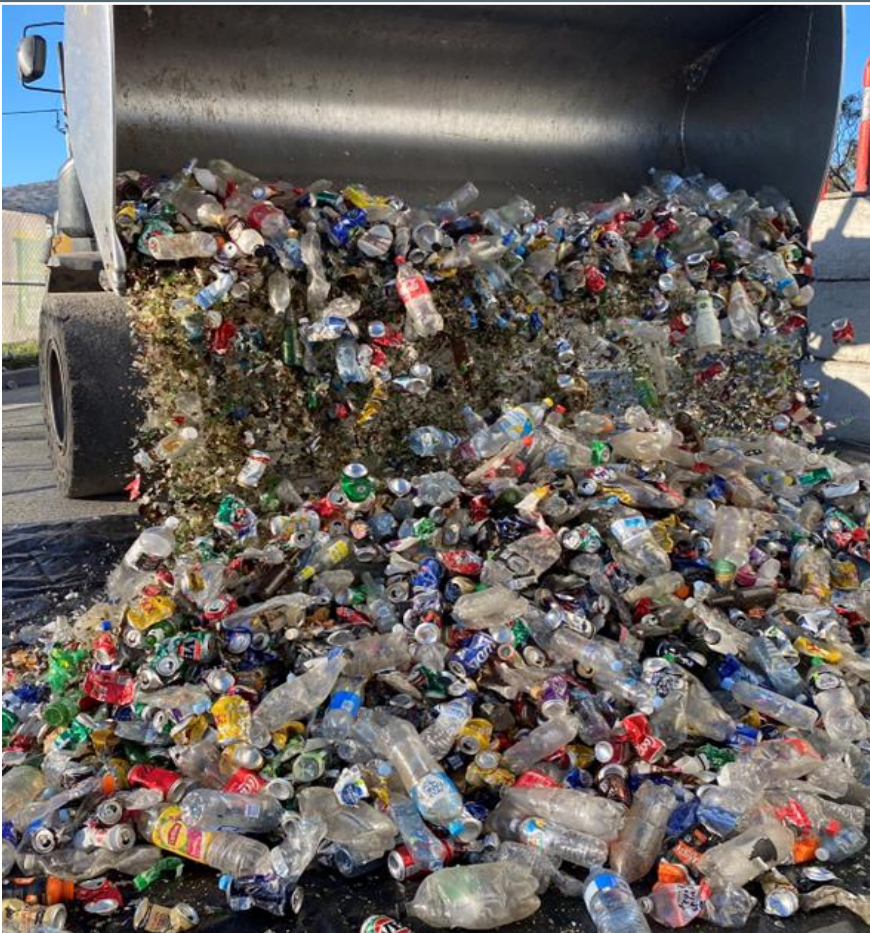




2022

ACT NoWaste  
Report:  
Audit of MRF inputs and outputs



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## ACRONYMS

<b>ACT</b>	Australia Capital Territory
<b>APC</b>	A.Prince Consulting
<b>CDS</b>	container deposit scheme
<b>LPB</b>	liquid paperboard
<b>MRF</b>	material recovery facility
<b>MGB</b>	mobile garbage bin
<b>RDOC</b>	recycling drop-off centre

## EXECUTIVE SUMMARY

### About the audit

- An audit of 75 samples taken from 32 incoming loads, 9 residual and 34 outbound commodities from the recycling sorting process was undertaken at Hume Material Recovery Facility (MRF) over ten days in May 2022.
- A physical sort of 6.878 tonnes was undertaken, including 3.790 tonnes of input material, 989 kg of residual material (including oversize bins) and 2.099 tonnes of output material.

### Incoming and outgoing materials

#### Incoming material

- Kerbside material comprises 71% of all MRF feedstock with ACT kerbside (53%), NSW kerbside material (18%), ACT CDS (7%), commercial comingled (6%), NSW CDS (6%) and commercial cardboard 3%.
- The total average contamination in the material received at the MRF was 12.16%.
- Contamination by weight was highest in public place bins (39%) followed by both NSW and ACT kerbside (14%), commercial recycling (8%), RDOC (2%), NSW CDS (0.3%) and ACT CDS (0.05%).
- Contamination by volume was highest in NSW kerbside 12%, ACT commercial (5%), NSW CDS (0.3%) and ACT CDS (0.01%).

#### Composition of incoming material

- NSW kerbside composition: paper/ cardboard (60%), glass (21%), plastics (13%), steel (4%), aluminium (0.6%).
- ACT kerbside composition: paper/ cardboard (41%), glass (33%), plastics (9%), steel (3%), aluminium (0.6%).
- ACT commercial loads comprised paper/ cardboard (73%), glass (23%), Pet clear (1%) and all other materials <1%.
- ACT public place loads comprised paper/ cardboard (49%), glass (37%), Pet clear (6%), mixed plastics (4%) aluminium (2%) all other materials <1%

### Plastic bags

- The ACT implemented a ban on single-use, lightweight plastic shopping bags in November 2011.
- Plastic shopping bags represent almost 0.73% of the overall residual comprising high density branded bags (0.56%), single use bags (0.10%) and low density barrier bags (0.07%).

## Outbound materials

### Outbound residuals

- An audit of the **outbound residuals** reveals that 27% of this material is recyclable and 73% is residual material.
- The recyclables not recovered include aluminium (12%), plastics (8%), paper (4%), steel (2%) and glass (1%).
- The residual material comprises fines (54%), textiles (3.6%), bagged material (3.4%), plastic film and oversized plastics both (2%) and electrical items (1.5%). The remaining residual is very small amounts of a diverse list of materials.
- The main unacceptable items manually extracted at the pick line at the beginning of the MRF and prior to processing are oversized large plastic items like toys and tubs, compound materials and electronic items. These form 5.6% of the overall residual and 100% of the oversize non-metal load and 26% of the metal oversize bin.

### Outbound recyclables composition

- Of the commodities leaving the site contaminants were less than 1%.
- Almost 43% of the outbound recyclables consist of containers that are eligible for a 10c refund through the container deposit scheme.

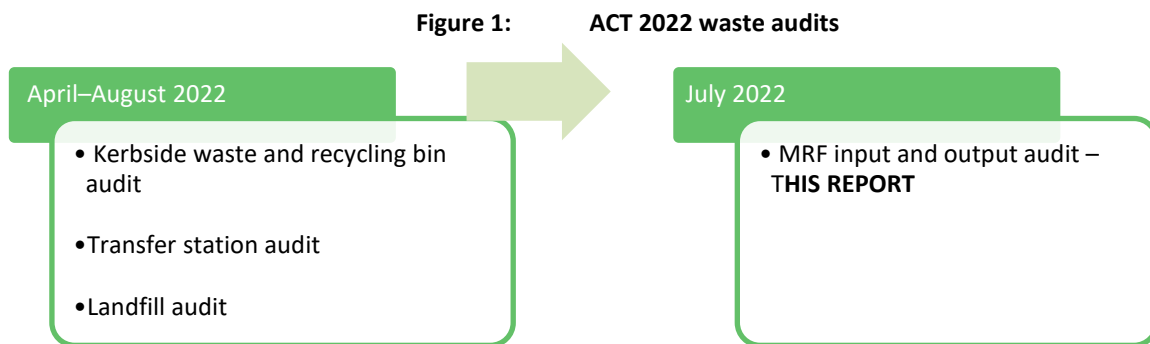


## 1 INTRODUCTION

ACT NoWaste conducted a series of kerbside waste audits during 2001, 2003, 2004, 2005, 2009, 2011, 2014 and 2022 as well as residual material audits at the Hume Material Recovery Facility (MRF) during 2005, 2006, 2007, 2009 and 2014. A.Prince Consulting (APC) has conducted eight of the nine previous kerbside audits and all six prior MRF audits.

ACT is to be congratulated for investing in this time-series data, as it provides a rich and valuable data resource for informed and fit-for-purpose decision-making on future policy. Time-series audits also provide an opportunity to undertake longitudinal data analysis to study past decisions and help predict future trends.

ACT NoWaste has engaged APC to conduct a series of audits in 2022, including domestic kerbside waste and recycling bins, the Hume MRF and landfill and transfer stations to understand waste flows within the ACT and gather data to inform future business and investment decisions as well as public policy. The range of audits being conducted in 2022 and timings of each are detailed below:



This report contains the results of the audit of inputs and outputs at the Hume MRF conducted in July 2022. It contains information about the composition of various incoming and outgoing material streams, including the amount and type of contamination. This is the first time an audit has included feedstock (or inputs) as well as outputs of material ready for market. All previous audits included an audit of the residuals stream only and it was not clear which loads were contributing to the contamination.

The Hume MRF is owned by the ACT government and is operated by Re.Group. The MRF receives and processes both kerbside and commercial commingled materials from the ACT and a number of regional NSW councils, as well as ACT public-place recycling bins and eligible used beverage containers through the Container Deposit Scheme (CDS), both from the ACT and NSW.

In August 2022 it was announced that a new MRF will be built at Hume, adjacent to the existing MRF, with co-investment from the federal and ACT governments of \$23 million through the Australian Government’s Recycling Modernisation Fund.<sup>1</sup>

<sup>1</sup> [https://www.cmtedd.act.gov.au/open\\_government/inform/act\\_government\\_media\\_releases/chris-steel-mla-media-releases/2022/powering-a-circular-economy-for-the-act-and-surrounds](https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/chris-steel-mla-media-releases/2022/powering-a-circular-economy-for-the-act-and-surrounds)



## 2 METHOD

### 2.1 Project inception meeting

APC held a project inception meeting with Re.Group operational staff and the ACT government to discuss all aspects of the project including timing and logistics. Due to space constraints within the MRF building and concerns about staff safety, a marquee was set up outside the MRF with all weighing equipment, tables, tarps and bins provided by APC.



Image 1: Marquee set up at MRF for APC

### 2.2 Incoming and outgoing material at the MRF

The MRF receives materials from the following sources:

- ACT CDS (arrive in clean bulka bags)
- NSW CDS
- NSW councils
- Commercial (cardboard and commingled)
- RDOC (recycling drop-off centre); and
- ACT government vehicles (public-place recycling bins)
- ACT government vehicles (kerbside bins).



Image 2: Incoming kerbside loads depositing comingled recyclables at the feedstock hall

Material arriving at the facility is placed in separate receive bays, dependent on whether it is general recyclables or CDS material. Each bay feeds a separate set of conveyors for processing. As the material moves through the conveyor belts, staff manually remove oversize materials that may potentially cause blockages or mechanical issues through the mechanical sorting facility.



**Image 3: Handpicking oversize, long, stringy or bagged material at the pre-sort station**

This problematic material is picked out and placed into the following two bins:

- a) Metal oversize bin (3 m<sup>3</sup> skip bin)
- b) Residual oversize bin (3 m<sup>3</sup> skip bin).



**Image 4: Metal oversize bin contents**



**Image 5: Residual oversize bin**



The material is then sorted into the specific material types that constitute the outputs from the MRF, being:

1. PET – Clear and coloured
2. HDPE – natural, coloured
3. Mixed plastics
4. Glass
5. Aluminium
6. Steel
7. Paper/cardboard/liquid paperboard
8. Residual.

Items 1–7 are sold as commodities. Any material not recovered or is considered contamination is compacted and sent to landfill. For this project, APC audited all streams of the input material as well as all the output material.

**Table 1: Incoming material streams for the Hume MRF**

Allocation	Collected from	Source	How does it enter the MRF?
<b>ACT CDS</b>	Canberra return-it depots	CDS material refers to material collected through the ACT Container Deposit Scheme whereby people hand-sort their material and bring it to depots where they receive a 10c refund. This material is largely clean and is run through the MRF at a separate time.	Material arrives at the MRF in bulka bags. All CDS material goes into a separate CDS material bunker at the MRF and is put through the MRF separately to make sure it does not mix in with the kerbside recycling material.
<b>NSW CDS</b>	Bega Queanbeyan Yass Goulburn	In NSW, the CDS material is returned via reverse vending machines. The reverse vending machines are emptied onto the trucks and the material is delivered to the MRF.	All CDS material goes into a separate CDS material bunker at the MRF and is put through the MRF separately to make sure it does not mix in with the kerbside recycling material.
<b>NSW councils</b>	Bega Queanbeyan Yass Goulburn Snowy Mountains	All councils in NSW provide households with a two- or three-bin system. A yellow-lid 240 L bin is provided for all recyclable material. These bins have commingled materials in them and therefore some contamination is expected. Councils engage contractors to pick up these bins and bring them to the MRF.	Trucks/skips place the material in the incoming bunker, where it is loaded onto the conveyor belt for sorting
<b>Commercial</b>		Commercial premises usually have a commingled recycling bin that is picked up by a contractor paid for by the business.	Trucks/skips place the material in the incoming bunker, where it is loaded onto the conveyor belt for sorting.
<b>RDOC</b>		ACT provides free drop-off services to commercial premises. The community can drop off their cardboard for free. This service is provided by Remondis.	Trucks/skips place the material in the incoming bunker, where it is loaded onto the conveyor belt for sorting.
<b>Public-place recycling</b>	All of ACT	All areas of Canberra (or the Australian Capital Territory) where there are bins provided in public places. These bins are sometimes in a 'matched pair' – garbage and recycling. The ACT government in-house staff service these bins.	Trucks/skips place the material in the incoming bunker, where it is loaded onto the conveyor belt for sorting.

The MRF outputs sampled are described below:

**Table 2: Outgoing material streams for the Hume MRF**

OUTPUTS (Product)	Description
PET – clear/coloured	Material sorted by the MRF into specific commodities. Material is sampled from the line after the last QA point and prior to baling.
HDPE – natural/coloured	
Mixed plastics	
Aluminium	
Steel	
Paper/cardboard/LPB	
Output – Oversize metal	Oversize material and metal picked out by staff at the pick station as being unsuitable/dangerous to proceed through to the sorting process
Output – Residual	Material that goes through the entire sorting process but cannot be sorted into existing output product categories. This material is compacted and sent to landfill.
Output – Oversize bin	Material that was oversize and picked out by the staff at the front end of the sorting belt as being unsuitable/dangerous to proceed through sorting process.



**Image 6: Oversize metal bin**

### 2.3 Sample size and selection

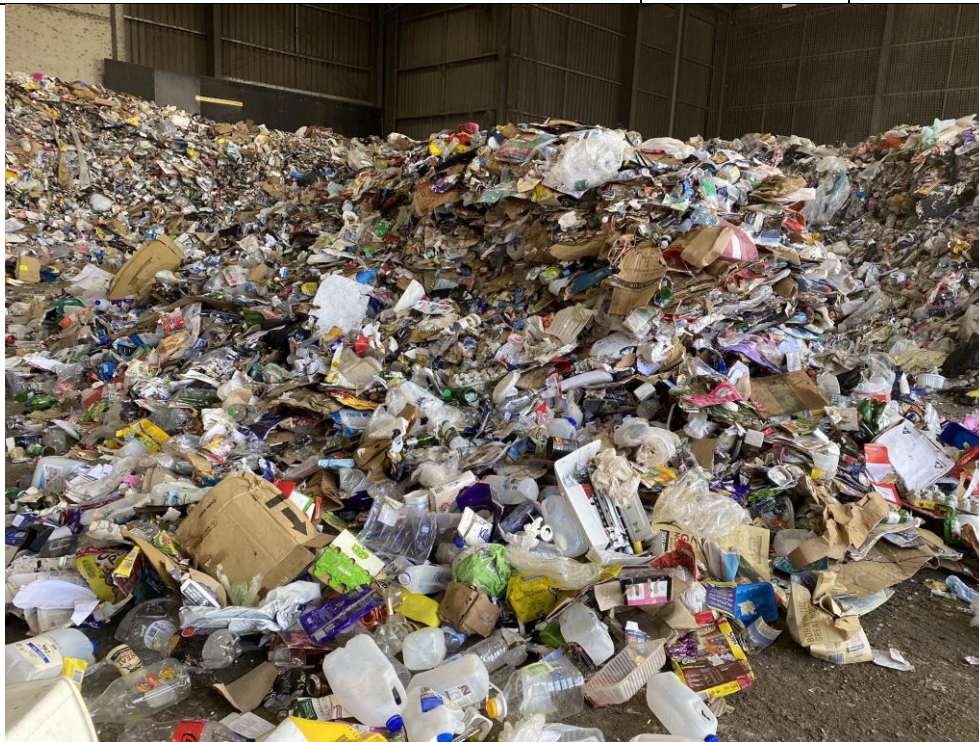
The audit sampling was undertaken over two weeks, Monday to Friday from the 2 May to 13 May 2022. The sampling plan was designed to take as many samples as possible across the input and output streams within the available time. Based on the total quantities of material received from each source, the audit team was given a sample size target of 37 incoming loads and 54 outputs, comprising 20 residual loads and 34 commodity samples. This provided a total sample size of 91 samples.

Each sample was required to be a minimum of 2 m<sup>3</sup>. On the first two days, however, the initial samples extracted by the front-end loader bucket were approximately 3 m<sup>3</sup> to 4 m<sup>3</sup> each. The number of samples audited was reduced, due to the size of these initial samples, constraints around when the vehicles arrived at the MRF and the time taken to sort the samples. In total, 32 incoming, 9 residuals and 34 commodity samples were audited (75 samples), as detailed in the Table 3 below.

No loads of kerbside recycling or CDS from Goulburn arrived during the audit period.

**Table 3: Input samples requested and samples collected**

<b>INPUT AUDITS</b>			
	<b>Collected from</b>	<b>Sample requested</b>	<b>Samples achieved</b>
ACT CDS	Canberra return-it depots	5	4
NSW CDS	Bega	2	2
	Queanbeyan	3	2
	Yass	1	1
NSW council	Bega	1	1
	Queanbeyan	4	4
	Yass	1	1
	Snowy Mountains	2	2
Commercial	ACT Commercial – JJ Richards	1	1
	ACT Commercial – Cleanaway	2	0
	ACT Commercial – Suez	3	4
	ACT Commercial – Remondis	1	1
RDOC	Cardboard drop-off	6	6
Public-place recycling	All of ACT	5	3
<b>Sub-total</b>		<b>37</b>	<b>32</b>

**Image 7: Comingled recycling receive area****Table 4: Output samples requested and samples collected**

<b>OUTPUTS (residual)</b>			
Residual	Compactor	10	5
Oversize	Metal – oversize	5	2
	Residual – oversize	5	2
<b>Sub-total</b>		<b>20</b>	<b>9</b>
<b>OUTPUTS (sorted)</b>			

PET – clear	Conveyor belt	5	5
PET – coloured	Conveyor belt	3	3
HDPE – natural	Conveyor belt	5	5
HDPE – coloured	Conveyor belt	5	5
Mixed plastics	Conveyor belt	5	5
Aluminium	Conveyor belt	5	5
Steel	Conveyor belt	3	3
Paper/cardboard/LPB	Conveyor belt	3	3
<b>Sub-total</b>		<b>34</b>	<b>34</b>
<b>Total</b>		<b>91</b>	<b>75</b>

## 2.4 Sample collection

APC worked with the Re.Group staff and management in an effort to minimise any interference with the normal operation of the MRF. We thank all staff for their support and co-operation. A list of registration numbers was gained for each separate source of inbound material. These vehicles were randomly intercepted for sampling over the course of the audit in accordance with the sample number.

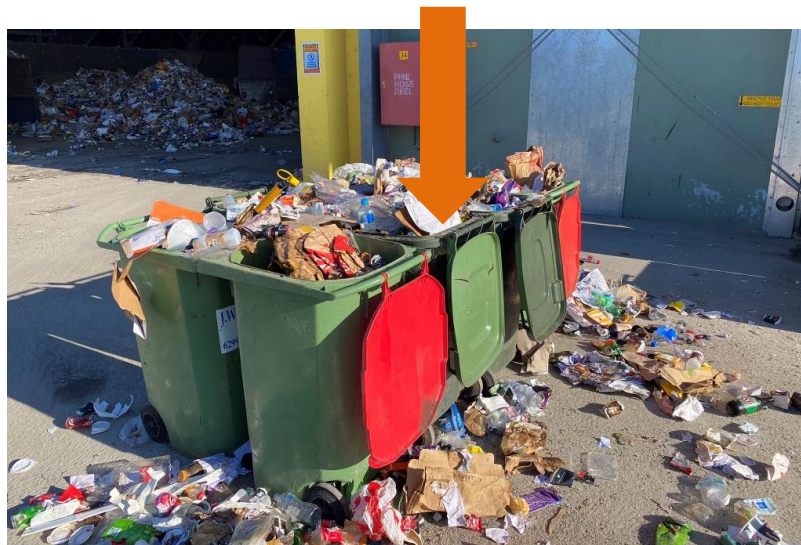
Residuals were intercepted by Re.Group using a skip bin at the discharge point to capture the waste prior to the material entering the stationary compactor. Oversize bins from the pre-sort area were directed to the audit team for auditing. Output samples were taken after the last QA point and prior to baling and subsequently collected in bulk bags.

### 2.4.1 Incoming material collection

After the truck emptied the material onto the receival hall, a front-end loader bucket was used to scoop up a representative sample. Samples were emptied into eight 240 litre bins (see Image 8). The material captured in the bins was considered the sample to be sorted for that input material. The MGBs were then moved to the sorting area and any overflow material on the ground was cleared.

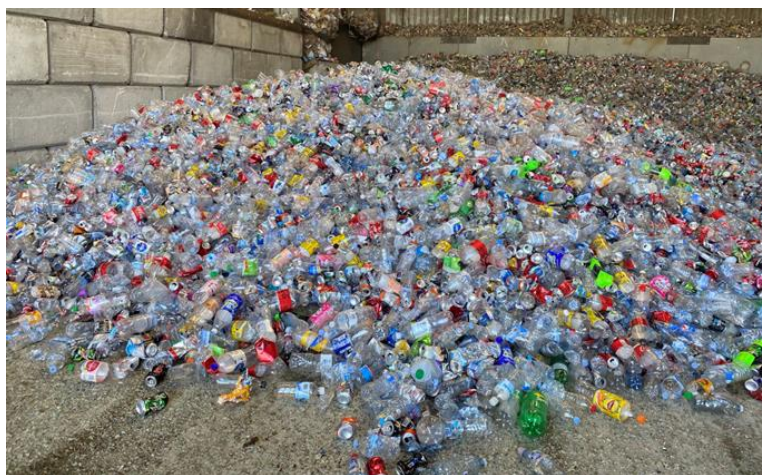
Sampling for all commingled samples from ACT and NSW kerbside, commercial and public-place recycling were collected in this manner.





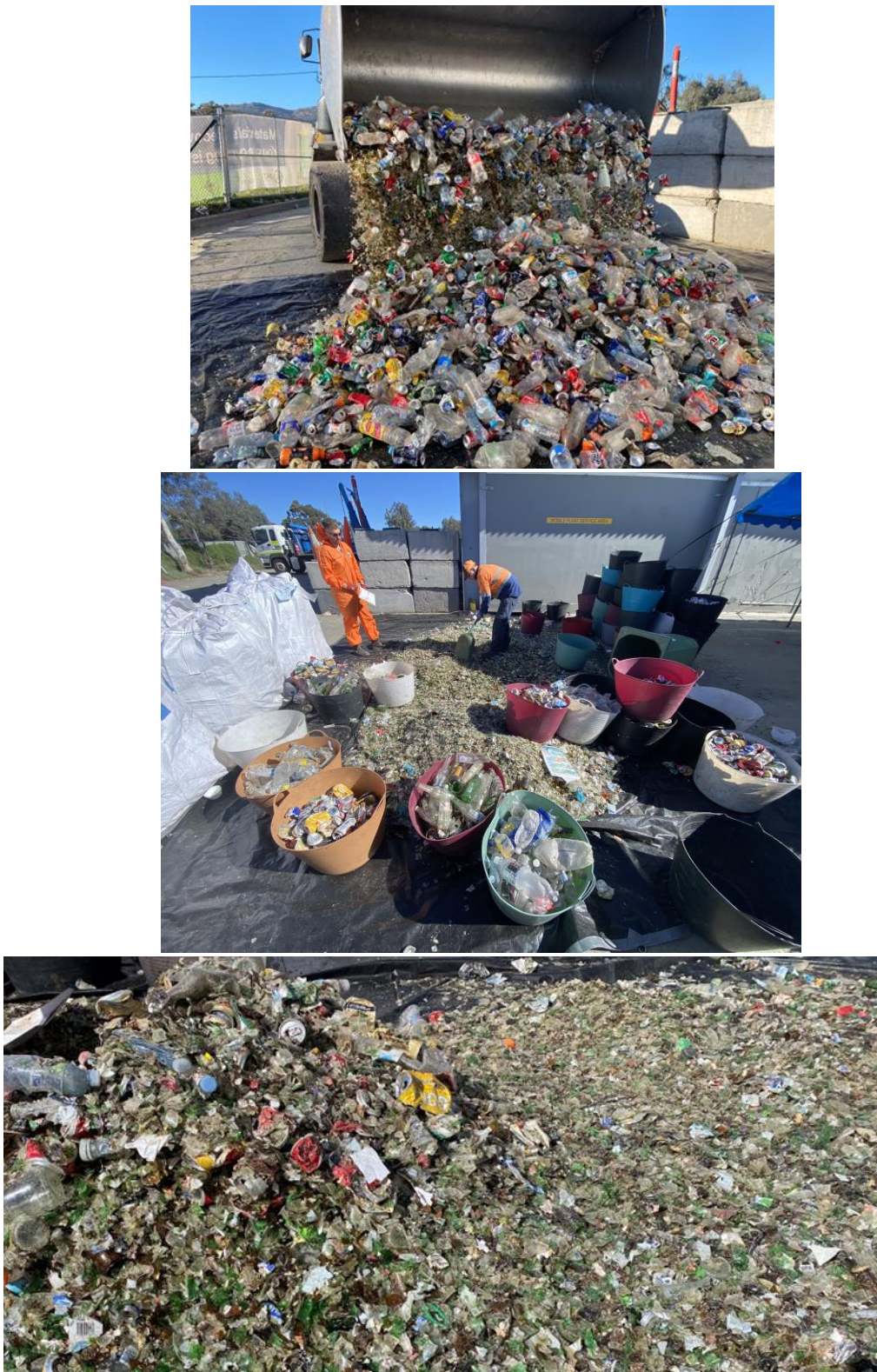
**Image 8: Sampling of incoming commingled material**

Eligible used beverage containers collected as part of the ACT and NSW CDSs are processed separately at the MRF. The ACT material arrives in bulka bags separated by material type. APC intercepted these bags for auditing. The NSW material arrives in trucks, separated as 'light' (plastics and aluminium) and 'heavy' (glass). Sampling for the NSW CDS was taken directly from the trucks and moved to sort area.



**Image 9: CDS NSW material as delivered**





**Image 10: Sorting NSW CDS loads and with glass fines**

A front-end loader bucket was used to convey cardboard samples to the sort site. Most cardboard was too large to fit in the MGBs bins.





Image 11: Sampling of cardboard loads

#### 2.4.2 Oversize and residual material collection

Oversized materials were delivered directly to a scrap metal bulk bin which was tipped at the marquee for sorting. The entire contents of the bin formed the sample.



Image 12: Oversize bulk bins delivered and emptied for auditing

Residual material is discharged from the plant via a conveyor belt into a compactor bin located outside to the building. Residual waste spilled from the compactor as the compactor bin was removed and this formed the samples. These samples were transferred by front-end loader to the sorting area.

### 2.4.3 Output material collection

Output material was collected at the end of the conveyor belt using a bulka bag slung under a hopper on a metal frame after the last waste quality assurance (WQA) point and before entering the baling chamber. When requested to collect a sample, the MRF staff were able to redirect the material from the output belt to the hopper instead of the baler. APC staff placed a bulka bag under the hopper and allowed material to fall into the bulka bag until it was full to constitute a sample of each type of output material produced by the MRF.



Image 13: Bulka bag used to collect sorted sample material through the hopper

## 2.5 Incoming and outgoing material sorting

Sorting categories were developed in conjunction with ACT NoWaste based on the previous audits. The sorting categories for inputs and outputs varied as the types of contaminants differed. All material was sorted into the relevant categories by source using the data sheets in **Appendix A** and to the definitions provided in **Appendix B**.

After the initial sort, all containers were sub-sorted to determine if they were eligible for the ACT CDS scheme. Three different types of plastic bags were also separated, as per below:

- 1 High-density (branded) shopping bags
- 2 Plastic bags – low-density barrier bags
- 3 Lightweight single-use shopping bags.

A sub-sort was also conducted on the residual, oversize bins to help identify hazardous or problematic items, as discussed below in section 2.6.

A new category called 'residual fines' was created for the residual audit, as the mix of contamination was light, fluffy material with dirt, glass sand and small pieces of paper, making a further sorting stage impossible.





**Image 14:: Residual fines – light, fluffy material with small quantities of dirt and glass sand**

**2.6 Problematic contaminants**

ACT NoWaste identified a number of problematic contaminants within the recycling process. Each of these is summarised in the Table 4 below and accompanied by an explanation of APC’s approach to sorting.

**Table 5: Problematic contaminants**

Issues	APC action
Long stringy items likely to affect machinery	Visual item count, recording by weight and photographs of separated items
Presence of electrical and compound items	
Large plastic items with potential to cause breakdowns	
Presence of large and heavy items	
Items in plastic bags	Store separately, weigh and then sort at the end of the main sort into the agreed categories



**Long and stingy**

**Image 15:**



**Heavy – 65 kgs block of concrete found Supplementnary sorts**

## 2.7 Analysis

Table 6 below outlines the classification of materials found during the analysis phase of the project.

**Table 6: Classification of material**

Material	Category	Sub-category
Paper/cardboard	Recyclable	Recyclable paper
Liquid paperboard	Recyclable	Recyclable paper
Glass fines (<50 mm diameter)	Recyclable	Glass fines
Glass containers	Recyclable	Recyclable glass containers
Aluminium	Recyclable	Recyclable metal containers
Steel	Recyclable	Recyclable metal containers
PET clear	Recyclable	Recyclable plastic containers
HDPE semi-opaque	Recyclable	Recyclable plastic containers
Mixed plastic containers	Recyclable	Recyclable plastic containers
Film plastics	Contamination	Contamination
Electrical appliances	Contamination	Contamination
Food and kitchen waste	Contamination	Contamination
Green waste and timber	Contamination	Contamination
Other glass and crockery	Contamination	Contamination
Nappies	Contamination	Contamination
Expanded polystyrene	Contamination	Contamination
Textiles	Contamination	Contamination
Hazardous	Contamination	Contamination
Automotive parts	Contamination	Contamination
Other miscellaneous	Contamination	Contamination
Containerised food and liquid	Contamination	Contamination
Bagged recycling	Contamination	Contamination
Bagged garbage	Contamination	Contamination
Plastic bags – low-density barrier bags	Contamination	Contamination
Plastic bags – lightweight single-use shopping bags	Contamination	Contamination
Long items	Contamination	Contamination
Large heavy items	Contamination	Contamination
Large plastic items	Contamination	Contamination

## 2.8 Study limitations

The data for this study was collected and analysed using the best and most accurate methods available within the constraints of available time and budget. This study is a survey, which means that a relatively small amount of data has been collected and then treated as representative of the total. As in any survey, there are limitations to the accuracy of the data, as described below.

### Time frame

- These audits were carried out over ten sample collection days. The data was then used as being representative of the whole MRF.
- Seasonal trends (e.g. warmer weather leading to increased consumption of beverages, e.g. Easter, Christmas) and weather events (e.g. heatwaves) may change waste generation over time.
- The results of this audit should be treated with caution when comparing the results with reports based on data taken at different times of year.

### Representative sample

- The sample for this audit is necessarily small due to the high per-capita cost and resource-intensive nature of waste auditing.
- There is always a small probability of inadvertently collecting waste from atypical households, resulting in non-representative data.
- APC undertook the entire sample from one locality using random sampling, but not stratified by geographic area.

### Sample size limitations

- All surveys carry an element of sampling error, which is the mathematical error associated with using a sample to represent a total population.
- Sampling error can be reduced by taking larger samples. The sampling error involved in waste audits is usually small and can be tabulated by producing estimates augmented by upper and lower confidence intervals.

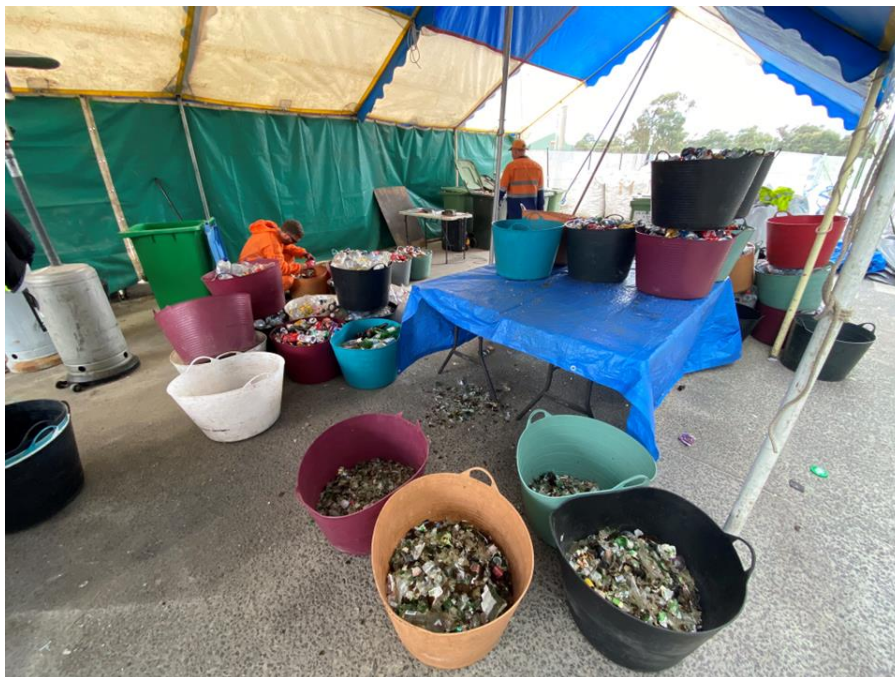


Image 16: Sorting samples in the marquee



### 3 RESULTS – INCOMING MATERIAL COMPOSITION

#### 3.1 Material sorted

The audit included a physical sort of 6,878 kilograms of material, including 3,790 kilograms of input material, 989 kilograms of residual material (including oversize bins) and 2,099 kilograms of output material sampled over ten days.

Table 7 below shows the incoming material over the course of the two-week audit. The ACT kerbside material is the major source of feedstock, at 53%, followed by NSW kerbside at 18%, ACT CDS at 7%, commercial commingled and NSW CDs both at 6% and commercial cardboard at 3%.

**Table 7: Hume MRF indicative feedstock sources, 2022\***

Source	Week 1		Week 2		Total weighbridge	Total per cent
	Weighbridge	Per cent	Weighbridge	Per cent		
ACT CDS	115.149	10%	52.369	5%	167.518	7%
ACT kerbside commingled	599.31	52%	588.06	53%	1187.37	53%
ACT public place	2.76	0%	2.2	0%	4.96	0%
Commercial cardboard	32.44	3%	32.48	3%	64.92	3%
Commercial commingled	66.3	6%	61.41	6%	127.71	6%
NSW CDS	81.62	7%	61.94	6%	143.56	6%
NSW kerbside commingled	181.16	16%	236.88	21%	418.04	18%
RDOC	67.82	6%	79.1	7%	146.92	6%
<b>Total</b>	<b>1146.559</b>	<b>100%</b>	<b>1114.439</b>	<b>100%</b>	<b>2260.998</b>	<b>100%</b>

No auditing of the kerbside-delivered loads occurred because data was sourced from the detailed kerbside audit of 700 ACT household recycling bins. The results of this audit are contained in a separate report.



**Image 17: Counting CDS eligible containers**



### 3.2 Contamination in incoming materials

All incoming materials were sorted into recyclables as defined by the MRF outputs for PET, HDPE, aluminium, steel, paper/cardboard/liquid paperboard and glass. Any non-recyclable material was deemed contamination. Table 8 below summarises the proportion of recyclable material and contamination by input stream based on the audit.

**Table 8: Contamination by input stream**

Source	Recyclables Weight (kg)	Contamination Weight (kg)	Total weight (kg)	Recyclables %	Contamination %
ACT CDS	230.2	0.12	230.3	99.9%	0.05%
NSW CDS	604.8	1.68	606.5	99.7%	0.28%
ACT kerbside	Based on ACT kerbside audit			85.9%	14%
NSW kerbside	634.6	101.66	736.2	86.2%	13.81%
RDOC	1,107.2	21.7	1,128.8	98.1%	1.92%
ACT commercial	784.4	70.74	855.1	91.7%	8.27%
ACT public place	283.3	180.78	464.1	61.0%	38.95%
<b>Total</b>	<b>3,644.5</b>	<b>376.7</b>	<b>4,021.2</b>		

The percentage contamination found in each of the material streams was applied to the total incoming material into the MRF for the two-week audit period. The total contamination in the material received at the MRF was 12.16% during the audit. The overall analysis indicates that the public-place bins are the most heavily contaminated, at 39%, followed by both NSW and ACT kerbside (14%), commercial loads (8%) and RDOC (2%).

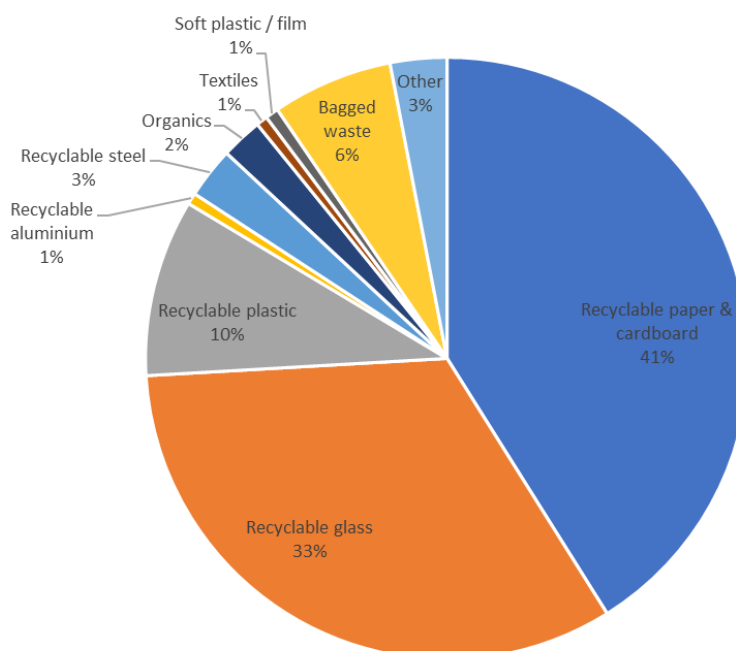
**Table 9: Contamination in the material coming into the MRF**

Allocation	Total weighbridge	Recyclable (tonnes)	Contamination (tonnes)	Contamination %
ACT CDS	167.518	167	0	0%
ACT kerbside commingled	1187.37	1021	166	14%
ACT public place	4.96	3	2	40%
Commercial cardboard	64.92	60	5	8%
Commercial commingled	127.71	117	11	9%
NSW CDS	143.56	143	0	0%
NSW kerbside commingled	418.04	360	58	14%
RDOC	146.92	144	3	2%
<b>Total</b>	<b>2260.998</b>	<b>2016</b>	<b>245</b>	<b>12.16%</b>

### 3.3 ACT kerbside composition

The ACT kerbside stream was audited directly from the kerbside bins as part of the kerbside bin audit. The data is relevant as this feedstock represents 53% of all deliveries. We assume the NSW kerbside loads are of similar composition and they represent 18% of feedstock to the MRF. The kerbside audit of the recycling stream for all 714 households (350 single dwellings and 364 multi-unit dwellings) shows that the largest proportion of the recycling stream is recyclable paper and cardboard (41%) and recyclable containers (45.3%), comprising glass (33%), plastic (10%), steel (3%) and aluminium (1%). Contamination, including bagged waste, is 14%.

**Figure 2: Composition of the ACT kerbside recycling stream**



**Table 10: Composition of the ACT recycling stream, all households (kg/household/week)**

Category	SDs		MUDs		Total waste stream	
	kg/week	%	kg/week	%	kg/week	%
Recyclable paper & cardboard	1.44	42.8%	0.67	36.6%	1.05	40.6%
Recyclable glass	1.15	34.2%	0.55	29.8%	0.84	32.6%
Recyclable plastic	0.34	10.0%	0.15	8.4%	0.24	9.4%
Recyclable aluminium	0.02	0.5%	0.01	0.7%	0.02	0.6%
Recyclable steel	0.09	2.7%	0.05	2.7%	0.07	2.7%
Other non-recyclable metals	0.01	0.3%	0.01	0.3%	0.01	0.3%
Organics	0.06	1.7%	0.06	3.2%	0.06	2.2%
Textiles	0.02	0.6%	0.01	0.6%	0.02	0.6%
Soft plastic/film	0.02	0.7%	0.01	0.6%	0.02	0.7%
E-waste	0.00	0.1%	0.00	0.1%	0.00	0.1%
Single use plastics	0.00	0.0%	0.00	0.0%	0.00	0.0%
Non-recyclable plastic	0.01	0.2%	0.00	0.2%	0.01	0.2%
Hazardous/problematic	0.00	0.0%	0.00	0.0%	0.00	0.0%
Building waste, inert	0.01	0.4%	0.01	0.5%	0.01	0.5%
Nappies	0.00	0.0%	0.00	0.0%	0.00	0.0%
Bagged waste	0.14	4.1%	0.19	10.6%	0.17	6.4%
Other	0.05	1.5%	0.10	5.6%	0.08	3.0%
<b>Total</b>	<b>3.35</b>	<b>100.0%</b>	<b>1.83</b>	<b>100.0%</b>	<b>2.58</b>	<b>100.0%</b>

### 3.4 NSW kerbside composition

Eight 3m<sup>3</sup> samples were taken from five NSW councils that deliver their kerbside recyclables to the MRF for processing. The average contamination in these kerbside loads was also 14%, the same as for the ACT deliveries.

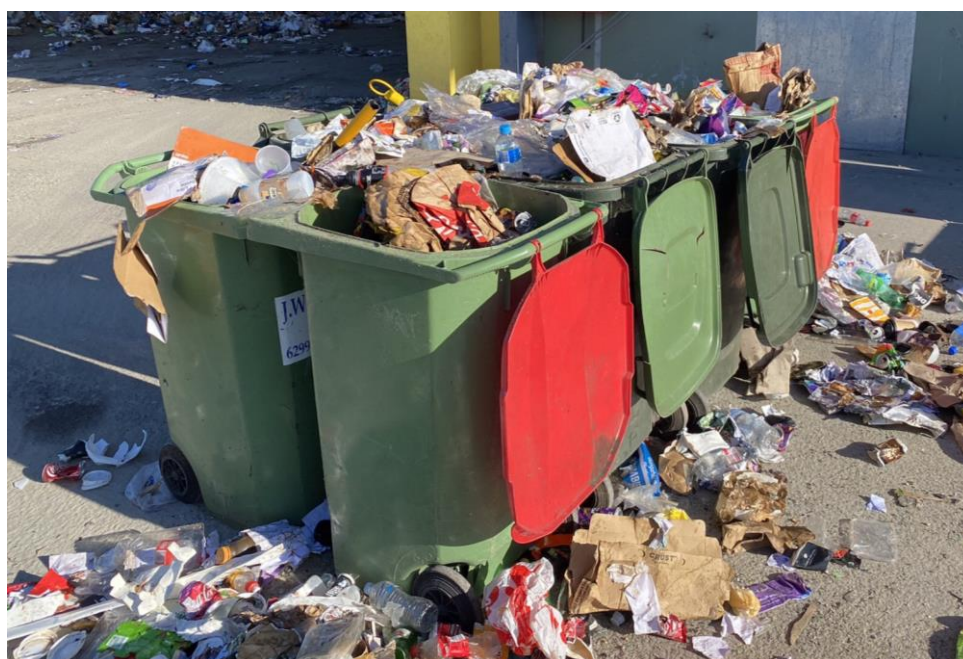
**Table 11: NSW kerbside composition**

Material class	Weight (kg)	Per cent	Volume (L)	Volume %
Recyclables	634.56	86.2%	10,158	88.2%
Contamination	101.66	13.8%	1,367	11.8%
<b>Total</b>	<b>736.22</b>	<b>100%</b>	<b>11,526</b>	<b>100%</b>

The composition of NSW kerbside differs from ACT, with paper/cardboard being substantially higher, at 60%, when compared with ACT (41%). In NSW glass is lower, at 21%, compared with ACT (33%); in NSW plastics is 13.3% (compared with ACT at 9.4%); in NSW steel is 3.8% (compared with ACT at 2.7%) and aluminium is 0.6% in both NSW and ACT.

**Table 12: Detailed composition of recyclables in NSW kerbside**

Material	Weight (kg)	Per cent
Paper	381.82	60.2%
Glass	135.7	21.4%
PET clear	25.32	4.0%
HDPE natural	24.76	3.9%
HDPE coloured	8.76	1.4%
Mixed plastics	26.5	4.2%
Aluminium	3.94	0.6%
Steel	24.18	3.8%
LPB	3.58	0.6%
<b>Total</b>	<b>634.56</b>	<b>100.0%</b>



**Image 18: NSW kerbside material sample**

**3.5 ACT and NSW CDS**

APC audited bulk bags from ACT and truckloads of ‘light’ (plastics and aluminium) and ‘heavy’ (glass) items, a combined 836 kg of CDS material, comprising 239 kg from ACT and 606 kg from NSW. Combined, the samples contained 22,224 containers. ACT CDS containers by weight contained negligible contamination (0.05%) and NSW CDS 0.28%. By volume, ACT contamination was 0.01% and NSW 0.28%.

**Table 13: Contamination in the CDS input streams**

ACT CDS						
Material class	Weight (kg)	Weight (%)	Volume (L)	Volume %	Count	Count %
Recyclables	230.15	99.95%	8338.5	99.99%	10,150	100%
Contamination	0.12	0.05%	1	0.01%	0	0%
<b>Total</b>	<b>230.27</b>	<b>100%</b>	<b>8339.5</b>	<b>100%</b>	<b>10,150</b>	<b>100.00%</b>
NSW CDS						
Material class	Weight (kg)	Per cent	Volume (L)	Volume %	Count	Count %
Recyclables	604.82	99.72%	7979.2	99.81%	15,074	100%
Contamination	1.68	0.28%	15.5	0.19%	0	0%
<b>Total</b>	<b>606.5</b>	<b>100%</b>	<b>7994.7</b>	<b>100%</b>	<b>15074</b>	<b>100%</b>



**Aluminium cans**



**Glass containers**



**PET**



**Coloured PET**

**Image 19: Examples of sorted CDS material**



### 3.6 Recycling drop-off centre composition

The RDOC material within this audit represents the free public and commercial drop-off available at the two transfer stations in the ACT as well as 5 other sites throughout Canberra within the Paper and Cardboard cages or containers at each site. By weight, RDOC samples contained 2.3% contamination, of which polystyrene comprised 0.5%. By volume, the contamination was 4.1% of which polystyrene was 1.4%.

**Table 14: Composition of RDOC material**

Sample sort	Wt	Per Cent	Vol	Per Cent
Cardboard	774.4	68.6%	15700	86.0%
Paper/Magazine/Book	327.6	29.0%	1805	9.9%
Polystyrene (EPS)	5.18	0.5%	261	1.4%
Other - contamination	21.7	1.9%	490	2.7%
<b>Total</b>	<b>1128.88</b>	<b>100.0%</b>	<b>18256</b>	<b>100.0%</b>



**Image 20: Styrofoam (EPS) contamination in the RDOC sample**

### 3.7 ACT commercial composition

Commercial material in the ACT comes into the MRF as cardboard as well as commingled material from commercial collections. Audit data indicates that by weight, 92% of the commercial commingled loads are recyclables and 8% is contamination.

**Table 15: Contamination in commercial loads**

Material class	Weight (kg)	Per cent	Volume (L)	Volume %
Recyclables	784.42	91.73%	14,103	94.63%
Contamination	70.74	8.27%	800	5.37%
<b>Total</b>	<b>855.16</b>	<b>100%</b>	<b>14,903</b>	<b>100%</b>

Of the recyclable material audited in the commercial loads, 73% is paper and cardboard and 23% is glass. Other recyclables comprise 4%, with PET (1%), steel (0.88%), HDPE (0.86%), aluminium (0.65%) and mixed plastics (0.41%).

**Table 16: Details of recyclables in commercial loads**

Material	Weight (kg)	Per cent
Paper	569.62	72.62%
Glass	182.44	23.26%
PET clear	8.16	1.04%
HDPE natural	6.38	0.81%
HDPE coloured	0.36	0.05%
Mixed plastics	3.2	0.41%
Aluminium	5.06	0.65%
Steel	6.9	0.88%
LPB	2.3	0.29%
<b>Total</b>	<b>784.42</b>	<b>100%</b>

### 3.8 ACT public-place bin composition

The ACT public-place bins are serviced by ACT government vehicles, which deliver the loads to the MRF for processing at intermittent intervals. The contamination in the public-place bins is high, at 39%. Interestingly, most of the recyclables in the public-place bins are paper and glass, which is similar to the kerbside bins.

**Table 17: Contamination in the ACT public-place commingled loads**

Material class	Weight (kg)	Per cent	Volume	Per cent
Recyclables	283.34	61%	3260	58.5%
Contamination	180.78	39%	2310	41.5%
<b>Total</b>	<b>464.12</b>	<b>100%</b>	<b>5570</b>	<b>100.0%</b>

Of the recyclable material audited in the public-place bins, the main components are paper and cardboard (49%), glass (37%), PET (6.3%), mixed plastics (3.6%), aluminium (2.3%).

**Table 18: Recyclables in the ACT public-place commingled loads**

Material	Weight (kg)	Per cent
Paper	138.82	48.99%
Glass	104.18	36.77%
PET clear	17.94	6.33%
HDPE natural	2.36	0.83%
HDPE coloured	0.34	0.12%
Mixed plastics	10.2	3.60%
Aluminium	6.44	2.27%
Steel	1.52	0.54%
LPB	1.54	0.54%
<b>Total</b>	<b>283.34</b>	<b>100%</b>

#### 4 RESULTS – OUTBOUND MATERIAL COMPOSITION

Based on the weighbridge weights, overall a total of 2,418 tonnes of material left the MRF during the 10 days of the audit. Of this, 88% was recyclables and 12.4% was residuals. An audit of the outbound residuals reveals that 27% of this material is actually recyclable in nature. Of the outbound recyclables audited, only 1% represents contaminants.

**Table 19: Summary of outbound material from the Hume MRF**

Overall outbound	Outbound weighbridge (tonnes)	Outbound per cent	Recyclables in residual	Contamination in recyclables
Outbound residuals	299.76	12.4%	27%	
Outbound recyclables	2118.34	87.6%		1.04%
<b>Total</b>	<b>2418.1</b>	<b>100%</b>	27%	1.04%

##### 4.1 Outbound residual material

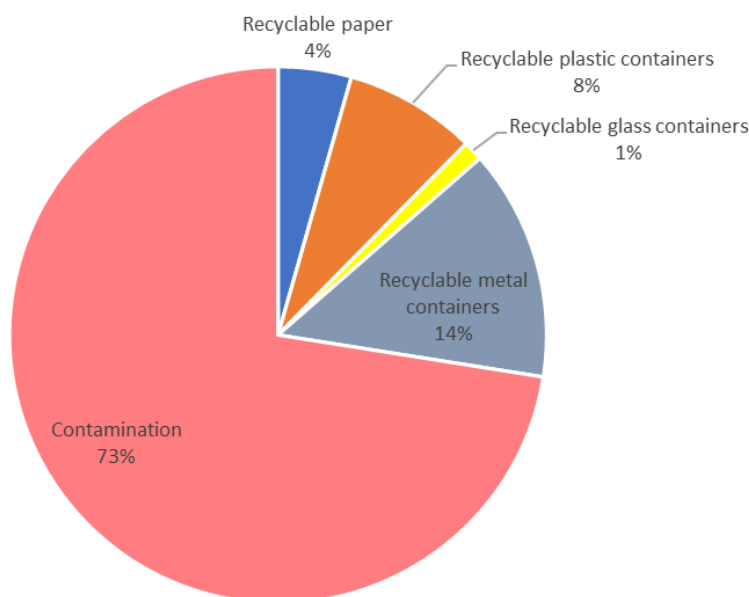
The recyclables that are not recovered during the MRF process are discharged into a stationary compactor and the compacted material delivered to landfill for disposal. Large or oversize materials are also collected at the beginning of the sorting process by staff in the pick line and placed into oversize bins. There are two oversize bins at the Hume MRF: one for metals and the other for miscellaneous materials. These bulk bins are cleared at the end of each MRF shift. APC staff audited all of these residual bins, as follows:

- Residual compactor
- Metal oversize bin
- Non-metal oversize bin.

The detailed composition of the material in these bins is discussed below.

##### 4.1.1 Residual compactor material

Five 2m<sup>3</sup> samples were taken from the residual compactor material over the course of the audit. Recyclable materials that were not recovered through the process account for 30% of the overall material found in the residual compactor.



**Figure 3: Composition of residual compactor material**



The information in the Figure 3 above is presented in the Table 19 below.

**Table 20: Composition of residual compactor loads**

Material category	Total amount (kg)	Per cent
Recyclable paper	47.1	4%
Recyclable plastic containers	85.16	8%
Recyclable glass containers	12.76	1%
Recyclable metal containers	149.24	14%
Contamination	775.72	72%
<b>Total material collected</b>	<b>1,069.98</b>	<b>100%</b>

The detailed composition of the residual loads and their proportion of the entire load is provided below.

**Table 21: Composition of residual compactor loads**

Material	Allocation	Total	Per cent
Mixed clean paper including cardboard	Recyclable paper	27.8	2.60%
Liquid paperboard	Recyclable containers	4.6	0.43%
Glass fines (under 50mm)	Glass fines	0	0.00%
Glass containers	Recyclable glass containers	12.76	1.19%
Aluminium	Recyclable metal containers	127.36	11.90%
Steel	Recyclable metal containers	21.88	2.04%
PET	Recyclable plastic containers	31.68	2.96%
HDPE	Recyclable plastic containers	17.32	1.62%
Mixed plastic containers	Recyclable plastic containers	35.1	3.28%
Electrical appliances	Contamination	15.86	1.48%
High-density (branded) shopping bags	Contamination	5.94	0.56%
Plastic bags – low-density barrier bags	Contamination	0.74	0.07%
Lightweight single-use shopping bags	Contamination	1.06	0.10%
Film plastics	Contamination	22.6	2.11%
Green waste and timber	Contamination	9.38	0.88%
Non-recyclable glass and crockery	Contamination	0.32	0.03%
Hazardous	Contamination	0.04	0.00%
Nappies	Contamination	6.96	0.65%
Expanded polystyrene	Contamination	2.14	0.20%
Textiles	Contamination	38.14	3.56%
Food and kitchen waste	Contamination	4.44	0.41%
Automotive	Contamination	0	0.00%
Residual fines	Contamination	579.9	54.20%
Mixed disposable paper	Recyclable paper	14.7	1.37%
Other plastics	Contamination	8.04	0.75%
Long items, e.g. carpet, large textiles, rope, electrical cables or string	Contamination	13.52	1.26%
Items in plastic bags	Contamination	36.56	3.42%
Electrical and compound items	Contamination	0.82	0.08%
Large plastic items	Contamination	20.48	1.91%
Large heavy items	Contamination	0	0.00%
Disposable nappies	Contamination	1.58	0.15%
Other	Contamination	8.26	0.77%

#### 4.1.1.1 Recyclables in the residual compactor load

The outbound residual from the compactor contains 27% recyclables of which aluminium is 43%, mixed plastic 12%, PET 11%, recyclable paper 10%, steel 7.5%, HDPE 6%, disposable paper 5% and glass containers 4.35%.

**Table 22: Recyclables in the compactor load**

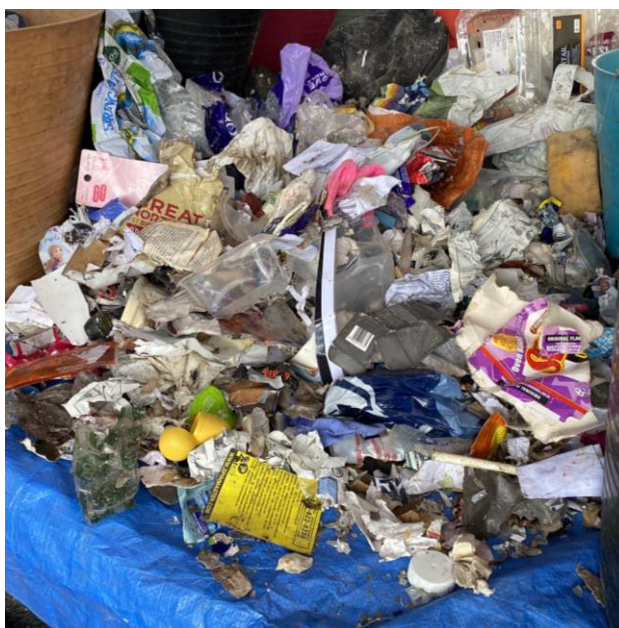
Material	Allocation	Total (kg)	Per cent
Mixed clean paper including cardboard	Recyclable paper	27.8	9.48%
Liquid paperboard	Recyclable containers	4.6	1.57%
Glass fines (under 50mm)	Glass fines	0	0.00%
Glass containers	Recyclable glass containers	12.76	4.35%
Aluminium	Recyclable metal containers	127.36	43.44%
Steel	Recyclable metal containers	21.88	7.46%
PET	Recyclable plastic containers	31.68	10.80%
HDPE	Recyclable plastic containers	17.32	5.91%
Mixed plastic containers	Recyclable plastic containers	35.1	11.97%
Mixed disposable paper	Recyclable paper	14.7	5.01%
<b>Total</b>		<b>293.2</b>	<b>100%</b>

#### 4.1.1.2 Contamination in the residual compactor load

Table 23 below shows the composition in the residual compactor samples. Three-quarters of the load (75%) was made up of residual fines consisting of fine, dirt-like material comprising small bits of paper and some glass sand. Other materials included textiles (4.9%), plastic film (2.9%) and electrical appliances (2.04%); large plastic items (2.6%) included a plastic tub and plastic milk crates.

**Table 23: Composition of residual**

	Allocation	Total	Per cent
Electrical appliances	Contamination	15.86	2.04%
High-density (branded) shopping bags	Contamination	5.94	0.76%
Plastic bags – low-density barrier bags	Contamination	0.74	0.10%
Lightweight single-use shopping bags	Contamination	1.06	0.14%
Film plastics	Contamination	22.6	2.91%
Green waste and timber	Contamination	9.38	1.21%
Non-recyclable glass and crockery	Contamination	0.32	0.04%
Hazardous	Contamination	0.04	0.01%
Nappies	Contamination	6.96	0.90%
Expanded polystyrene	Contamination	2.14	0.28%
Textiles	Contamination	38.14	4.91%
Food and kitchen waste	Contamination	4.44	0.57%
Automotive	Contamination	0	0.00%
Residual fines	Contamination	579.9	74.65%
Other plastics	Contamination	8.04	1.04%
Long items, e.g. carpet, large textiles, rope, electrical cables, string	Contamination	13.52	1.74%
Items in plastic bags	Contamination	36.56	4.71%
Electrical and compound items	Contamination	0.82	0.11%
Large plastic items	Contamination	20.48	2.64%
Disposable nappies	Contamination	1.58	0.20%
Other	Contamination	8.26	1.06%
<b>Total</b>		<b>776.78</b>	<b>100%</b>



**Image 21: Residual load ready for sorting**

#### 4.1.1.3 Plastic bags

Plastic bags were sorted to three categories, as follows, adding a category from previous audits:

- High-density (branded) shopping bags
- Plastic bags – low-density barrier bags
- Lightweight single-use shopping bags

**Table 24: Plastic shopping bags in residual material**

Item	Wt in sample	Per cent in sample
High-density (branded) shopping bags	5.94	0.56%
Plastic bags – low-density barrier bags	0.74	0.07%
Lightweight single-use shopping bags	1.06	0.10%
<b>Total</b>	<b>7.74</b>	<b>0.73%</b>

Plastic shopping bags represent almost 0.73% of the overall residual samples from the residual compactor. The MRF processes households from both NSW and ACT. ACT has had a bag ban since 2011. The NSW plastic bag ban on lightweight plastic bags (35 microns or less) only came into effect from June 2022 and was not introduced at the time of this audit. It is not possible from this audit to determine the source of the bags, however plastic bags were a specific category in the kerbside audit and that report provides detailed data on the plastic bags found in recycling bins.

#### 4.1.2 Non-metal residual oversize bin

As well as the residual material at the end of the line, large plastic items and those deemed to be too large or not suitable to go through the MRF sorting process were taken at the beginning of the process. In the 4.5 m<sup>3</sup> sample, comprised of two separate bins collected at different times on two separate days, APC counted 89 such items. The bin samples contents are shown in Table 24 below:

**Table 25: Non-metal oversize bin composition**

	Wt	Vol	Count	Wt%	Vol%	Count%
Long items, e.g. carpet, large textiles, rope, electrical cables or string	43.16	0	17	15%	0%	19%
Items in plastic bags	0	0	0	0%	0%	0%
Presence of electrical and compound items	63.62	0	14	22%	0%	16%
Large plastic items	69.38	0	43	24%	0%	48%
Presence of big, heavy items	24.22	0	1	8%	0%	1%
Presence of disposable nappies	0	0	0	0%	0%	0%
Other	87.6	50	14	30%	100%	16%
<b>Total</b>	<b>287.98</b>	<b>50</b>	<b>89</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>



**Image 22: Oversize non-metal bin sample**



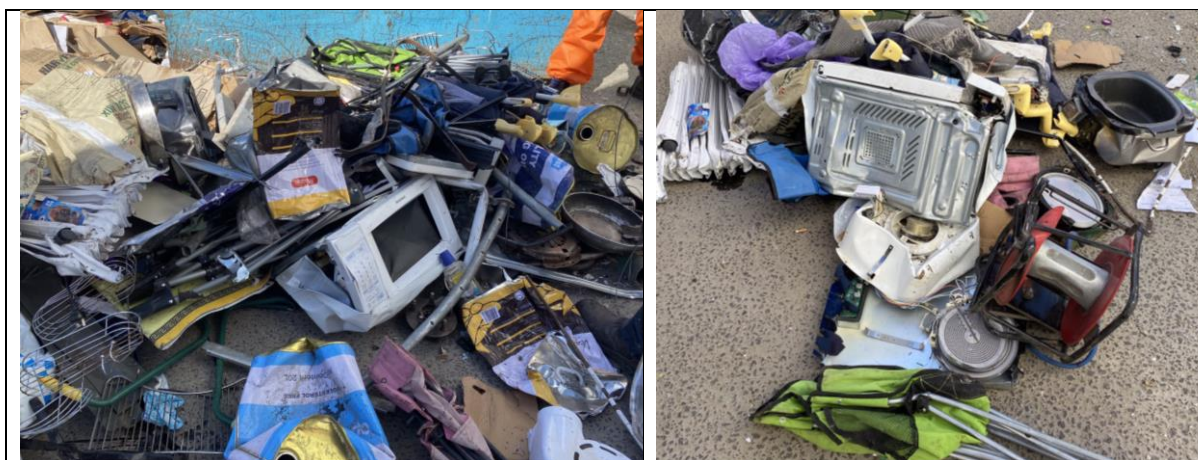
### 4.1.3 Metal oversize bin

The metal oversize bins contain metal items removed by hand from the incoming material at the pick line. These oversize items are not appropriate to be sorted as part of the MRF processes.

Based on the 4.8 m<sup>3</sup> samples audited, 73% of the material in these bins was metal and the remaining 26% was either electrical or compound items consisting of multiple materials. These materials would require further dismantling prior to the metal being available for recycling.

**Table 26: Composition of the metal oversize bin**

Metal bin	Wt (kg)	Vol (L)	Count	Wt %	Vol %
Metal	482.16	3470		73%	72%
Contamination	3.92	60		1%	1%
Supplementary items	Wt	Vol	Count		
Long items, e.g. carpet, large textiles, rope, electrical cables or string	7.18	0	8	1%	0%
Items in plastic bags	0	0	0	0%	0%
Presence of electrical and compound items	170.24	1300	47	26%	27%
Large plastic items	0	0	0	0%	0%
Presence of big, heavy items	0	0	0	0%	0%
Presence of disposable nappies	0	0	0	0%	0%
Other	0	0	0	0%	0%
<b>Total</b>	<b>663.5</b>	<b>4830</b>	<b>55</b>	<b>100%</b>	<b>100%</b>



**Image 23: Metal oversize bin contents**

### 4.1.3 Supplementary sort of problem materials

Large, problematic materials were found in all residual loads from the compactor, oversize metal and oversize non-metal bins. Of the samples audited, these items form 5.6% of the residual compactor material, 26% of the metal oversize bin and 100% of the oversize non-metal bin.

These materials were sorted and a total of 215 items was counted and placed in relevant categories. Large plastic items (72) and electrical and compound materials (64) were the largest categories, followed by long items including string, rope and electrical cables (43).

**Table 27: Supplementary sort of problem materials**

Supplementary sort	Residual compactor		Non-metal oversize bin		Metal oversize bin		Total	
	Wt	Count	Wt	Count	Wt	Count	Wt	Count
Long items, e.g. carpet, large textiles, rope, electrical cables or string	13.52	18	43.16	17	7.18	8	63.86	43
Items in plastic bags	36.56	21	0	0	0	0	36.56	21
Electrical and compound items	0.82	3	63.62	14	170.24	47	234.68	64
Large plastic items	20.48	29	69.38	43	0	0	89.86	72
Large heavy items	0	0	24.22	1	0	0	24.22	1
Disposable nappies	1.58	0	0	0	0	0	1.58	0
Other	8.26	0	87.6	14	0	0	95.86	14
<b>Total</b>	<b>81.22</b>	<b>71</b>	<b>287.98</b>	<b>89</b>	<b>663.5</b>	<b>55</b>	<b>1032.7</b>	<b>215</b>

**Image 24: Examples of supplementary sort - long and stringy, oversize and heavy**

## 4.2 Outbound recyclable material

The Hume MRF sorts all inbound material into aluminium, PET (clear and coloured), HDPE (natural and coloured), steel and paper.

### 4.2.1 Commodities composition

Representative samples were taken from the output streams of each of these materials and audited to determine the amount and type of contamination. Data shows that the MRF is producing very clean container streams with negligible contamination. However, contamination in paper stream was 13%. Clear PET in the coloured PET stream was calculated as contamination. The coloured PET stream otherwise had negligible contamination.

**Table 28: Contamination in the output stream**

Material	Wt Total	Ct Total	Contamination weight	Contamination count	contamination % wt	contamination % Ct
Aluminium	625	40471	0	0	0.00%	0.00%
PET	375	11489	0.06	3	0.02%	0.03%
PET coloured	79.3	1991	0.24	7	0.30%	0.35%
Mixed plastics	499.52	4865	0	0	0.00%	0.00%
HDPE coloured	375	279	0.2	3	0.05%	1.08%
HDPE natural	225.04	115	0	0	0.00%	0.00%
Steel	122.16	20	1.06	1	0.87%	5.00%
Paper	138.58	N/A	21.04	N/A	13%	N/A
<b>Total</b>	<b>2460.64</b>	<b>59233</b>	<b>25.6</b>	<b>14</b>	<b>1.04%</b>	<b>0.02%</b>

### 4.2.2 CDS containers

By weight, a large proportion of the clean recyclable material in the MRF output stream by weight is eligible for a 10c refund under the NSW and ACT CDSs. Containers eligible for the CDS refund by material included coloured PET (94%), aluminium (92.5%), PET clear (55%), mixed plastics (15%) HDPE coloured (3%) and HDPE natural (2%).

**Table 29: CDS-eligible materials in the output streams (kgs)**

Material	Wt Total	Wt CDL	CDS %
Aluminium	625	578.28	92.52%
PET	375	206.62	55.10%
PET coloured	79.3	74.76	94.27%
Mixed plastics	499.52	75.22	15.06%
HDPE coloured	375	10.82	2.89%
HDPE natural	225.04	5.08	2.26%
Steel	122.16	N/A	N/A
<b>Total</b>	<b>2301.02</b>	<b>950.78</b>	<b>41.32%</b>



## 5 COMPARISON WITH PREVIOUS AUDITS

### 5.1 Residual

Previous MRF audits only audited residual materials at the Hume MRF. The audit categories were also slightly different in 2022 as additional plastic bag categories were added and black plastic items were removed from the supplementary sort after discussions at the inception meeting as the optical sorters can now distinguish black items and the conveyor belt colour has been changed to blue. Previous MRF audits have been conducted over shorter time frames and auditing only for residuals. The most significant difference from 2014 and 2022 was the reduction in glass fines, with the glass-sand process established to recover all glass and fines. Between 2014 and 2022 saw an increase in residual fines. Some categories of material were combined in 2022 to make them comparable with previous years.

**Table 30: Comparison of outbound residual material**

Item	Weight in the residual material	
	2014 %	2022 %
Glass fines (<50 mm diameter)	24.31%	0.00%
Other miscellaneous**	14.46%	56.35%
Automotive parts	0.00%	0.00%
Paper/cardboard***	8.79%	3.97%
Liquid paperboard	0.41%	0.43%
Large heavy items	3.41%	0.00%
PET clear	1.63%	2.96%
HDPE semi-opaque	0.88%	1.62%
Lightweight single-use shopping bags	0.06%	0.10%
Plastic bags – low-density barrier bags	0.08%	0.07%
Expanded polystyrene	0.13%	0.20%
Green waste and timber	1.47%	0.88%
Hazardous	0.15%	0.00%
Large plastic items	1.21%	1.91%
Black plastic items – recyclable	0.36%	
Black plastic items – non-recyclable	0.30%	
Nappies	0.58%	0.80%
Film plastics	1.53%	2.11%
Textiles	3.30%	3.56%
Other glass/crockery	0.81%	0.03%
Aluminium	1.00%	11.90%
Mixed plastic containers	3.74%	3.28%
Bagged recycling	1.91%	
Food and kitchen waste	2.13%	0.41%
Electrical appliances *	2.57%	1.48%
Glass containers	2.57%	1.19%
Long items	3.73%	1.26%
Containerised food and liquid	4.52%	
Steel	5.64%	2.04%
Bagged garbage	8.33%	3.42%
<b>Total</b>	<b>100%</b>	<b>100%</b>

\*Electrical appliances in 2022 contain electrical and compound items

\*\*HDPE branded shopping bags, other and other plastics have all been added to miscellaneous in 2022

\*\*\*Mixed disposable paper has been added to paper and cardboard

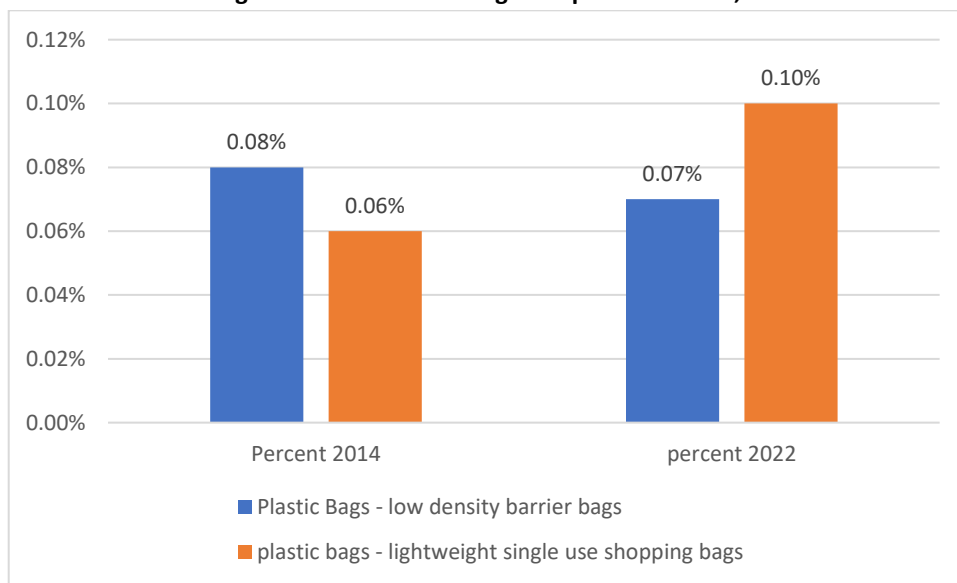
## 5.2 Plastic bags

The proportion of plastic bags in the MRF residual was higher in 2022 than 2014, due to increases in both low-density and lightweight single-use bags. By weight, plastic bags still account for a very low proportion of MRF residual.

**Table 31: Plastic shopping bags in residual material over the years**

Item	Weight in the residual material	
	Per cent 2014	Per cent 2022
Plastic bags – low-density barrier bags	0.08%	0.07%
Plastic bags – lightweight single-use shopping bags	0.06%	0.10%
<b>Total</b>	<b>0.14%</b>	<b>0.17%</b>

**Figure 4: Plastic bags comparison – 2014, and 2022**



Please note the plastic shopping bag categories were more detailed in 2022. The above data only compares the comparable categories.

## 6 KEY FINDINGS

The audit included a physical sort of 6.8 tonnes of material of which 3,790 kg was input material, 989 kg residual material (including oversize bins) and 2,099 kg output material.

### 6.1 Incoming material

- Kerbside material comprises 71% of all MRF feedstock with ACT kerbside (53%), NSW kerbside material (18%), ACT CDS (7%), commercial comingled (6%), NSW CDS (6%) and commercial cardboard 3%.
- The total average contamination in the material received at the MRF was 12.16%.
- Contamination by weight was highest in public place bins (39%) followed by both NSW and ACT kerbside (14%), commercial recycling (8%), RDOC (2%), NSW CDS (0.3%) and ACT CDS (0.05%)
- Contamination by volume was highest in NSW kerbside 12%, ACT commercial (5%), NSW CDS (0.3%) and ACT CDS (0.01%)

#### 6.1.1 Composition of incoming materials

- NSW kerbside composition: paper/ cardboard (60%), glass (21%), plastics (13%), steel (4%), aluminium (0.6%).
- ACT kerbside composition: paper/ cardboard (41%), glass (33%), plastics (9%), steel (3%), aluminium (0.6%).
- ACT commercial loads comprised paper/ cardboard (73%), glass (23%), Pet clear (1%) and all other materials <1%.
- ACT public place loads comprised paper/ cardboard (49%), glass (37%), Pet clear (6%), mixed plastics (4%) aluminium (2%) all other materials <1%

### 6.2 Outbound materials

Based on the weighbridge weights, a total of 2,418 tonnes of material left the MRF over the course of the two weeks of the audits. Of this, 88% was recyclables and 12.4% was as residuals.

#### 6.2.1 Outbound residuals composition

- An audit of the **outbound residuals** reveals that 27% of this material is recyclable and 73% is residual material.
- The recyclables not recovered include aluminium (12%), plastics (8%), paper (4%), steel (2%) and glass (1%).
- The residual material comprises fines (54%), textiles (3.6%), bagged material (3.4%) plastic film and oversized plastics both (2%) and electrical items (1.5%). The remaining residual is very small amounts of a diverse list of materials.
- The main unacceptable items manually extracted at the pick line at the beginning of the MRF and prior to processing are oversized large plastic items like toys and tubs, compound materials and

electronic items. These form 5.6% of the overall residual and 100% of the oversize non-metal load and 26% of the metal oversize bin.

### 6.2.2 Outbound recyclables composition

- Of the commodities leaving the site contaminants were less than 1%.
- Almost 43% of the outbound recyclables consist of containers that are eligible for a 10c refund through the container deposit scheme.

### 6.3 Plastic bags

The ACT implemented a ban on single-use, lightweight shopping plastic bags in November 2011.

- Plastic shopping bags represent almost 0.73% of the overall residual loads sampled from the compactor in 2022.
- Plastic bag composition comprised high density branded bags (0.56%), single use bags (0.10%) and low density barrier bags (0.07%)
- The proportion of plastic bags in the MRF residual are different in 2022 as compared to 2014, due to a decreases in low-density and an increase in lightweight single-use bags.

**Appendix A DATA RECORDING BY SOURCE**

**ACT commercial, kerbside, public-place sorting sheet**

<b>Date</b>	<b>Time</b>	<b>Sample number</b>			
<b>Volume of sample</b>		<b>Photo</b>			
<b>Bagged material wt</b>	<b>Bag recyclable wt</b>	<b>Bag garbage wt (as intended)</b>			
<b>Comments:</b>					
<b>Material</b>	<b>Wt</b>	<b>Vol</b>	<b>Count</b>	<b>PIC</b>	
Paper/ cardboard					
Glass					
PET					
HDPE natural					
HDPE coloured					
Mixed plastics					
Aluminium					
Steel					
LPB					
Other – contamination (non-recyclables)					
<b>CDL sub sort</b>	<b>Wt</b>	<b>Vol</b>		<b>Count</b>	<b>PIC</b>
PET clear/coloured					
HDPE natural					
HDPE coloured					
Mixed plastics					
Aluminium					
Steel					
LPB					
<b>Comments</b>					

**MRF output sorting sheet**

<b>Sample number</b>	<b>Date</b>	<b>Time</b>		
<b>Weight of sample</b>	<b>Volume of sample</b>	<b>Photos</b>		
	<b>Wt</b>	<b>Vol</b>	<b>CDS Count</b>	<b>Pic</b>
<b>MRF Output being sorted</b>				
<b>Contamination</b>				
<b>Comments</b>				

**RDOC sorting sheet**

<b>Sample number</b>	<b>Date</b>	<b>Time</b>		
<b>Weight of sample</b>	<b>Volume of sample</b>	<b>Photos</b>		
	<b>Wt</b>	<b>Vol</b>	<b>Pic</b>	
Cardboard				
Paper/Magazine/Book				
Polystyrene (EPS)				
Other contamination				

## Residual compactor sorting sheet

Sample number	Date	Time	
Weight of sample	Volume of sample		Photos
	Wt	Vol	Photo
Mixed clean paper including cardboard			
Liquid paperboard			
Glass Fines (under 50mm)			
Glass containers			
Aluminium			
Steel			
PET			
HDPE			
Mixed plastic containers			
Electrical appliances			
High density (branded) shopping bags			
Plastic bags – low-density barrier bags			
Lightweight single-use shopping bags			
Film plastics incl. kitchen tidy bags/bin liners			
Green waste and timber			
Non-recyclable glass and crockery			
Hazardous			
Nappies			
Expanded polystyrene			
Textiles			
Food and kitchen waste			
Automotive			
SUPPLEMENTARY SORT of OVERSIZE BINS	Wt	Count	Pic
Long items, e.g. carpet, large textiles, rope, electrical cables or string			
Items in plastic bags			
Presence of electrical and compound items			
Large plastic items *			
Presence of big, heavy items ( >18 kg)			
Presence of disposable nappies			
<b>Sub total</b>			



## Oversize Metal bin sorting sheet

Sample number		Date		Time
Weight of sample		Volume of sample		Photos
	Wt	Volume	Photo	
Metal				
Contamination'				
SUPPLEMENTARY SORT of OVERSIZE bins		Wt	Count	Pic
Long items, e.g. carpet, large textiles, rope, electrical cables or string				
Items in plastic bags				
Presence of electrical and compound items				
Large plastic items *				
Presence of big, heavy items ( >18 kg)				
Presence of disposable nappies				

## Oversize Residual bin sorting sheet

Sample number		Date		Time
Weight of sample		Volume of sample		Photos
SUPPLEMENTARY SORT of OVERSIZE bins		Wt	Count	Pic
Long items, e.g. carpet, large textiles, rope, electrical cables or string				
Items in plastic bags				
Presence of electrical items				
Large plastic items *				
Presence of big, heavy items ( >18 kg)				
Presence of disposable nappies				
Other				

**APPENDIX B SORTING CATEGORIES AND DEFINITIONS****Sorting category definitions**

<b>Material</b>	<b>Definition</b>
Paper/cardboard	Newspapers, newspaper-like pamphlets, magazines (glossy and non-glossy), pamphlets, brochures, wrapping paper, labels, paper packaging (no plastic or wax coatings), cardboard with corrugation, cardboard without corrugation (glossy and non-glossy), cereal boxes, business cards, A4 document paper, writing pads, letters, envelopes, books
Liquid paperboard	Soy milk cartons, some fruit juice cartons, UHT/long-life milk
Glass containers	Recyclable (all colours) – beer bottles, wine bottles, spirit cider/fruit-based, flavoured water, fruit juice, sports drinks, plain water, sauce bottles, jam jars, vegetable oils, other food containers
Glass fines (<50 mm)	Mixed glass or glass fines < 4.75 mm
Aluminium	Beer and soft drink
Steel	Alcoholic sodas and spirit-based mixers, beer, soft drink, food cans, pet food cans, aerosols, industrial cans, clean/empty paint cans
PET clear	(Polyethylene) – soft drink, flavoured water, fruit juice, sports drinks, plain water (carbonated/non-carb), food containers, mouthwash containers, detergent bottles
HDPE semi-opaque	(High-density polyethylene) – milk and flavoured milk bottles, bleach bottles, oil containers, food containers
Mixed plastic containers	Clear cordial and juice bottles, detergent bottles
Film plastics	Plastic film
Electrical appliances	Anything with a cord – small electrical items (toaster, blender, etc.)
Green waste and timber	Grass clippings, tree trimmings/prunings, flowers, wood/timber
Non-recyclable glass and crockery	Pyrex, mirror glass, Corningware, light globes, laboratory and medical glass, white opaque glass (e.g. Malibu alcohol bottles)
Nappies	Used disposable nappies
Expanded polystyrene	Meat and poultry trays, vending cups, fragile-item packaging
Textiles	Wool, cotton and natural fibre materials
Hazardous	Paint (dry or wet), compact fluorescent lamps (CFLs), asbestos-containing products, sharps, blood-stained disposable material or equipment, gas bottles, batteries
Automotive parts	Anything from a motor vehicle
Other miscellaneous	Composites, appliance parts, crates and boxes, toys, houseware/kitchenware, furniture, plant pots, mouldings, irrigation fittings
Food and kitchen waste	Loose food and Any rigid container/soft plastic including food and liquid heavier than the container, i.e. drink bottle containing water, takeaway container with food, vegetable oils, shampoo, liquid soaps, vegetable scraps, meat scraps, animal food, leftover food
Bagged recycling	Recycling in a plastic bag
Bagged garbage	General waste in a plastics bag
Plastic bags – low-density barrier bags	LDPE – other bags e.g. potatoes, tomatoes, sugar, ice, bread bags, etc.
Plastic bags – lightweight, single-use shopping bags	Fully transparent, not opaque
Black plastic items – recyclable	Meat trays, flower pots and any other black containers
Black plastic items – non-recyclable	Oil containers
Long items	Rope, string, hose, electrical cable, carpet
Large, heavy items	Any single item weighing more than 18 kg, any item or material with two of any three of its dimensions greater than 400 mm or any one of its three dimensions greater than 1,000 mm
Large plastic items	20-litre drums, crates, broken furniture

## APPENDIX C: DETAILED COMPOSITION

Table 32 Residual composition – detailed

Material	Weight (kg)						Per cent
	MRC1	MRC2	MRC3	MRC4	MRC5	Total	
Mixed clean paper including cardboard	7.44	7.6	3.24	6.44	3.08	27.8	2.81%
Liquid paperboard	0.3	2.82	1.22	0.1	0.16	4.6	0.47%
Glass Fines (under 50mm)	0	0	0	0	0	0	0.00%
Glass containers	3.22	0	1.58	6.28	1.68	12.76	1.29%
Aluminium	1.42	122	2.82	0.56	0.56	127.36	12.88%
Steel	9.98	4.4	3.04	3.24	1.22	21.88	2.21%
PET	0	8.72	12.48	5.28	5.2	31.68	3.20%
HDPE	1.2	4.12	8.04	2.28	1.68	17.32	1.75%
Mixed plastic containers	10.32	6.66	11.36	4.52	2.24	35.1	3.55%
Electrical appliances	5.2	3.56	2.84	2.9	1.36	15.86	1.60%
High density (branded) shopping bags	1.98	1.42	0.52	1.32	0.7	5.94	0.60%
Plastic bags - low density barrier bags	0.16	0	0.22	0.28	0.08	0.74	0.07%
Lightweight single use shopping bags	0.08	0.16	0.16	0.58	0.08	1.06	0.11%
Film plastics	6.24	5.82	1.34	6.02	3.18	22.6	2.29%
Green waste and timber	2.68	1.98	1.94	1.82	0.96	9.38	0.95%
Non-recyclable glass and crockery	0.32	0	0	0	0	0.32	0.03%
Hazardous	0.04	0	0	0	0	0.04	0.00%
Nappies	0.9	1.58	0.16	4.04	0.28	6.96	0.70%
Expanded polystyrene	0.32	0.5	0.76	0.32	0.24	2.14	0.22%
Textiles	6.98	9.44	2.3	16.86	2.56	38.14	3.86%
Food and kitchen waste	3.02	0.52	0.22	0.68	0	4.44	0.45%
Automotive	0	0	0	0	0	0	0.00%
Residual fines	295.4	14.62	212.72	13.24	43.92	579.9	58.65%
Mixed disposable paper	6.2	0	0	4.16	4.34	14.7	1.49%
Other Plastics	0	3.26	1.36	2.82	0.6	8.04	0.81%
<b>Total weight</b>	<b>363.4</b>	<b>199.18</b>	<b>268.32</b>	<b>83.74</b>	<b>74.12</b>	<b>988.76</b>	<b>100.00%</b>