±0.6%)	0.10 kg (±0.04 kg)
	Broken glass/fines	0.0% -	0.00 kg -
	Non-recyclable glass	0.1% (±0.1%)	0.01 kg (±0.01 kg)
	Subtotal	4.8% (±2.6%)	0.38 kg (±0.21 kg)
Textiles		0.4% (±0.5%)	0.03 kg (±0.04 kg)
Sanitary paper		0.0% -	0.00 kg -
Other contamination		3.5% (±2.4%)	0.28 kg (±0.19 kg)
TOTAL		100.0%	7.98 kg (±1.55 kg)

The average contents of a 240-litre mixed recycling wheelie bin weighed 7.98 kg. Recyclable paper comprised the largest secondary component of mixed recycling, representing 67.4% of the total weight, or an average of 5.38 kg per wheelie bin. Plastic drink bottles, 5.4% of the total weight, or 0.43 kg per bin, was the second largest secondary category.

4.1 Approved materials in mixed recycling wheelie bins

Council publishes an online guide to materials that are approved for the kerbside recycling collections. Table 4.2 below shows the proportion of materials in mixed recycling wheelie bins that met Council's guidelines² for mixed recycling, materials that met the guidelines for glass recycling, and materials that should not have been disposed of in either recycling bin (contamination).

The broken glass/fines classification has been categorised as suitable for glass recycling as it was not possible to determine whether the glass was broken before disposal or during the sample collection and sorting process.

Table 4.2 - Approved materials in mixed recycling wheelie bins - December 2019

Queenstown Lakes District - Mixed recycling - Approved materials - December 2019	% of total weight	Kg per mixed recycling wheelie bin
MIXED RECYCLING - Approved by guidelines		
Paper - Recyclable paper	67.4%	5.38 kg
Plastic - Drink bottles	5.4%	0.43 kg
Plastic - #1-7 containers	3.7%	0.30 kg
Steel cans	3.6%	0.29 kg
Aluminium drink cans	1.5%	0.12 kg
Other aluminium cans	0.0%	0.00 kg
Subtotal	81.6%	6.51 kg
GLASS RECYCLING - Not approved by guidelines for mixed recycling		
Glass - Beverage bottles	3.5%	0.28 kg
Glass - Other recyclable	1.2%	0.10 kg
Broken glass/fines	0.0%	0.00 kg
Subtotal	4.7%	0.38 kg
CONTAMINATION- Not approved by guidelines for mixed recycling		
Paper - Drink containers	0.4%	0.03 kg
Paper - Non-recyclable paper	1.7%	0.14 kg
Plastic - Unrinsed containers	1.6%	0.13 kg
Plastic - Other non-recyclable	3.2%	0.25 kg
All organic	1.9%	0.15 kg
Steel - Other steel	0.9%	0.07 kg
Other non-ferrous	0.1%	0.01 kg
Non-recyclable glass	0.1%	0.01 kg
Textiles	0.4%	0.03 kg
Sanitary paper	0.0%	0.00 kg
Other contamination	3.5%	0.28 kg
Subtotal	13.7%	1.09 kg
TOTAL	100.0%	7.98 kg

² <https://www.qldc.govt.nz/services/rubbish-recycling/rubbish-recycling-collection>

Of the 7.98 kg of material in the average 240-litre mixed recycling wheelie bin, 6.51 kg, or 81.6%, met Council’s guidelines for mixed recycling. Materials that met the guidelines for glass recycling comprised 4.7% of the total weight, or an average of 0.38 kg per bin. Contamination (materials that do not meet the guidelines for either mixed recycling or glass recycling) comprised 13.7% of the total weight, or 1.09 kg per bin.

This breakdown of materials is shown in Figure 4.1 below. Materials that met the Council’s guidelines for mixed recycling are broken out and itemised in the figure.

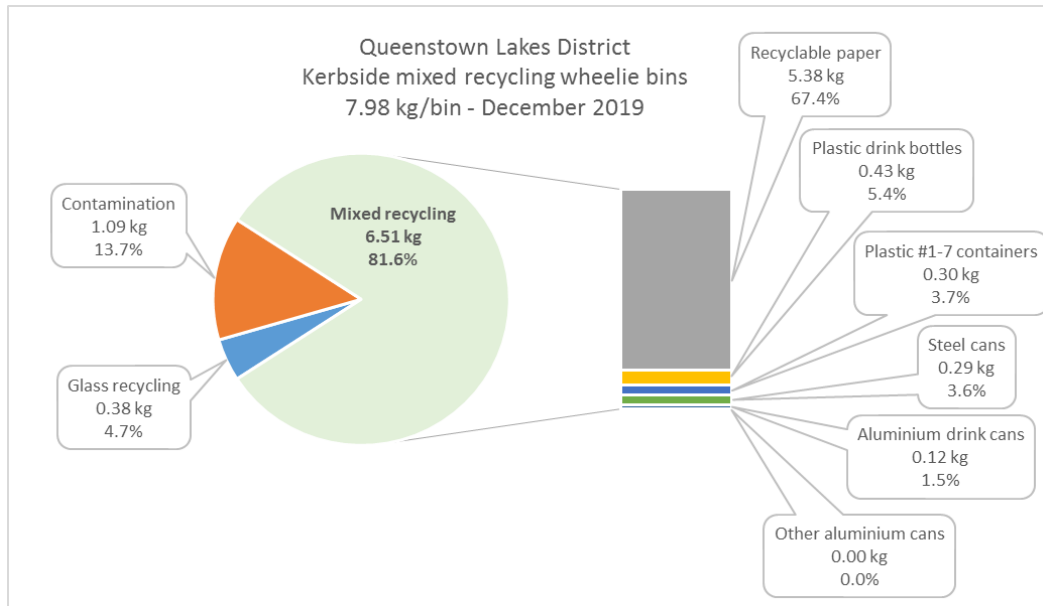


Figure 4.1 - Materials in mixed recycling wheelie bins - December 2019

The proportion of recyclable paper in the audit results is, possibly, anomalously high. A single wheelie bin contained 68 kg of undistributed junk mail, 17% of all recyclable paper recorded in the audit.



Photo 4.1 - Undistributed junk mail from a single mixed recycling wheelie bin

4.2 Distribution of kerbside mixed recycling bin weights

A total of 76 kerbside mixed recycling wheelie bins, containing 606 kg of material, were sorted for the audit. The average weight per bin was 7.98 kg. The median weight was 6.47 kg. The materials in the lightest bin weighed 0.66 kg and, in the heaviest, 68.30 kg. The distribution of wheelie bin weights is shown in Figure 4.2.

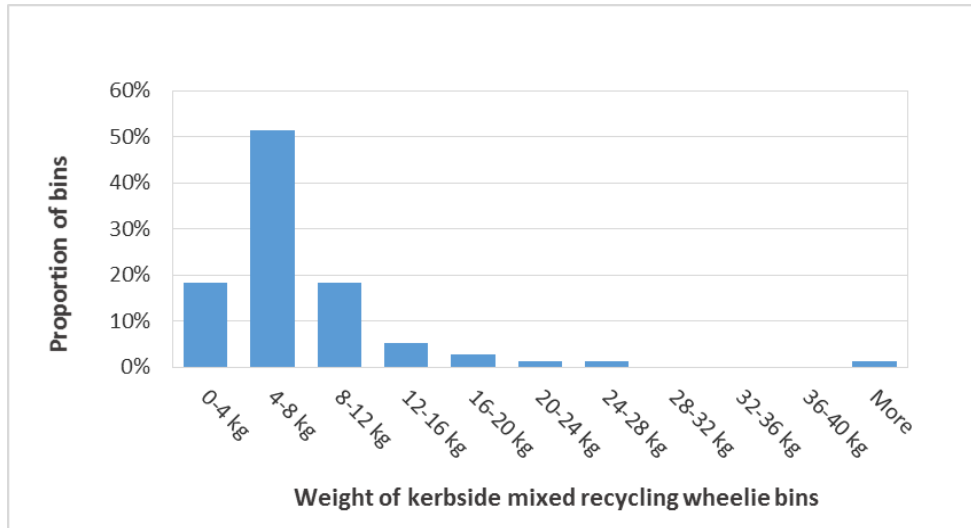


Figure 4.2 - Distribution of kerbside mixed recycling wheelie bin weights - December 2019

Over 50% of mixed recycling wheelie bins contained between four and eight kg of material. Twelve percent weighed more than 12 kg.

5 Glass recycling audit

A total of 72 kerbside glass recycling wheelie bins, weighing 852 kg, were sorted for the audit. The results of the audit of Council's glass recycling wheelie bins are shown, in Table 5.1 below, in terms of percentage composition and weight per wheelie bin. As all bins collected each day were sorted as a single sample, a statistical analysis cannot be done.

Table 5.1 - Composition of glass recycling wheelie bins - December 2019

Queenstown Lakes District - Glass recycling - December 2019		% of total weight	Kg per glass recycling wheelie bin
Paper	Drink containers	0.0%	0.00 kg
	Recyclable paper	0.1%	0.01 kg
	Non-recyclable paper	0.0%	0.00 kg
	Subtotal	0.1%	0.01 kg
Plastics	Drink bottles	0.0%	0.01 kg
	# 1-7 containers	0.0%	0.00 kg
	Unrinsed containers	0.0%	0.00 kg
	Other non-recyclable	0.0%	0.00 kg
	Subtotal	0.1%	0.01 kg
Organics		0.0%	0.00 kg
Ferrous metals	Steel cans	0.1%	0.01 kg
	Other steel	0.0%	0.00 kg
	Subtotal	0.1%	0.01 kg
Non ferrous metals	Aluminium drink cans	0.0%	0.01 kg
	Other aluminium cans	0.0%	0.00 kg
	Other non-ferrous	0.0%	0.00 kg
	Subtotal	0.0%	0.01 kg
Glass	Beverage bottles	89.6%	11.47 kg
	Other recyclable glass	7.3%	0.93 kg
	Broken glass/fines	1.9%	0.24 kg
	Non-recyclable glass	1.0%	0.12 kg
	Subtotal	99.7%	12.76 kg
Textiles		0.0%	0.00 kg
Sanitary paper		0.0%	0.00 kg
Other contamination		0.0%	0.00 kg
TOTAL		100.0%	12.81 kg

The contents of an average 140-litre glass recycling wheelie bin weighed 12.81 kg. Beverage bottles comprised the largest secondary component of glass recycling, representing 89.6% of the total weight, or an average of 11.47 kg per wheelie bin.

5.1 Approved materials in glass recycling wheelie bins

Table 5.2 below shows the proportion of materials in glass recycling wheelie bins that met Council's guidelines³ for glass recycling, materials that met the guidelines for mixed recycling, and materials that should not have been disposed of in either recycling bin (contamination).

Table 5.2 - Approved materials in glass recycling wheelie bins - December 2019

Queenstown Lakes District - Glass recycling - Approved materials - December 2019	% of total weight	Kg per glass recycling wheelie bin
GLASS RECYCLING - Approved by guidelines		
Glass - Beverage bottles	89.6%	11.47 kg
Glass - Other recyclable	7.3%	0.93 kg
Broken glass/fines	1.9%	0.24 kg
Subtotal	98.7%	12.64 kg
MIXED RECYCLING - Not approved by guidelines for glass recycling		
Paper - Recyclable paper	0.1%	0.01 kg
Plastic - Drink bottles	0.0%	0.01 kg
Plastic - #1-7 containers	0.0%	0.00 kg
Steel cans	0.1%	0.01 kg
Aluminium drink cans	0.0%	0.01 kg
Other aluminium cans	0.0%	0.00 kg
Subtotal	0.2%	0.03 kg
CONTAMINATION - Not approved by guidelines for glass recycling		
Paper - Drink containers	0.0%	0.00 kg
Paper - Non-recyclable paper	0.0%	0.00 kg
Plastic - Unrinsed containers	0.0%	0.00 kg
Plastic - Other non-recyclable	0.0%	0.00 kg
All organic	0.0%	0.00 kg
Steel - Other steel	0.0%	0.00 kg
Other non-ferrous	0.0%	0.00 kg
Non-recyclable glass	1.0%	0.12 kg
Textiles	0.0%	0.00 kg
Sanitary paper	0.0%	0.00 kg
Contamination	0.0%	0.00 kg
Subtotal	1.0%	0.13 kg
TOTAL	100.0%	12.81 kg

Materials that met Council's guidelines for glass recycling comprised 98.7% of all materials, by weight, in the glass recycling bins included in the audit. The broken glass/fines classification has been categorised as suitable for glass recycling as it was not possible to determine whether the glass was broken before disposal or during the sample collection and sorting process.

³ <https://www.qldc.govt.nz/services/rubbish-recycling/rubbish-recycling-collection>

This breakdown of materials is shown in Figure 5.1 below. Materials that met Council’s guidelines for glass recycling are broken out and itemised in the figure.

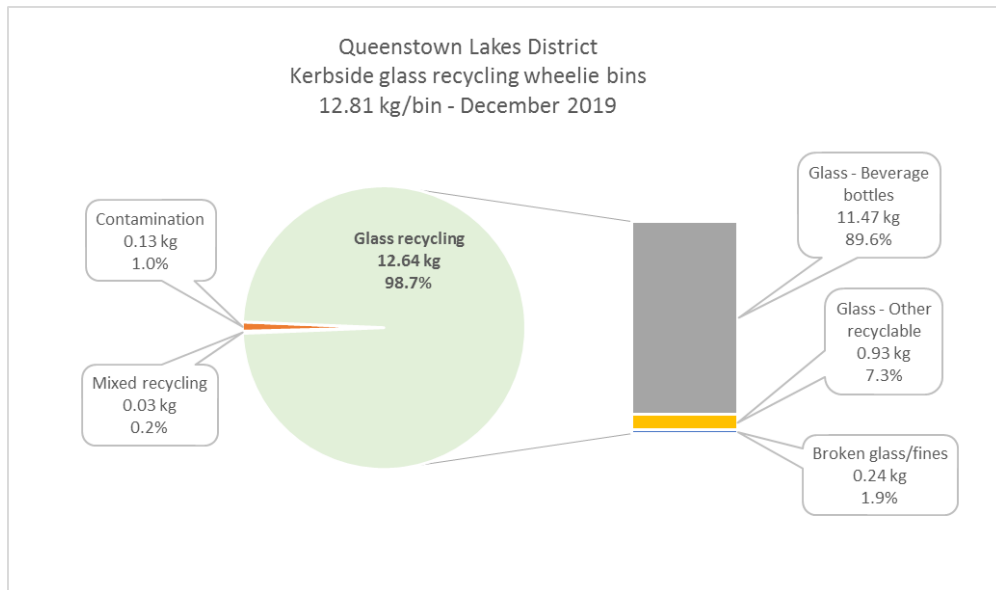


Figure 5.1 - Materials in glass recycling wheelie bins - December 2019

5.2 Distribution of kerbside glass recycling bin weights

A total of 72 kerbside glass recycling wheelie bins were sorted for the audit. The glass recycling that was sorted weighed 852 kg.⁴ The average weight per bin was 12.81 kg. The median weight was 10.84 kg. The materials in the lightest bin weighed 1.52 kg and the heaviest, 36.90 kg. The distribution of wheelie bin weights is shown in Figure 5.2.

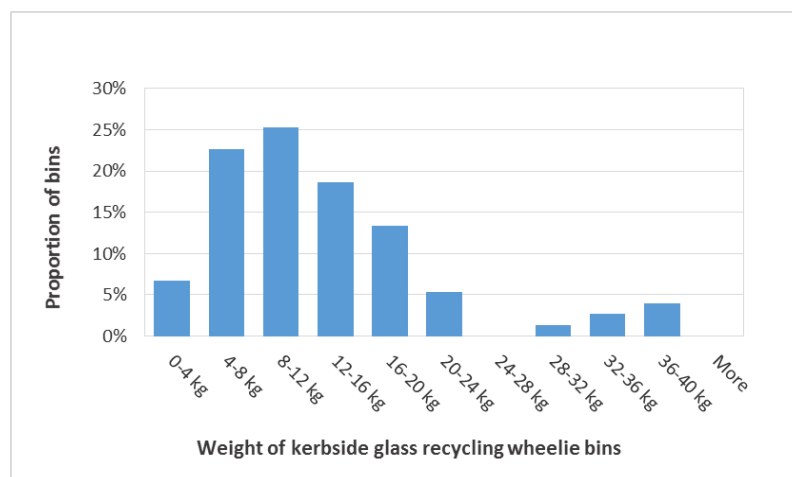


Figure 5.2 - Distribution of glass recycling wheelie bin weights - December 2019

Seven percent of wheelie bins weighed under four kg and thirteen percent weighed more than 20 kg.

⁴ During the sample collection, three wheelie bins that were too heavy to be lifted safely were not collected. Estimated weights for these bins have been included in all calculations, including those in Table 5.1.

6 Discussion

6.1 Precision of audit results

The SWAP defines a precision level of $\pm 20\%$ as being a “reasonable level of accuracy”. For paper, which comprises in the region of 10% of kerbside rubbish, a precision level of $\pm 20\%$ at the 95% confidence interval means that the sample average for 95% of samples would lie within about 2% (the margin of error) of the “actual” proportion of paper. The precision levels for the primary categories for the rubbish and mixed recycling audits are shown in Table 6.1 below.

Those levels that are $\pm 20\%$ or less at the 95% confidence interval are shown in bold. The results of the glass recycling audit have not been analysed as the collected material was sorted in bulk, and not in individual samples. This did not provide data suitable for statistical analysis.

As different classifications were used for sorting the rubbish and recycling, there is no data for several of the primary categories for mixed recycling.

Table 6.1 - Precision level of kerbside rubbish and recycling audit results

Precision level of audit results	Rubbish wheelie bins	Mixed recycling wheelie bins
Paper	26%	28%
Plastics	8%	18%
Organics	10%	74%
Ferrous metals	34%	28%
Non-ferrous metals	33%	33%
Glass	26%	54%
Textiles	25%	136%
Sanitary paper	29%	-
Rubble	57%	N/A
Timber	59%	N/A
Rubber	63%	N/A
Potentially hazardous	29%	N/A
Other contamination	N/A	71%

Two of the primary categories (plastics and organics) in the kerbside rubbish audit achieved precision levels of less than $\pm 20\%$. The paper primary category would also have achieved this precision level except for one large sample (>25kg) that skewed the results. Five secondary categories also had precision levels of less than $\pm 20\%$.

Plastics was the only primary category in the mixed recycling audit that has a precision level of less than $\pm 20\%$. As with the kerbside rubbish audit, the paper primary category would also have achieved this precision level except for one large sample that skewed the results. One secondary category also had a precision level of less than $\pm 20\%$.

6.2 Effects of container return scheme

Four of the classification used for the sorting of rubbish and recycling were defined so as to permit an analysis of the effect a container return scheme might have on Council’s kerbside collections. The definition that was used for containers that might be included in a container return scheme was “All ‘ready-to-drink’ beverage containers (including milk) over 300ml and under 3 litres”.⁵ This definition was used for secondary classifications in the primary paper, plastic, aluminium, and glass primary categories.

Using weight per item data collected during the audit and volume per item data from previous research, the number and volume of beverage containers in kerbside mixed recycling, glass recycling, and rubbish wheelie bins have been estimated.

6.2.1 Beverage containers in kerbside recycling wheelie bins

Table 6.2 shows the number of beverage containers per recycling wheelie bin and the volume of those items. These figures are shown separately for mixed recycling wheelie bins and glass recycling wheelie bins.

Table 6.2 - Beverage containers in kerbside recycling

Beverage containers in kerbside recycling - December 2019	Mixed recycling wheelie bins			Glass recycling wheelie bins		
	Weight per wheelie bin	# items per wheelie bin	Volume per wheelie bin	Weight per wheelie bin	# items per wheelie bin	Volume per wheelie bin
Paper - Drink containers	0.03 kg	1.4	0.90 litre	0.00 kg	0.0	0.00 litre
Plastic - Drink bottles	0.43 kg	8.7	14.68 litre	0.01 kg	0.1	0.17 litre
Aluminium drink cans	0.12 kg	7.2	3.26 litre	0.01 kg	0.3	0.14 litre
Glass - Beverage bottles	0.28 kg	0.9	0.56 litre	11.47 kg	38.2	22.94 litre
TOTAL	0.86 kg	18.3	19.39 litre	11.48 kg	38.6	23.25 litre

Beverage containers in mixed recycling wheelie bins weighed an average of 0.86 kg per bin, 11% of the total weight of materials in the bins. On average, there were 18.3 beverage containers with a volume of 19.39 litres in each mixed recycling wheelie bin.

In glass recycling wheelie bins, beverage containers weighed an average of 11.48 kg per bin, 90% of the total weight of materials. On average, there were 38.6 beverage containers with a volume of 23.25 litres in each glass recycling wheelie bin.

⁵ Envision New Zealand (2015) The InCENTive to Recycle - The Case for a Container Deposit System in New Zealand

6.2.2 Beverage containers in kerbside rubbish wheelie bins

The data in Table 6.3 shows the average number of beverage containers in kerbside rubbish wheelie bins and the volume of those items.

Table 6.3 - Beverage containers in kerbside rubbish

Beverage containers in kerbside rubbish - December 2019	Kerbside rubbish wheelie bins		
	Weight per wheelie bin	# items per wheelie bin	Volume per wheelie bin
Paper - Drink containers	0.02 kg	1.0	0.61 litre
Plastic - Drink bottles	0.03 kg	0.7	1.11 litre
Aluminium drink cans	0.02 kg	1.1	0.51 litre
Glass - Beverage bottles	0.12 kg	0.4	0.24 litre
TOTAL	0.19 kg	3.2	2.47 litre

Beverage containers in kerbside rubbish wheelie bins weighed an average of 0.19 kg per bin, 2% of the total weight of materials in the bins. On average, there were 3.2 beverage containers with a volume of 2.47 litres in each kerbside rubbish wheelie bin.

6.2.3 Beverage containers in kerbside collections - weekly

New Council kerbside collection services were introduced in Queenstown Lakes District on 1 July 2019. For this report, WMNZL has provided tonnage data for the three kerbside collections for the period July 2019-January 2020. As July was the first month of the new services, the tonnage data for that month could be anomalous and has not been used for this analysis. In Table 6.4 below, tonnage data for the period August 2019 - January 2020 has been used to calculate an average weekly tonnage for each collection during that period.

Table 6.4 - Weekly tonnages of kerbside collections

Weekly tonnages of kerbside collections	Tonnes - August 2019 - January 2020	Average tonnes/week
Rubbish	1657 tonnes	63 T/week
Mixed recycling	524 tonnes	20 T/week
Glass recycling	486 tonnes	18 T/week

6.2.4 Beverage containers in kerbside collections - per week

Beverage containers as a percentage of kerbside rubbish, mixed recycling, and glass recycling are provided in sections 3.2, 4, and 5, respectively. These percentages have been applied to the weekly tonnages of each of the three collections in Table 6.5 to calculate the average weekly tonnage of each type of beverage container in each of the kerbside collections.

The average weight for each type of container has then been applied to the average weekly tonnage to calculate the average number of beverage containers in each collection per week.

Table 6.5 - Beverage containers in kerbside collections - per week

Beverage containers in kerbside collections- Aug 2019 - Jan 2020	Weekly weight of beverage containers			Weekly number of beverage containers		
	Rubbish	Mixed recycling	Glass recycling	Rubbish	Mixed recycling	Glass recycling
Paper - Drink containers	0.12 T/week	0.08 T/week	0.00 T/week	5,365	3,557	0
Plastic - Drink bottles	0.18 T/week	1.08 T/week	0.01 T/week	3,628	21,646	148
Aluminium drink cans	0.10 T/week	0.29 T/week	0.01 T/week	6,288	18,082	461
Glass - Beverage bottles	0.67 T/week	0.70 T/week	16.56 T/week	2,236	2,319	55,201
TOTAL	1.07 T/week	2.15 T/week	16.58 T/week	17,516	45,603	55,810

6.2.1 Recovery rate of beverage containers in kerbside collections

The effectiveness of the new kerbside collection system can be assessed by expressing the number of beverage containers in the two recycling collections as a percentage of beverage containers in all three collections. The 'recovery rates' for the four types of beverage containers are calculated in Table 6.6.

Table 6.6 - Recovery rate of beverage containers in kerbside collections

Recovery rate of beverage containers in kerbside collections- Aug 2019 - Jan 2020	Rubbish	Mixed recycling	Glass recycling	Total weekly number of containers	Percentage recycled
Paper - Drink containers	5,365	3,557	0	8,921	40%
Plastic - Drink bottles	3,628	21,646	148	25,421	86%
Aluminium drink cans	6,288	18,082	461	24,831	75%
Glass - Beverage bottles	2,236	2,319	55,201	59,756	96%
TOTAL	17,516	45,603	55,810	118,930	85%

Forty percent of paper drink containers (such as Tetra Paks) were disposed of through the mixed recycling system. These containers, however, are not approved for recycling. The recovery rate for plastic drink bottles was 86%, for aluminium drink cans, 75%, and for glass beverage bottles, 96%. Overall, the recovery rate for beverage containers was 85%.

Appendix 1 - Kerbside rubbish classifications

Primary category	Secondary category	Definitions
Paper	Drink containers	'Ready-to-drink' paper-based beverage containers (including milk) over 300 ml and under 3 litres
	Recyclable paper	Clean cardboard incl. pizza boxes, newspapers, brochures, office paper, magazines, books, printer paper, other paper packaging
	Non-recyclable paper	Non-recyclable paper packaging (wet-strength, food contaminated), coffee cups, photographic paper, playing cards, laminated paper
Plastics	Drink bottles	'Ready-to-drink' plastic beverage containers (including milk) over 300 ml and under 3 litres
	#1-7 containers	Other bottles & containers with recycling logo # 1 to 7
	Plastic bags/film	All plastic bags, film, and other soft plastics
	Other non-recyclable	Non-recyclable plastic packaging, including polystyrene meat trays, paint, engine oil and chemical containers. All non-packaging materials made primarily of plastic.
Organics	Kitchen waste	All kitchen food waste
	Greenwaste	All organic garden waste, excludes soil
	Other organic	All other primarily organic items – includes cat tray litter, hair, vacuum cleaner bags
Steel	Steel cans	All steel cans, except aerosol cans
	Other steel	Other items made primarily of steel, incl. aerosol cans
Non-ferrous metals	Aluminium drink cans	'Ready-to-drink' beverage cans over 300ml
	Other aluminium cans	Food and other aluminium cans, except aerosol cans
	Other non-ferrous	All other items made primarily of non-ferrous metal, incl. aerosol cans
Glass	Beverage bottles	All 'ready-to-drink' glass beverage containers (including milk) over 300ml and under 3 litres
	Other recyclable glass	Jars and other recyclable containers
	Non-recyclable glass	All other items made primarily of glass, includes light bulbs, drinking glasses, and window glass
Textiles	Clothing & rags	All woven items primarily made of a fabric, such as clothes, curtains, suitable for rags
	Other textiles	Includes shoes, backpacks, handbags, rugs, not suitable for rags
Sanitary paper		Includes disposable nappies, paper towels, tissues, menstruation products, wet wipes
Rubble, concrete		All concrete, rubble, ceramics, and soil
Timber		All items made primarily of timber
Rubber		All items made primarily of rubber (e.g. kitchen gloves)
Potentially hazardous	Household	Batteries, aerosol cans, medicines and cosmetics, cleaning agents
	Other hazardous	Potentially hazardous items not associated with domestic activity, such as used oil and garden chemicals.

Appendix 2 - Recycling classifications

Primary category	Secondary category	Definitions
Paper	Drink containers	'Ready-to-drink' paper beverage containers (including milk) over 300 ml and under 3 litres
	Recyclable paper	Clean cardboard incl. pizza boxes, newspapers, brochures, office paper, magazines, books, printer paper, junk mail, other paper packaging
	Non-recyclable paper	Non-recyclable paper packaging (wet-strength, food contaminated), coffee cups, photographic paper, playing cards, laminated paper.
Plastics	Drink bottles	'Ready-to-drink' plastic beverage containers (including milk) over 300ml and under 3 litres
	#1-7 container	Other bottles & containers with recycling # 1 to 7
	Unrinsed containers	Unrinsed bottles & containers with recycling # 1 to 7
	Other non-recyclable	Plastic bags & film, non-recyclable plastic packaging, including polystyrene meat trays, paint, engine oil and chemical containers. All other non-packaging materials made primarily of plastic
Organics	Organic waste	All kitchen food waste, greenwaste, other organic items
Steel	Steel cans	All steel cans, except aerosol cans
	Other steel	Items made primarily of steel, incl. aerosol cans
Non-ferrous metals	Aluminium drink cans	'Ready-to-drink' beverage cans over 300ml
	Other aluminium cans	Food and other aluminium cans, except aerosol cans
	Other non-ferrous	All other items made primarily of non-ferrous metal
Glass	Beverage bottles	Clear 'ready-to-drink' glass beverage containers (including milk) over 300ml and under 3 litres
	Other recyclable glass	Clear jars and other containers, including small bottles
	Broken glass and fines	Broken pieces of glass unsuitable for hand sorting
	Non-recyclable glass	All other items made primarily of glass, includes light bulbs, drinking glasses, and window glass
Textiles		All items made of textiles (woven materials)
Sanitary paper		Includes disposable nappies, paper towels, tissues, menstruation products, wet wipes
Other contamination		All other non-recyclable items