



REPORT PRODUCED FOR:
City of Monash

Kerbside Waste Bin Audit in February 2019



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Report: February 2019

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Name: EC Sustainable Pty Ltd

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Executive summary

City of Monash (Council) engaged EC Sustainable Pty Ltd (EC Sustainable) to conduct a Council-wide audit of the kerbside residential waste bins. The audit included 250 households, conducted in February 2019. The audit provides up-to-date independent data to inform waste education initiatives and waste collection and processing contracts.

The data indicators reported include unrecovered resources rates (i.e. recyclable materials in the waste bins), bin generation rates and bin presentation rates. The key results are shown below.

Key data indicators

Key statistic		Unit of measurement	Results
Generation rate	When a bin was presented	Weight – kg/hh/wk	8.94
	With non-presentation [^]	Weight – kg/hh/wk	7.55
	When a bin was presented	Volume – L/hh/wk #	77.2
	With non-presentation [^]	Volume – L/hh/wk	65.1
Unrecovered materials in the waste bins and balance to landfill	Recyclable	Weight – kg/hh/wk	1.04
	Potentially recyclable		0.61
	Compostable food – loose *		4.29
	Compostable garden organics		0.18
	Compostable other		0.91
	Balance – landfill		1.91
	Recyclable	Percentage (%) by weight	11.6
	Potentially recyclable		6.9
	Compostable food – loose *		48.0
	Compostable garden organics		2.0
	Compostable other		10.2
	Balance – landfill		21.3

[^] Based on a presentation rate of 84.4%. | # 60.6% bin percentage full. | * Excludes containerised material.

The results show that in this audit:

- An average household generated 8.94kg of waste per week, used 60.6% of their bin capacity and had 77.2L of contents in their bins when a bin was presented.
- 84.4% of the households presented their bins at the time of collection.
- Unrecovered recyclables were 1.04kg/hh/wk, 11.6% of the waste bin contents. Council could encourage more recovery of recyclables, particularly paper and plastic containers.
- Compostable waste was 5.38kg/hh/wk, 60.2% of the waste stream. This was mainly food and other organics such as compostable tissue paper and animal faeces and litter.
- Council should continue to conduct on-going data collection, particularly for seasons and areas where recovery, diversion or waste reduction interventions have been conducted.

1 Introduction

1.1 Background

City of Monash (Council) engaged EC Sustainable Pty Ltd (EC Sustainable) to conduct a Council-wide audit of the kerbside residential waste bins. The audit included 250 households, conducted in February 2019. A previous audit was completed in 2015 by the collection contractor (Solo Resource Recovery, 2015).

EC Sustainable completed the project planning, pre-collection bin surveys, sorting, data analysis and reporting. Council selected the street sample which was reviewed by EC Sustainable for conformance with the Sustainability Victoria residential waste auditing guidelines.

1.2 Objectives

The audit was conducted to provide up-to-date independent data to inform waste education initiatives and service planning and monitoring; such as for waste collection and processing contracts. A new waste collection contract will be tendered in coming months.

The data indicators reported include unrecovered resources rates (i.e. recyclable materials in the waste bins), bin generation rates and bin presentation rates.

1.3 Council information

City of Monash is a metropolitan south-eastern area of Melbourne with an area of approximately 81km². Based on the 2016 census, the population is 182,618 people and there are 70,510 households with 91.8% occupied (ABS [Australian Bureau of Statistics], 2016). The households are 71.7% Single Unit Dwellings (SUDs) and 28.3% Multi Unit Dwellings (MUDs) including semi-detached and terrace houses, townhouses, flats and apartments. Households have weekly waste bin collections and fortnightly on alternate weeks recycling and green organics bin collections.

1.4 Document structure

This report provides the methods used to obtain the data (Section 2) and the results of the audit (Section 3). Section 4 provides comments and recommendations. Appendices provide additional information, including project methods, additional data for nappies/ AHW and a comparison with the previous audit results.

2 Project methods

2.1 Sampling methods

2.1.1 Sample selection

EC Sustainable attended audit locations provided by Council to select the households that would be included in the audit to seek to meet the daily sample sizes required.

2.1.2 Sample size

Table 1 provides the sample frame for the audit with a one-week sampling period. A sample size of 250 households was targeted, with 50 households per day.

Table 1 - Audit sample frame and schedule

Collection details	Number of households			Suburbs	Number of streets	Bin size and collection frequency
	SUDs	MUDs	Total			
Monday, 11/02/2019	36	14	50	Mount Waverley, Glen Waverley, Ashwood	4	120L weekly, with optional 240L
Tuesday, 12/02/2019	26	24	50	Glen Waverley, Mount Waverley, Chadstone	5	
Wednesday, 13/02/2019	36	14	50	Glen Waverley, Wheelers Hill, Mount Waverley, Chadstone	5	
Thursday, 14/02/2019	40	10	50	Hughesdale, Oakleigh, Huntingdale, Mulgrave, Wheelers Hill	5	
Friday, 15/02/2019	32	18	50	Mulgrave, Clayton	5	
Total	170	80	250	-	24	-

2.1.3 Timing

The audit sampling was conducted from Monday 11th February to Friday 15th February 2019.

The kerbside bin survey and audit collection was conducted on the morning of the regular collection, but slightly before the normal bin collection time to avoid impacting the regular service. It is possible that the bin presentation rates may be increased slightly further between the audit truck sampling and the regular truck completing its collection.

2.2 Kerbside bin survey

A kerbside bin survey was completed prior to bin collection. The survey included bin size, bin presentation rate and bin capacity used (i.e. bin percentage full).

2.3 Material collection

Consistent with the Sustainability Victoria residential waste auditing guidelines, sampling was conducted using an aggregated collection system. Council supplied the collection truck and the auditors supervised collection of the households that had had a kerbside bin survey.

2.4 Sorting

2.4.1 Material categories

The materials were sorted and classified for analysis using the categories shown in Table 2.

Table 2 - Material categories

Categories			Categories			
Paper	Paper – recyclable		Plastic (cont.)	Other plastic containers (P7) – recyclable		
	Cardboard – recyclable			Other rigid plastics – not containers		
	Liquid paperboard containers			Soft plastics (bags and films) ^	Bagged recovered	
					Recoverable (loose bags in recycling)	
					Non-recoverable	
	Contaminated soiled paper			Composite (mostly plastic)		
Nappies and AHW (disposable)		Ferrous	Steel containers – recyclable			
Organic	Food (loose/ wrapped paper)		Fruit/ veg	Steel aerosols – recyclable		
			Meat/ fish	Steel other (non-packaging)		
		Dairy	Non-ferrous	Aluminium containers – recyclable		
		Staples (bread/pasta/rice)		Aluminium aerosols – recyclable		
		Tea bags/ coffee		Aluminium foil		
		Other including cooking oil		Non-ferrous other (non-packaging)		
	Food – containerised ^		Hazardous	Paint		
	Garden / vegetation			Fluorescent tubes and globes		
Other putrescible		Dry cell batteries				
Wood/ timber		Car (vehicle) batteries				
Textile/ rags/ leather/ footwear		Household chemicals				
Glass	Glass containers - recyclable			Asbestos		
	Other glass (not recyclable. – Pyrex, plate)			Clinical pathogenic infectious		
	Glass fines			Gas bottles		
Plastic	PET containers (P1) – recyclable			Earth	Hazardous other	
	HDPE containers (P2) – recyclable		Ceramics			
	PVC containers (P3) – recyclable		Plasterboard			
	LDPE containers (P4) – recyclable		Dirt, rock, inert, ash			
	PP containers (P5) – recyclable		Other	Electrical items and peripherals		
	PS containers (P6) – recyclable			Other materials		
	EPS - expanded (P6)					

☐ Marks materials compliant in the recycling bin.

☐ Marks materials compliant in the green waste bin.

^ Additional categories audited by EC Sustainable.

2.4.2 Location and disposal of sorted material

A safe sorting site was provided by City of Monash at Council transfer station, 380 Ferntree Gully Road, Notting Hill. Council removed the sorted material.

3 Results

3.1 Presentation rate

Table 3 provides the waste bin presentation rate by day. The average presentation rate was 84.4% in this audit. This was highest on Tuesday at 90.0% and lowest on Monday at 78.0%.

Council had an unoccupied household rate of 8.2% based on the census (ABS, 2016). Therefore, on average assuming random selection in the 2019 audit this means that 7.4% of households were occupied and did not present a bin.

Council's waste bin presentation rate based on the service data is approximately 87% (personal communication, City Monash, 28 February 2019). Therefore, the audit aligns closely with the service data.

Table 3 - Presentation rate

Presentation	Percentage of households (%)					
	Mon	Tues	Wed	Thur	Fri	Overall
Occupied – did present a bin	78.0	90.0	80.0	86.0	88.0	84.4
Occupied – did not present a bin	13.8	1.8	11.8	5.8	3.8	7.4
Unoccupied average assumed ^	8.2					8.2

^ Source: ABS 2016.

3.2 Generation

3.2.1 By weight

Table 4 provides the mean waste bin generation by weight by day and overall. Figure 1 provides the data graphically. The overall mean bin weight was:

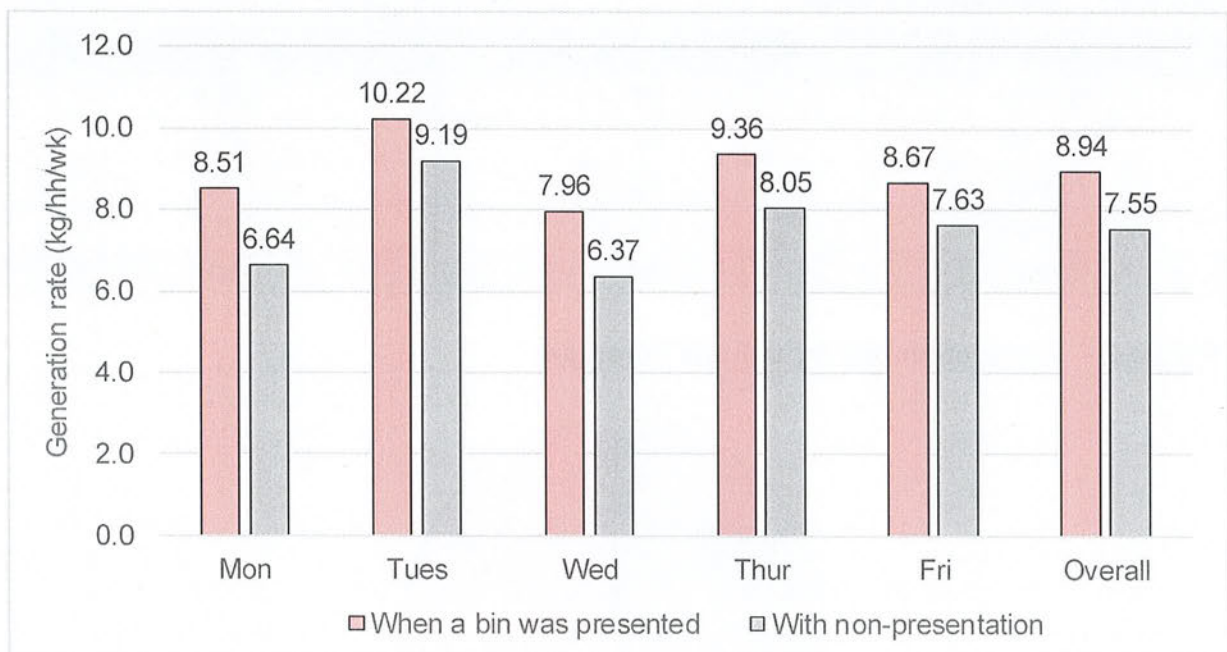
- 8.94kg/hh/wk, when a bin was presented to the kerbside in this audit.
- 7.55kg/hh/wk, when allowing for non-presentation of bins.

The average bin weight when a bin was presented was highest on Tuesday at 10.216kg/hh/wk and lowest on Wednesday at 7.961kg/hh/wk.

Table 4 - Generation rate – by weight

Results	Generation rates – kg/hh/wk					
	Mon	Tues	Wed	Thur	Fri	Overall
When a bin was presented	8.512	10.216	7.961	9.357	8.665	8.941
With non-presentation	6.639	9.194	6.369	8.047	7.625	7.546

Figure 1 - Generation rate by weight



3.2.2 By volume

Table 5 provides the waste stream bin capacity used for each day, based on the bins presented. The generation rate by volume was 77L/hh/wk when a bin was presented and 65L/hh/wk when allowing for non-presentation.

Table 5 - Generation rate – by volume

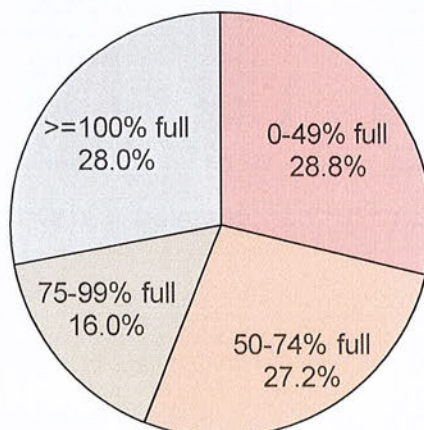
Results	Generation rate – by volume					
	Mon	Tues	Wed	Thur	Fri	Overall
Bin percentage full – %						
When a bin was presented	66.2	60.2	59.8	59.6	57.2	60.6
Volume – L/hh/wk						
When a bin was presented	88.6	74.6	74.4	78.7	69.6	77.2
With non-presentation	69.1	67.2	59.5	67.7	61.2	65.1

Table 6 provides the detailed bin capacity used at each household in the audits. Figure 2 provides the data graphically. The results showed that the 28.0% of the households used 100% or more of their waste bin capacity.

Table 6 - Bin capacity used

Percentage full (%)	Number of households	Percentage of households
0-49%	72	28.8
50-74%	68	27.2
75-99%	40	16.0
>=100%	70	28.0
Total	250	100.0

Figure 2 - Generation rate by volume in ranges



3.2.3 Density

Table 7 provides the average waste density based on the weights collected and the bin survey volumes when a bin was presented. The data for volume correlates closely with the weights presented, with an average density in the bin of kg/L.

Table 7 - Waste density

Results	Generation rates – when a bin was presented and density					
	Mon	Tues	Wed	Thur	Fri	Overall
Weight (kg/hh/wk)	8.512	10.216	7.961	9.357	8.665	8.941
Volume (L/hh/wk)	88.6	74.6	74.4	78.7	69.6	77.2
<i>Density (kg/L or t/m³)</i>	0.096	0.137 ^	0.107	0.119	0.124	0.116

^ Tuesday contained the highest generation rate of food, a dense material and had the highest density.

3.3 Bin composition

3.3.1 Summary composition

Table 8 provides the summary waste bin composition by weight (kg/hh/wk) by day. Table 9 provides the data by percentage (% by weight) by day. Figure 3 provides the Table 9 data graphically.

The Tables show the unrecovered resources in the waste stream by percentage based on suitability for particular uses:

- **Recyclable** – materials that can be placed into Council's kerbside recycling bins.
- **Potentially recyclable** – metals and recoverable soft plastics that are not compliant in Council's kerbside recycling bin, but that could be recovered by resource recovery facilities due to their value or other recovery programs.
- **Compostable** – additional materials that are compostable excluding materials that are compliant in the Council's kerbside recycling bin. For example, some paper could be composted but is compliant in the kerbside recycling bin and is therefore excluded from this category. The preferred option is the households place paper in the recycling bins.
- **MGB non-recyclable** – materials that cannot be placed into Council's kerbside recycling bins and are not compostable or potentially recyclable. This includes some materials that can be recovered (such as textiles at a clothes bank or e-waste at a drop-off centre, mobiles in MobileMuster) but that are not recoverable in the Council bin system.

The data is based on when a bin was presented to the kerbside. The data shows:

- Unrecovered MGB recyclable material weighing 1.04kg/hh/wk, 11.6% of the bin contents. These materials could be recovered in the recycling bin. Therefore, education should focus on the main unrecovered recyclables such as:
 - Recyclable paper at 0.49kg/hh/wk, 5.5% of the bin contents.
 - Recyclable plastics at 0.28kg/hh/wk, 3.1% of the bin contents.
- Compostable materials were 5.38kg/hh/wk, 60.2% of the bin contents.
 - Garden organics at 0.176kg/hh/wk, 2.0% of the bin contents. This could be recovered in the green waste bin.
 - Food waste at 4.29kg/hh/wk, 48.0% of the bin contents. This could potentially be recovered if Council were to implement an organics bin collection for food and garden organics.

The 'Total other' category includes other materials that could potentially be recovered but not within the Council bin system. This includes items that can mainly be recovered in resident drop-off systems such as textiles/rags, oils, wood, ceramics/dust/dirt/rock/inert/ash, mobile phones, computer equipment and ash/earth based. However, the Guidelines sorting requirements do not include sub-segregation of which parts of these items are recoverable and which parts are not recoverable. For example, some textiles may be contaminated beyond recovery, others can be re-used without re-processing (such as in charity shops) and some may be re-usable with re-processing.

Table 8 - Unrecovered resources in the waste stream – by weight

Material category	Weight (kg/hh/wk)					
	Mon	Tues	Wed	Thur	Fri	Overall
Recyclable paper	0.461	0.605	0.423	0.523	0.458	0.494
Recyclable glass	0.104	0.244	0.119	0.149	0.108	0.145
Recyclable plastics	0.325	0.306	0.221	0.317	0.229	0.280
Recyclable steel	0.036	0.072	0.061	0.076	0.070	0.063
Recyclable aluminium	0.043	0.068	0.054	0.054	0.068	0.057
Recyclable	0.969	1.295	0.878	1.119	0.933	1.039
Soft plastics recoverable ^	0.604	0.511	0.558	0.632	0.612	0.583
Metal other ferrous	0.026	0.037	0.010	0.043	0.044	0.032
Metal other non-ferrous	0.000	0.000	0.000	0.000	0.000	0.000
Potentially recyclable	0.630	0.548	0.568	0.675	0.656	0.615
Food	4.270	5.160	3.906	4.230	3.900	4.293
Garden / vegetation	0.372	0.040	0.202	0.185	0.082	0.176
Other organic potentially compostable <	0.862	0.911	0.952	0.982	0.856	0.913
Compostable	5.504	6.111	5.060	5.397	4.838	5.382
Non-recyclable plastics (other)	0.220	0.240	0.187	0.167	0.223	0.207
Non-recyclable glass	0.000	0.030	0.019	0.000	0.000	0.010
Non-recyclable paper	0.000	0.000	0.000	0.000	0.000	0.000
Total other	1.189	1.992	1.249	1.999	2.015	1.687
MGB non-recyclable	1.409	2.262	1.455	2.166	2.238	1.905
Total	8.512	10.216	7.961	9.357	8.665	8.941

^ Such as in the flexible soft plastics recovery programs conducted by some Melbourne councils.

< Includes other putrescible, wood/ timber and contaminated soiled paper.

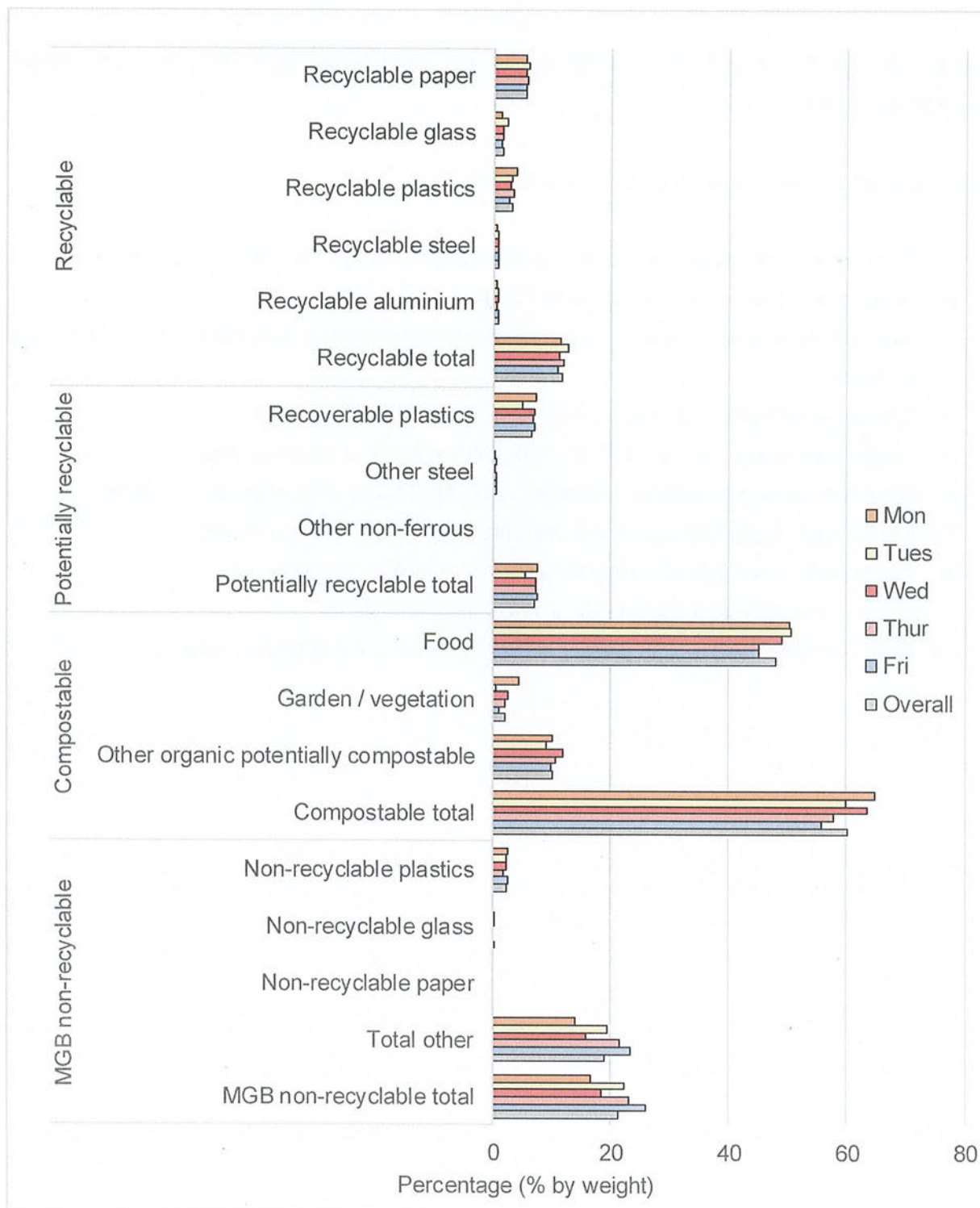
Table 9 - Unrecovered resources in the waste stream – by percentage

Material category	Percentage (% by weight)					
	Mon	Tues	Wed	Thur	Fri	Overall
Recyclable paper	5.41	5.92	5.31	5.59	5.28	5.52
Recyclable glass	1.22	2.39	1.49	1.59	1.25	1.62
Recyclable plastics	3.82	3.01	2.78	3.39	2.65	3.12
Recyclable steel	0.42	0.71	0.77	0.82	0.81	0.70
Recyclable aluminium	0.51	0.66	0.68	0.58	0.79	0.63
Recyclable	11.38	12.69	11.03	11.97	10.78	11.59
Soft plastics recoverable ^	7.10	5.00	7.01	6.75	7.06	6.52
Metal other ferrous	0.31	0.36	0.13	0.46	0.51	0.36
Metal other non-ferrous	0.00	0.00	0.00	0.00	0.00	0.00
Potentially recyclable	7.41	5.36	7.14	7.21	7.57	6.88
Food	50.17	50.50	49.05	45.20	45.01	48.03
Garden / vegetation	4.37	0.39	2.54	1.98	0.95	1.97
Other organic potentially compostable <	10.14	8.92	11.96	10.50	9.88	10.20
Compostable	64.68	59.81	63.55	57.68	55.84	60.20
Non-recyclable plastics (other)	2.58	2.34	2.35	1.79	2.58	2.32
Non-recyclable glass	0.00	0.30	0.24	0.00	0.00	0.11
Non-recyclable paper	0.00	0.00	0.00	0.00	0.00	0.00
Total other	13.96	19.52	15.69	21.36	23.26	18.86
MGB non-recyclable	16.54	22.16	18.28	23.15	25.84	21.29
Total	100.00	100.00	100.00	100.00	100.00	100.00

^ Such as in the flexible soft plastics recovery programs conducted by some Melbourne councils.

< Includes other putrescible, wood/ timber and contaminated soiled paper.

Figure 3 - Unrecovered resources composition



3.3.2 Detailed categories

Tables 10 and 11 provide the detailed waste bin composition by weight and percentage respectively by day.

The results show that overall the main materials were:

1. Food (loose/wrapped paper) - fruit/ veg at 2.92kg/hh/wk, 32.7% of the bin contents.
2. Nappies and AHW at 0.84kg/hh/wk, 9.4% of the bin contents¹.
3. Food (loose/wrapped paper) - staples (bread/pasta/rice) at 0.71kg/hh/wk, 8.0% of the bin contents.
4. Contaminated soiled paper at 0.67kg/hh/wk, 7.5% of the bin contents.
5. Plastic bags / films - recoverable at 0.58kg/hh/wk, 6.5% of the bin contents.
6. Food (loose/wrapped paper) - meat/ fish at 0.44kg/hh/wk, 4.9% of the bin contents.
7. Textile/ rags/ leather/ footwear at 0.35kg/hh/wk, 4.0% of the bin contents.
8. Cardboard - recyclable at 0.24kg/hh/wk, 2.7% of the bin contents.
9. Paper - recyclable at 0.24kg/hh/wk, 2.7% of the bin contents.
10. Food - containerised (e.g. in plastic) at 0.22kg/hh/wk, 2.4% of the bin contents.

¹ There was a high level of nappies and AHW. This includes all AHW including children's products, adult incontinence and feminine hygiene products. In the census ABS (2016):

- Children aged 0-4 years were 5.1% of the population.
- Aged people, those aged 65+ years, were 17.2% of the population.

Table 10 - Detailed composition by weight

Category		Weight (kg/hh/wk)					
		Mon	Tues	Wed	Thur	Fri	Overall
Paper	Paper – recyclable	0.222	0.340	0.165	0.247	0.209	0.236
	Cardboard – recyclable	0.231	0.238	0.234	0.267	0.220	0.238
	Liquid paperboard containers	0.008	0.027	0.024	0.009	0.029	0.020
	Contaminated soiled paper	0.615	0.607	0.784	0.808	0.558	0.674
	Nappies and AHW	0.525	1.283	0.482	0.777	1.118	0.837
	Sub-total	1.601	2.495	1.689	2.108	2.134	2.005
Organic	Food (loose/wrapped paper) – fruit/ veg	3.173	3.499	2.805	2.299	2.835	2.922
	Food (loose/wrapped paper) – meat/ fish	0.300	0.503	0.408	0.500	0.463	0.435
	Food (loose/wrapped paper) – dairy	0.108	0.562	0.056	0.064	0.065	0.171
	Food (loose/wrapped paper) – staples	0.645	0.555	0.583	1.297	0.483	0.713
	Food (loose/wrapped paper) – tea bags/coffee	0.021	0.015	0.035	0.048	0.030	0.030
	Food (loose/wrapped paper) – other	0.023	0.026	0.019	0.022	0.024	0.023
	Food – containerised	0.150	0.194	0.171	0.363	0.212	0.218
	Garden / vegetation	0.372	0.040	0.202	0.185	0.082	0.176
	Other putrescible	0.221	0.212	0.144	0.132	0.260	0.194
	Wood/ timber	0.026	0.092	0.024	0.042	0.038	0.044
	Textile / rags / leather / footwear	0.254	0.276	0.251	0.502	0.485	0.353
	Sub-total	5.293	5.974	4.698	5.454	4.977	5.279
Glass	Glass containers – recyclable	0.104	0.244	0.119	0.149	0.108	0.145
	Other glass (not recyclable - Pyrex, plate etc)	0.000	0.020	0.000	0.000	0.000	0.004
	Glass fines	0.000	0.010	0.019	0.000	0.000	0.006
	Sub-total	0.104	0.274	0.138	0.149	0.108	0.155
Plastics	PET containers (P1) – recyclable	0.142	0.108	0.094	0.130	0.093	0.113
	HDPE containers (P2) – recyclable	0.010	0.023	0.017	0.030	0.025	0.021
	PVC containers (P3) – recyclable	0.000	0.020	0.010	0.010	0.004	0.009
	LDPE containers (P4) – recyclable	0.028	0.000	0.000	0.000	0.000	0.006
	PP containers (P5) – recyclable	0.111	0.095	0.093	0.113	0.092	0.101
	PS containers (P6) – recyclable	0.034	0.000	0.007	0.005	0.011	0.011
	EPS - expanded (P6)	0.019	0.028	0.055	0.026	0.006	0.027
	Other plastic containers (P7) – recyclable	0.000	0.060	0.000	0.029	0.004	0.019
	Other rigid plastics – not containers	0.062	0.000	0.013	0.000	0.064	0.028

Table 10 (cont.) - Detailed composition by weight

Category		Weight (kg/hh/wk)					
		Mon	Tues	Wed	Thur	Fri	Overall
Plastics	Plastic bags/films – recoverable loose	0.604	0.511	0.558	0.632	0.612	0.583
	Plastic bags/films – non-recoverable	0.102	0.130	0.057	0.060	0.104	0.091
	Composite (mostly plastic)	0.037	0.082	0.062	0.081	0.049	0.062
	Sub-total	1.149	1.057	0.966	1.116	1.064	1.071
Ferrous	Steel containers – recyclable	0.025	0.057	0.038	0.066	0.070	0.051
	Steel aerosols – recyclable	0.011	0.015	0.023	0.010	0.000	0.012
	Steel other (non-packaging)	0.026	0.037	0.010	0.043	0.044	0.032
	Sub-total	0.062	0.109	0.071	0.119	0.114	0.095
Non-Ferrous	Aluminium containers – recyclable	0.043	0.034	0.008	0.014	0.039	0.028
	Aluminium aerosols – recyclable	0.000	0.000	0.008	0.000	0.004	0.002
	Aluminium foil	0.000	0.034	0.038	0.040	0.025	0.027
	Non-ferrous other (non-packaging)	0.000	0.000	0.000	0.000	0.000	0.000
	Sub-total	0.043	0.068	0.054	0.054	0.068	0.057
Hazardous	Paint	0.000	0.000	0.000	0.010	0.026	0.007
	Fluorescent tubes and globes	0.000	0.000	0.000	0.000	0.000	0.000
	Dry cell batteries	0.007	0.019	0.004	0.009	0.008	0.009
	Car (vehicle) batteries	0.000	0.000	0.000	0.000	0.000	0.000
	Household chemicals	0.044	0.098	0.120	0.064	0.026	0.071
	Asbestos	0.000	0.000	0.000	0.002	0.000	0.000
	Clinical pathogenic infectious	0.010	0.009	0.001	0.011	0.043	0.015
	Gas bottles	0.000	0.000	0.000	0.000	0.000	0.000
	Hazardous other	0.000	0.000	0.000	0.000	0.000	0.000
	Sub-total	0.061	0.126	0.125	0.096	0.103	0.102
Earth	Ceramics	0.013	0.013	0.003	0.021	0.032	0.016
	Plasterboard	0.116	0.000	0.000	0.199	0.000	0.063
	Dirt, rock, inert, ash	0.001	0.009	0.175	0.008	0.033	0.045
	Sub-total	0.130	0.022	0.178	0.228	0.065	0.124
Other	Electrical items and peripherals	0.069	0.070	0.007	0.012	0.023	0.036
	Other materials	0.000	0.021	0.035	0.021	0.009	0.017
	Sub-total	0.069	0.091	0.042	0.033	0.032	0.053
Total		8.512	10.216	7.961	9.357	8.665	8.941

Table 11 - Detailed composition by percentage

Category		Percentage (% by weight)					
		Mon	Tues	Wed	Thur	Fri	Overall
Paper	Paper – recyclable	2.61	3.33	2.07	2.64	2.41	2.64
	Cardboard – recyclable	2.71	2.33	2.94	2.85	2.54	2.66
	Liquid paperboard containers	0.09	0.26	0.30	0.10	0.33	0.22
	Contaminated soiled paper	7.23	5.94	9.85	8.64	6.44	7.54
	Nappies and AHW	6.17	12.56	6.05	8.30	12.90	9.36
	Sub-total	18.81	24.42	21.21	22.53	24.62	22.42
Organic	Food (loose/wrapped paper) – fruit/ veg	37.28	34.25	35.23	24.57	32.72	32.68
	Food (loose/wrapped paper) – meat/ fish	3.52	4.92	5.12	5.34	5.34	4.87
	Food (loose/wrapped paper) – dairy	1.27	5.50	0.70	0.68	0.75	1.91
	Food (loose/wrapped paper) – staples	7.58	5.43	7.32	13.86	5.57	7.97
	Food (loose/wrapped paper) – tea bags/coffee	0.25	0.15	0.44	0.51	0.35	0.34
	Food (loose/wrapped paper) – other	0.27	0.25	0.24	0.24	0.28	0.26
	Food – containerised	1.76	1.90	2.15	3.88	2.45	2.44
	Garden / vegetation	4.37	0.39	2.54	1.98	0.95	1.97
	Other putrescible	2.60	2.08	1.81	1.41	3.00	2.17
	Wood/ timber	0.31	0.90	0.30	0.45	0.44	0.49
	Textile / rags / leather / footwear	2.98	2.70	3.15	5.36	5.60	3.95
	Sub-total	62.19	58.47	59.00	58.28	57.45	59.05
Glass	Glass containers – recyclable	1.22	2.39	1.49	1.59	1.25	1.62
	Other glass (not recyclable - Pyrex, plate etc)	0.00	0.20	0.00	0.00	0.00	0.04
	Glass fines	0.00	0.10	0.24	0.00	0.00	0.07
	Sub-total	1.22	2.69	1.73	1.59	1.25	1.73
Plastics	PET containers (P1) – recyclable	1.67	1.06	1.18	1.39	1.07	1.26
	HDPE containers (P2) – recyclable	0.12	0.23	0.21	0.32	0.29	0.23
	PVC containers (P3) – recyclable	0.00	0.20	0.13	0.11	0.05	0.10
	LDPE containers (P4) – recyclable	0.33	0.00	0.00	0.00	0.00	0.07
	PP containers (P5) – recyclable	1.30	0.93	1.17	1.21	1.06	1.13
	PS containers (P6) – recyclable	0.40	0.00	0.09	0.05	0.13	0.12
	EPS - expanded (P6)	0.22	0.27	0.69	0.28	0.07	0.30
	Other plastic containers (P7) – recyclable	0.00	0.59	0.00	0.31	0.05	0.21
	Other rigid plastics – not containers	0.73	0.00	0.16	0.00	0.74	0.31

Table 11 (cont.) - Detailed composition by percentage

Category		Percentage (% by weight)					
		Mon	Tues	Wed	Thur	Fri	Overall
Plastics	Plastic bags/films – recoverable loose	7.10	5.00	7.01	6.75	7.06	6.52
	Plastic bags/films – non-recoverable	1.20	1.27	0.72	0.64	1.20	1.02
	Composite (mostly plastic)	0.43	0.80	0.78	0.87	0.57	0.69
	Sub-total	13.50	10.35	12.14	11.93	12.29	11.96
Ferrous	Steel containers – recyclable	0.29	0.56	0.48	0.71	0.81	0.57
	Steel aerosols – recyclable	0.13	0.15	0.29	0.11	0.00	0.13
	Steel other (non-packaging)	0.31	0.36	0.13	0.46	0.51	0.36
	Sub-total	0.73	1.07	0.90	1.28	1.32	1.06
Non-Ferrous	Aluminium containers – recyclable	0.51	0.33	0.10	0.15	0.45	0.31
	Aluminium aerosols – recyclable	0.00	0.00	0.10	0.00	0.05	0.02
	Aluminium foil	0.00	0.33	0.48	0.43	0.29	0.30
	Non-ferrous other (non-packaging)	0.00	0.00	0.00	0.00	0.00	0.00
	Sub-total	0.51	0.66	0.68	0.58	0.79	0.63
Hazardous	Paint	0.00	0.00	0.00	0.11	0.30	0.08
	Fluorescent tubes and globes	0.00	0.00	0.00	0.00	0.00	0.00
	Dry cell batteries	0.08	0.19	0.05	0.10	0.09	0.10
	Car (vehicle) batteries	0.00	0.00	0.00	0.00	0.00	0.00
	Household chemicals	0.52	0.96	1.51	0.68	0.30	0.79
	Asbestos	0.00	0.00	0.00	0.02	0.00	0.00
	Clinical pathogenic infectious	0.12	0.09	0.01	0.12	0.50	0.17
	Gas bottles	0.00	0.00	0.00	0.00	0.00	0.00
	Hazardous other	0.00	0.00	0.00	0.00	0.00	0.00
	Sub-total	0.72	1.24	1.57	1.03	1.19	1.14
Earth	Ceramics	0.15	0.13	0.04	0.22	0.37	0.18
	Plasterboard	1.36	0.00	0.00	2.13	0.00	0.70
	Dirt, rock, inert, ash	0.01	0.09	2.20	0.09	0.38	0.50
	Sub-total	1.52	0.22	2.24	2.44	0.75	1.38
Other	Electrical items and peripherals	0.81	0.69	0.09	0.13	0.27	0.40
	Other materials	0.00	0.21	0.44	0.22	0.10	0.19
	Sub-total	0.81	0.90	0.53	0.35	0.37	0.59
Total		100.0	100.0	100.0	100.0	100.0	100.0

3.4 Hazardous materials

This section provides the weights and counts for hazardous materials in the waste stream. Tables 12 and 13 provide the hazardous materials composition by weight and by count respectively. Figure 4 provides the results graphically.

The data shows the key hazardous materials were:

- Household chemicals at 57.7% by weight and 58.5% by count of hazardous materials.
- Electrical items and peripherals at 29.3% by weight and 13.9% by count of hazardous materials.
- Dry cell batteries at 7.3% by weight and 26.9% by count of hazardous materials. There were 0.34 dry cell batteries per household overall, approximately 1 item for every three households.

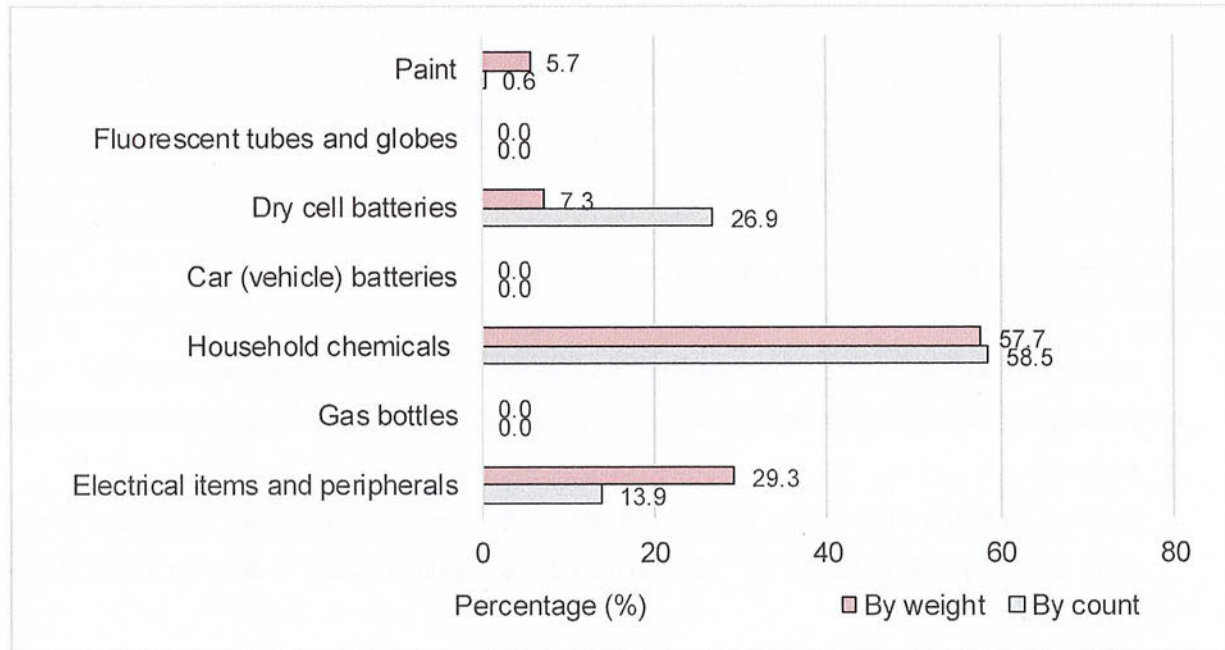
Table 12 - Hazardous materials – by weight

Material	Weight	
	Weight (kg/hh/wk)	% by weight
Paint	0.007	5.69
Fluorescent tubes and globes	0.000	0.00
Dry cell batteries	0.009	7.32
Car (vehicle) batteries	0.000	0.00
Household chemicals	0.071	57.72
Gas bottles	0.000	0.00
Electrical items and peripherals	0.036	29.27
Total	0.123	100.00

Table 13 - Hazardous materials – by count

Hazardous item	Count		
	Item count	Item/hh/wk	% by count
Paint	2	0.01	0.63
Fluorescent tubes and globes	0	0.00	0.00
Dry cell batteries	85	0.34	26.90
Car (vehicle) batteries	0	0.00	0.00
Household chemicals	185	0.74	58.54
Gas bottles	0	0.00	0.00
Electrical items and peripherals	44	0.18	13.92
Total	316	1.26	100.00

Figure 4 - Hazardous materials composition



4 Comments and recommendations

The results show that in this audit:

- An average household generated 8.94kg of waste per week, used 60.6% of their bin capacity and had 77.2L of contents in their bins when a bin was presented meaning on average there was capacity available in the service. However,
 - 28.0% of the households used 100% or more of their waste bin capacity.
 - Council could aim to increase bin capacity for those households that have used 100% or more of their bin capacity. This could be achieved by:
 1. Reducing the amount of recycling and organics material in the waste bins.
 2. Consider service options to avoid full or overfull bins as a last resort, which may involve additional bins for a fee or larger bins. Overfull bins can present a littering issue.
- The presentation rate was high at 84.4% of the households that presented their bins at the time of collection. This closely matched the service average of 87% supplied by Council.
- Unrecovered recyclables were 1.04kg/hh/wk, 11.6% of the waste bin contents. Council could encourage more recovery of recyclables, particularly paper and plastic containers.
- Compostable waste was 5.38kg/hh/wk, 60.2% of the waste stream.
 - This was mainly food and other organics such as compostable tissue paper and animal faeces and animal litter.
 - There was a low level of unrecovered garden organics. Council has a separate garden organics bin service.
- Nappies and AHW was a substantial portion of the waste bin contents at 9.4% of the bin contents, 0.84kg/hh/wk. Due to this it may be worthwhile to sort more detailed AHW categories in future audits:
 - Children's nappies.
 - Adult incontinence products.
 - Feminine hygiene products.
- Council should continue to conduct on-going data collection, particularly for seasons and areas where recovery, diversion or waste reduction interventions have been conducted.

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List of abbreviations

AHW	Absorbent Hygiene Waste
AS	Australian Standard
ARRT	Advanced Resource Recovery Technology
AWD	Australian Waste Database
AWT	Advanced Waste Treatment
ERA	Extended Regulated Area
FOGO	Food and Garden Organics
HAC	Hazard Assessment Check
HDPE	High Density Polyethylene
HH	Household
LDPE or LLDPE	Low Density Polyethylene
LGA	Local Government Authority
LPB	Liquid paperboard
MGB	Mobile Garbage Bin
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MUD	Multiple Unit Dwelling
PET	Polyethylene Terephthalate
PP	Polypropylene
PPE	Personal Protective Equipment
PS	Polystyrene
PVC	Polyvinyl Chloride
SUD	Single Unit (Occupancy) Dwelling
SWMS	Safe Work Method Statement
SV	Sustainability Victoria
WEEE	Waste Electronic and Electrical Equipment
WHS	Work Health and Safety
WK	Week

Glossary

This section defines the main terms in the report and provides the formulae used for calculations. All formulae are based on the properties in the study and are based on the kerbside results, excluding any other improvements that may occur after collection, such as at a processing facility.

Generation rate:	The amount of material generated in a timeframe such as a week, provided by household as weight or volume. The generation rates in this report are based on the contents of the bins presented, not only the compliant material in the bins.
Presentation rate:	<p>The percentage of bins placed out on the kerbside for collection compared to the total number of bins available at those properties</p> $= \frac{\text{Bins presented}}{\text{All bins available}} \times 100$
Recyclable material:	Material that is accepted for recycling by Council.
Rubbish/waste bin:	The contents of the red-lidded waste bins, also known as also known as garbage or Municipal Solid Waste (MSW). Collectively known as the waste stream.
Unrecovered resources:	Recoverable material in the residual waste bins, which is also known as resource loss.

Appendix 1 – Project methods: quality and WHS

Quality control

The following quality control methods were implemented:

- **Material weighing** – Each weight was verified by a second person for accuracy.
- **Scale servicing** – Each scale was serviced prior to the audit and calibrated for accuracy to within 0.5% of an interval for use.
- **Scale calibration** – Scales were externally serviced and calibrated if they did not calibrate based on internal calibrations.
- **Purity audits** – A team leader conducted a purity audit of selected sorted material to ensure quality control standards were met.
- **Data form back-up** – All data forms were created in duplicate in the field using electronic back-up. The original and back-up resided in two separate secure locations until data entry.
- **Monitoring** - A management staff member was assigned the role of monitoring the audit for WHS compliance, sorting accuracy, conducting equipment checks, managing stakeholders and data verification.

Work Health and Safety (WHS)

General

A Work Health and Safety Management System (WHSMS) was developed for the audit including completing a safe work method statement and Hazard Assessment Check (HAC) process for both the collection and sorting tasks in the audit.

All staff wore PPE as outlined in the Safe Work Method Statement (SWMS) and shown in Table 14.

Table 14 - Personal protective equipment (PPE) used

PPE required	Applicable standard compliance
Dust mask (Optional, except when advised by a manager)	AS/ NZS 1715: 2009 – Selection, use and maintenance of respiratory protective devices.
Gloves Heavy duty rubber or neoprene	AS/ NZS 2161: 2000 – Occupational protective gloves.
Gloves Needle proof	Turtleskin™ needle proof gloves which withstand 1.1 pounds force against a 28g needle to NIJ99-114 test methods.
Eye protection (optional) Low impact goggles with indirect ventilation (HT or CT with C, D optional)	AS/ NZS 1336: 2004 – Recommended practices for occupational eye protection.
Hearing protection Ear plugs or ear muffs	AS/NZS 1270: 2002 – Acoustics - hearing protectors
Overalls Full length protective trousers and shirts/ overalls	Not applicable.
Safety boots Steel toe capped fully enclosed boots	AS/NZS 2210.3:2009 – Occupational protective footwear - Specification for safety footwear.
High visibility vest Fluorescent with reflective strips	AS/ NZS 4602: 2011 - High visibility safety garments.
Sun protection including sunscreen (and hats and sunglasses) Very high protection - SPF 30+ (When necessary if working outside in daylight conditions)	AS/ NZS 2604: 2012 – Sunscreen products, evaluation and classification.
Insect repellent	Not applicable.

* National Institute of Justice (NIJ) Test Protocol 99-114.

Training

All waste auditors were EC Sustainable staff that work full-time in waste and recycling audits. All staff had the following pre-requisite quality and WHS training:

- Waste auditing certificate from a third-party trainer.
- WHS card.
- Vaccinations – Hepatitis A and B and Tetanus.
- Current police check.
- Confidentiality agreement.
- Manual handling training from a third-party trainer.

In addition, two staff had the following training:

- Asbestos awareness certificate.
- Senior first aid.

As well as this, one project staff member had a certificate IV in WHS.

Appendix 2 – Counts of nappies and AHW

This Appendix, in Table 15, provides the counts of nappies and AHW of this audit. The result shows that on average each household disposed approximately 3 nappies/ AHW per week in the waste bins.

Table 15 - Counts of nappies and AHW

Results	Count					
	Mon	Tues	Wed	Thur	Fri	Overall
Total count in audit	113	253	216	95	134	811
Average count per household presenting a bin (item/hh/wk)	2.26	5.06	4.32	1.90	2.68	3.24

Appendix 3 – Comparison with previous data

This appendix, in Table 16, provides a comparison of key data indicators in the 2015 audit (Solo Resource Recovery, 2015) and this audit. The 2015 audit was conducted in November over one-week period, also of 250 households.

The audits provide a single snapshot in time and may vary depending on season and scope. Some key observations in regards to differences in the 2015 and 2019 audit data indicators are below.

Food

- There was a high level of food in both audits:
 - 2015 audit: 51.1%, 5.47kg/hh/wk.
 - 2019 audit: 48.0%, 4.29kg/hh/wk.
 - 1.18kg/hh/wk higher in the 2015 audit, 27% more than 4.29kg/hh/wk in 2019².

Nappies and AHW

- There was a high level of nappies and AHW³ in both audits.
 - 2015 audit: 12.4%, 1.33kg/hh/wk.
 - 2019 audit: 9.4%, 0.84kg/hh/wk.
 - 0.49kg/hh/wk higher in the 2015 audit, 59% more than 0.84kg/hh/wk in 2019.

Paper and cardboard

- There was a similar level of recyclable paper and cardboard in the two audits:
 - Recyclable paper:
 - 2015 audit: 3.2%, 0.34kg/hh/wk.
 - 2019 audit 2.6%, 0.24kg/hh/wk.
 - Recyclable cardboard:
 - 2015 audit: 2.3%, 0.25kg/hh/wk.
 - 2019 audit 2.7%, 0.24kg/hh/wk.
- However, the 2019 audit had an additional amount of contaminated soiled paper – tissues, napkins etc (soft paper not in recyclable paper). This was 7.5%, 0.67kg/hh/wk, in the 2019 audit and classified within other organic potentially compostable material in the main report.

² The 2019 audit had an additional 2.4% of the bin contents (0.22kg/hh/wk) separately recorded as *food – containerised*. This included sealed containers such as tins or bottles with consumable food and liquid. It was excluded in 2019 because it is not generally available for composting or recovered in current residential FOGO systems.

³ The 2019 audit included all AHW including children's products, adult incontinence and feminine hygiene products. In the census ABS (2016) the population included children (aged 0-4 years) at 5.1% and aged people (65+ years) at 17.2%.

Table 16 - Comparison with previous data

Key statistic		Unit of measurement	Results		
			2015 [^]	2019	Diff- erence
Presentation rate	Target bins presented	Percentage (%)	100.0	84.4 #	-15.6
Generation rate	When a bin was presented	Weight – kg/hh/wk	10.71	8.94	-1.77
	With non-presentation ^{^^}	Weight – kg/hh/wk	10.71	7.55	-3.16
	When a bin was presented	Volume – L/hh/wk	77.3	77.2	-0.1
	With non-presentation ^{^^}	Volume – L/hh/wk	77.3	65.1	-12.2
Unrecovered materials in the waste bins and balance to landfill	Recyclable – containers	Weight – kg/hh/wk	0.83	0.57	-0.26
	Recyclable – paper and card		0.59	0.47	-0.12
	Potentially recyclable <		0.54	0.62	+0.07
	Compostable food *		5.47	4.29 *	-1.18
	Compostable garden organics		0.63	0.18	-0.46
	Compostable other >		0.21	0.91	+0.70
	Nappies and AHW		1.33	0.84	-0.49
	Balance – other landfill		1.11	1.07	-0.04
	Recyclable	Percentage (%) by weight	7.7	6.3	-1.4
	Recyclable – paper and card		5.5	5.3	-0.2
	Potentially recyclable <		5.0	6.9	+1.8
	Compostable food *		51.1	48.0 *	-3.0
	Compostable garden organics		5.9	2.0	-3.9
	Compostable other >		2.0	10.2	+8.2
	Nappies and AHW		12.4	9.4	-3.0
	Balance – other landfill		10.3	11.9	+1.6

[^] Interpreted from Solo Resource Recovery, 2015.

Council had an unoccupied household rate of 8.2% based on the census (ABS, 2016). Therefore, on average, assuming random selection in the 2019 audit this means that 7.4% of households were occupied and did not present a bin.

^{^^} Based on the presentation rates shown.

* Excludes “food – containerised” in 2019, which was not a discrete category in the 2015 audit (Solo Resource Recovery, 2015).

< Calculated by EC Sustainable to include:

- 2015 audit: other metal, other mixed recyclables and all the soft plastics (0.52kg/hh/wk, 4.8% of bin contents).
- 2019 audit: steel other (non-packaging), non-ferrous other (non-packaging), as well as recoverable soft plastics (0.58kg/hh/wk, 6.5% of bin contents), given recent programs in Melbourne to consider soft plastics recovery.

< Calculated by EC Sustainable to include:

- 2015 audit: other putrescible and wood/ timber (excluding wood/timber building material).
- 2019 audit: other putrescible, wood/ timber, as well as contaminated soiled paper at 0.67kg/hh/wk, 7.5% of bin contents, given the potential inclusion in FOGO or AWT / ARRT composting.

Appendix 4 – Raw data

This Appendix provides the raw data of this audit in a separate Excel file.