

# C&I WASTE AUDIT OF METROPOLITAN SOUTH AUSTRALIA PUBLIC REPORT

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Prepared for Green Industries SA



Rawtec Pty Ltd  
11 Paringa Avenue  
Somerton Park  
South Australia

## Document verification

Date	Version	Title	Authors	Reviewed by	Approved by
16/01/2023	V1	C&I Waste Audit Public Report 2022	M. Bailey	M. Rawson	M. Rawson

## Acknowledgments

The South Australian Commercial and Industrial Waste Audit was funded by Green Industries SA. The physical audits were conducted by Dynamic 3E and KESAB Environmental Solutions, and the statistical analysis conducted by Symbolix.

Many thanks to the staff at each audit site; Cleanaway, IWS, Solo Resource Recovery, Southern Waste ResourceCo and Veolia ResourceCo, who provided assistance across all stages of the audit.

## Acknowledgment of Country

We acknowledge the Kurna people of the Adelaide Plains as the traditional custodians of the land on which we live and work on. We respect their spiritual relationship with Sea and Country and acknowledge their Elders - past and present. We also pay our respect to the cultural authority of Aboriginal and Torres Strait Islander peoples from other areas of South Australia and Australia.

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# Executive Summary

Green Industries SA appointed Rawtec to lead physical audits of Commercial and Industrial (C&I) waste at five key receipt/processing sites in metropolitan Adelaide.

The purpose of the audits was to improve understanding of the composition of mixed C&I waste (general waste and dry general waste streams) in South Australia at the point of generation.

The audits took place in September and October 2022. A total of 8,457 kg of waste was audited across samples from 50 C&I waste trucks.

The audit results were weighted with consideration to the net weight of the truck which the sample was taken from, and the total incoming tonnes of C&I waste at each audit site. The weighted audit results are in Table 1.

Six streams emerged as the biggest components of mixed C&I waste (% wt.):

1. Paper and cardboard - **18.9%**
2. Food organics (loose & packaged in steel & glass, plastic)<sup>1</sup> - **18.8%**
3. Plastic films - **13.6%**
4. Wood (treated and untreated) - **13.1%**
5. Non-recyclable plastic / expanded polystyrene - **8.5%**
6. Textile materials - **7.2%**

The results were compared with results from the most recent C&I waste audit in SA, conducted in 2007<sup>2</sup>. Key differences included:

- decrease in food organics (-13 % wt. pts.)
- decrease in inert materials (-10 % wt. pts.)
- increase in plastic (+14 % wt. pts.)
- increase in wood (+5 % wt. pts.).

Table 1: C&I audit results summary

Audit category	Composition of mixed C&I waste (% wt.)
Paper and cardboard	18.9%
Food organics (loose)	11.6%
Food organics (packaged in steel & glass, plastic)	7.1%
Green waste and garden waste	1.7%
Wood (treated and untreated)	13.1%
Textile materials	7.2%
Recyclable plastics	2.7%
Plastic films	13.6%
Non-recyclable plastic / expanded polystyrene	8.5%
Nappies and hygiene products	2.5%
Hazardous materials	0.1%
E-Waste	1.1%
Glass	2.2%
Non-ferrous metals	0.5%
Ferrous metals	2.0%
Inert materials / misc. non-combustibles	1.5%
Fines / sweepings / dust / dirt / glass fines	3.0%
Other (not allocated to the above)	2.7%

<sup>1</sup> The categories of food organics (loose) & food organics (packaged in steel & glass, plastic) were combined for the analysis.

<sup>2</sup> Note that the 2007 audit followed a significantly different methodology (see Section 4).

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# 1. Project Background

Commercial and industrial (C&I) waste is a significant portion of waste generated in South Australia (SA). South Australia's residual C&I waste stream was last audited in 2007 and since this time there have been several changes to C&I collection and processing systems, including the introduction of new C&I recycling services (e.g. organics collections).

Table 2 lists C&I waste streams that were within and outside the scope of the audit. The streams within scope are referred to throughout the report as 'mixed C&I waste'.

*Table 2: C&I streams within and outside the scope of the audit*

Waste streams within scope	Waste streams outside of scope
<ul style="list-style-type: none"><li>• C&amp;I general waste</li><li>• C&amp;I dry general waste<sup>3</sup></li></ul>	<ul style="list-style-type: none"><li>• All segregated C&amp;I streams including:<ul style="list-style-type: none"><li>○ cardboard</li><li>○ paper (including confidential paper)</li><li>○ organics</li><li>○ CDS containers.</li></ul></li></ul>

Green Industries SA (GISA) appointed Rawtec to lead physical audits of C&I waste at various receipt and/or processing sites. The purpose of the audits was to improve understanding of the composition of mixed C&I waste in SA at the point of generation.

The audit results will be used to:

- assist stakeholders identify streams that are being effectively managed, and streams that will require focus for material recovery moving forward
- assess the key opportunities for business and industry in SA to improve recycling, and
- enable a better model of the circularity of the materials in the waste sector to be developed for South Australian and national reporting.

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<sup>3</sup> Note that C&I dry general waste services can be sold under various names including 'dry waste', 'dry recycling' and 'comingled recycling'.

## 2. Audit Method and Details

### 2.1. Audit details

Physical audits were conducted by Dynamic 3E and KESAB Environmental Solutions at five different sites across metropolitan Adelaide. Key details for each audit are in Table 3 below.

Table 3: Audit details

Audit site	Site address	Audit dates	C&I stream audited
<b>Solo Resource Recovery</b>	181 Morphett Rd, North Plympton SA 5037	26 <sup>th</sup> – 28 <sup>th</sup> September 2022 (3 days)	General waste
<b>Veolia ResourceCo</b>	Lot 246 Wilkins Rd, Wingfield SA 5013	4 <sup>th</sup> – 7 <sup>th</sup> October 2022 (4 days)	Dry general waste
<b>Cleanaway</b>	Hanson Rd, Wingfield SA 5013	10 <sup>th</sup> – 12 <sup>th</sup> October 2022 (3 days)	General waste
<b>IWS</b>	Wingfield Road &, Hines Rd, Wingfield SA 5013	10 <sup>th</sup> – 14 <sup>th</sup> October 2022 (5 days)	General waste
<b>Southern Waste ResourceCo</b>	19 Christie Rd, Lonsdale SA 5160	17 <sup>th</sup> – 18 <sup>th</sup> October 2022 (2 days)	General waste

A total of 8,457 kg of mixed C&I waste was audited across 50 samples, resulting in an average sample mass of 169 kg.

### 2.2. Sampling methodology

Trucks carrying mixed C&I waste were selected at random for sampling. The ‘cone and quarter’ method was used to prepare the samples, which was as follows:

1. Truck dropped load of C&I waste.
2. Loader mixed entire truck load of C&I waste.
3. Loader grabbed three buckets of waste from truck load and put in a pile.
4. Loader mixed pile.
5. Loader split pile into four quarters.
6. Loader removed two opposite quarters from the pile and pushed other two opposite quarters together to form a smaller pile.
7. Steps 4 – 6 were repeated until pile was approx. 150 – 200 kg. Sample weight was checked with scales or weighbridge when possible.
8. Loader delivered sample to auditing location.

Note that not all sites could facilitate the cone and quarter process due to limitations on time and equipment availability.

## 3. Audit Data Analysis

### 3.1. Truck data

50 trucks were selected for sampling across the five audit sites. When possible, data from the sampled trucks was collected. Data included:

- type of truck (front lift, rear lift, RORO etc.)
- net load weight (in tonnes), and
- approximate number of businesses collected from.

The number of businesses each truck collected from was provided either as an estimate by the driver or as an exact number by the collection contractor.

The truck data collected during the audit is below in Table 4.

Table 4: Truck data

Data point	Number of data points collected (of a possible 50)	Results	
		Front lift	Rear lift
<b>Type of collection truck</b>	50	44 front lifts	6 rear lifts
<b>Net load weight</b>	48 <sup>4</sup> (42 front lift, 6 rear lift)	Minimum: 1.3 t Maximum: 10.54 t Average: 5.6 t	Minimum: 1.36 t Maximum: 7.32 t Average: 4.1 t
<b>Approximate number of businesses collected from</b>	34 (28 front lift, 6 rear lift)	Minimum: 5 Maximum: 63 Average: 31	Minimum: 10 Maximum: 50 Average: 40

Based on the collected data, it is estimated that the 50 sampled trucks contained 271 tonnes of mixed C&I waste from over 1,500 businesses<sup>5</sup>.

<sup>4</sup> Net load weight was recorded for all 50 samples however two data points deemed invalid were removed.

<sup>5</sup> In instances where the number of businesses collected from was unknown, it was estimated using the average number of businesses per tonne of waste for the given type of truck.

## 3.2. Audit results summary

The C&I waste was audited into 18 categories.

The raw data was weighted with consideration to the net weight of the truck which the sample was taken from. For the samples where the net weight of the truck was not recorded, the average net weight for the same type of truck at that site was used. The audit results assume that the audited sample is representative of the whole truck load of waste.

The audit data from each site was weighted with consideration to:

1. the incoming tonnes of C&I waste at that site, and
2. the incoming tonnes of C&I waste at sites across SA that were not included in the audit.

The weighted audit data representing all South Australian mixed C&I waste is in Table 5.



Table 5: Weighted C&I audit results

#	Audit category	C&I mixed waste composition (% wt.)
1	Paper and cardboard	18.9%
2	Food organics (loose)	11.6%
3	Food organics (packaged in steel & glass, plastic)	7.1%
4	Green waste and garden waste	1.7%
5	Wood (all including treated and untreated)	13.1%
6	Textile materials	7.2%
7	Recyclable plastics (coded plastic 1 - 5)	2.7%
8	Plastic films (clean or contaminated)	13.6%
9	Non-recyclable plastic / expanded polystyrene	8.5%
10	Nappies and hygiene products	2.5%
11	Hazardous materials	0.1%
12	E-Waste	1.1%
13	Glass	2.2%
14	Non-ferrous metals	0.5%
15	Ferrous metals	2.0%
16	Inert materials / misc. non-combustibles (e.g. bricks/concrete)	1.5%
17	Fines / sweepings / dust / dirt / glass fines	3.0%
18	Other (not allocated to the above)	2.7%
		<b>100%</b>

### 3.3. Statistical analysis

Symbolix statistical consultants reviewed the audit methodology and raw audit data. A margin of error was calculated for each audit category at a 95% confidence interval. This is shown in Table 6, alongside estimates for annual tonnages (based on an estimated 460,000 tonnes of mixed C&I waste total).

*Table 6: Weighted audit results and annual tonnages at 95% confidence*

#	Audit category	Minimum value 95% confidence (% wt.)	Audit result (% wt.)	Maximum value 95% confidence (% wt.)	Annual C&I generation in SA (tonnes/year)
1	Paper and cardboard	16.3%	<b>18.9%</b>	21.4%	<b>86,800</b> ± 11,700
2	Food organics (loose)	8.9%	<b>11.6%</b>	14.4%	<b>53,500</b> ± 12,650
3	Food organics (packaged in steel & glass, plastic)	5.6%	<b>7.1%</b>	8.7%	<b>32,800</b> ± 7,200
4	Green waste and garden waste	1.1%	<b>1.7%</b>	2.3%	<b>7,700</b> ± 2,700
5	Wood (all including treated and untreated)	10.3%	<b>13.1%</b>	15.8%	<b>60,200</b> ± 12,600
6	Textile materials	4.9%	<b>7.2%</b>	9.6%	<b>33,200</b> ± 10,850
7	Recyclable plastics (coded plastic 1 – 5)	1.9%	<b>2.7%</b>	3.5%	<b>12,600</b> ± 3,600
8	Plastic films (clean or contaminated)	11.5%	<b>13.6%</b>	15.8%	<b>62,600</b> ± 9,950
9	Non-recyclable plastic / expanded polystyrene	7.4%	<b>8.5%</b>	9.7%	<b>39,200</b> ± 5,450
10	Nappies and hygiene products	1.9%	<b>2.5%</b>	3.1%	<b>11,400</b> ± 2,700
11	Hazardous materials	0.0%	<b>0.1%</b>	0.3%	<b>300</b> ± 600
12	E-Waste	0.7%	<b>1.1%</b>	1.4%	<b>4,800</b> ± 1,800
13	Glass	1.6%	<b>2.2%</b>	2.8%	<b>10,100</b> ± 2,700
14	Non-ferrous metals	0.1%	<b>0.5%</b>	0.9%	<b>2,200</b> ± 1,800
15	Ferrous metals	1.0%	<b>2.0%</b>	3.0%	<b>9,100</b> ± 4,500
16	Inert materials / misc. non-combustibles (e.g. bricks/concrete)	0.9%	<b>1.5%</b>	2.1%	<b>6,900</b> ± 2,700
17	Fines / sweepings / dust / dirt / glass fines	1.6%	<b>3.0%</b>	4.4%	<b>13,800</b> ± 6,350
18	Other (not allocated to the above)	2.1%	<b>2.7%</b>	3.3%	<b>12,500</b> ± 2,700
			<b>100%</b>		<b>460,000</b>

### 3.4. Results discussion

Six streams emerged as the biggest components of mixed C&I waste (% wt.).

1. Paper and cardboard - **18.9%**
2. Food organics (loose & packaged in steel & glass, plastic)<sup>6</sup> - **18.8%**
3. Plastic films (clean or contaminated) - **13.6%**
4. Wood (all including treated and untreated) - **13.1%**
5. Non-recyclable plastic / expanded polystyrene - **8.5%**
6. Textile materials - **7.2%**

Figure 1 visually displays percentages of key components of mixed C&I waste.

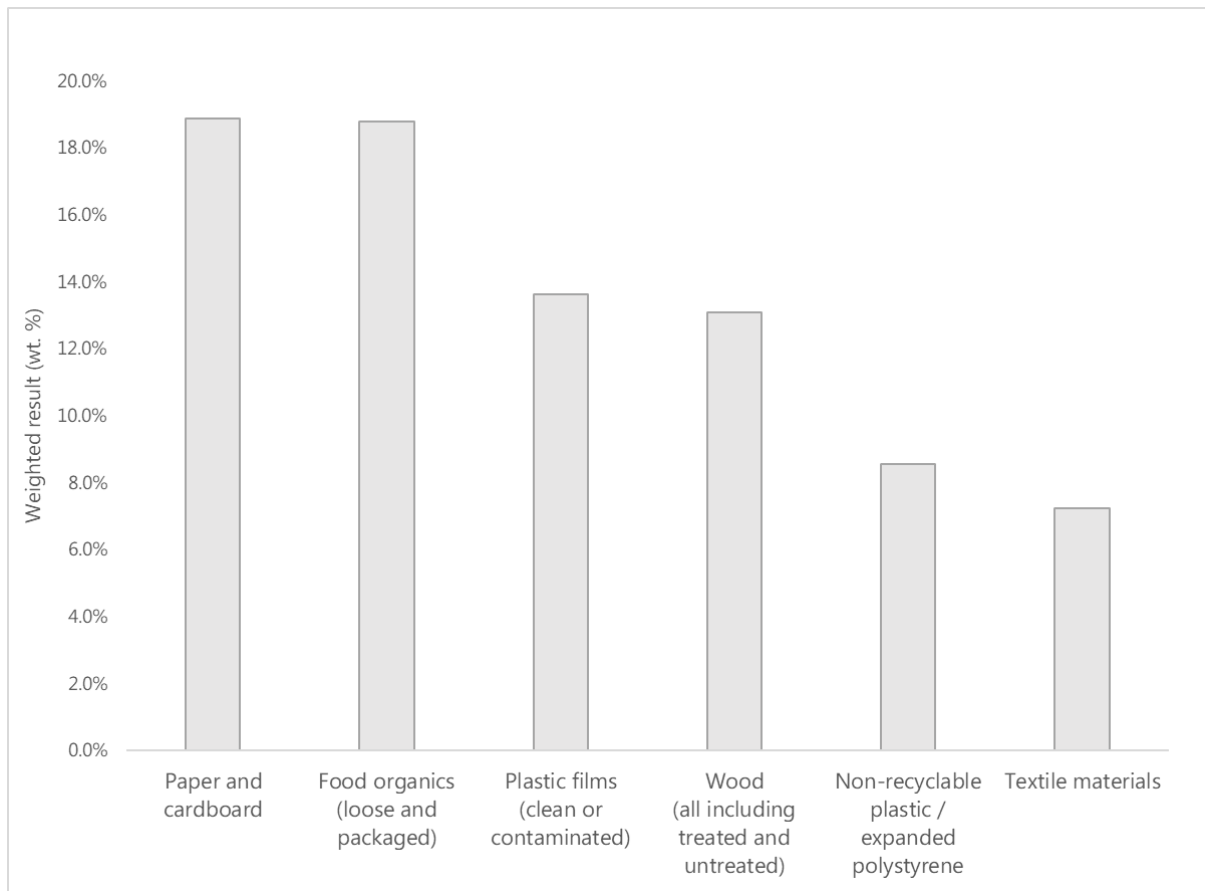


Figure 1: Key components of mixed C&I waste

<sup>6</sup> The categories of food organics (loose) & food organics (packaged in steel & glass, plastic) were combined for the analysis.

## 4. Comparison to 2007 C&I Audit

Prior to the 2022 audit, the most recent C&I waste audit in South Australia was in 2007. Table 7 lists key differences between the two audits.

*Table 7: Key differences between the 2007 and 2022 C&I waste audits*

	2022	2007
<b>Type of audit</b>	Physical audit of mass.	Visual audit of volume.
<b>Sites audited</b>	<ol style="list-style-type: none"> <li>Solo Resource Recovery</li> <li>IWS</li> <li>Cleanaway</li> <li>Veolia ResourceCo</li> <li>Southern Waste ResourceCo</li> </ol>	<ol style="list-style-type: none"> <li>Solo Resource Recovery</li> <li>IWS</li> <li>Wingfield Waste Recovery Centre</li> <li>Nuriootpa Landfill</li> <li>Southern Waste Depot (Lucas Earthmovers)</li> <li>Southern Region Waste Resource Authority (SRWRA) Landfill</li> <li>Northern Adelaide Waste Management Authority (NAWMA) Landfill.</li> </ol>
<b>Time auditing on each site</b>	Varied from 2 - 5 days.	One working week spent at each site (either 5 or 7 days depending on how many days site is open).
<b>Waste included in audit</b>	<ul style="list-style-type: none"> <li>C&amp;I general waste &amp; dry general waste streams.</li> <li>2 - 4 samples of 150 - 250 kg audited per day from randomly selected C&amp;I trucks (one sample per truck).</li> <li>Total of 8.5 tonnes physically audited from 50 trucks.</li> </ul>	<ul style="list-style-type: none"> <li>C&amp;I general waste stream only.</li> <li>All waste from every C&amp;I vehicle entering each site over one working week audited.</li> <li>Total of 896 tonnes visually audited from hundreds of trucks.</li> </ul>
<b>Number of categories</b>	18 categories.	36 categories.
<b>Determination of overall C&amp;I waste composition</b>	Each sample weighted with consideration to net weight of respective truck and total C&I waste received at the site annually.	Volume data converted to mass using assumed densities. No weighting of data undertaken.

To compare the two audits, the 2007 categories were reallocated to fit within the 2022 categories. Some categories from the 2022 audit were also combined:

- 'Food organics (loose)' was combined with 'Food organics (packaged in steel & glass, plastic)'
- 'Recyclable plastics (coded plastic 1 - 5)' was combined with 'Non-recyclable plastic / expanded polystyrene'.

The 2007 and 2022 C&I audit results are provided side by side in Table 8. Direct comparisons are indicative only and cannot be relied upon due to the different audit methodologies used.

*Table 8: Comparison between 2007 and 2022 C&I audit results*

#	Audit category	2007 audit results (% wt.)	2022 audit result (% wt.)	Change (% points)
1	Paper and cardboard	16.9%	18.9%	2%
2 & 3	Food organics (loose) and food organics (packaged in steel & glass, plastic)	32.0%	18.8%	-13%
4	Green waste and garden waste	4.6%	1.7%	-3%
5	Wood (all including treated and untreated)	7.9%	13.1%	5%
6	Textile materials	4.6%	7.2%	3%
7 & 9	Recyclable plastics (coded plastic 1 - 5) and non-recyclable plastic / expanded polystyrene	4.0%	11.3%	7%
8	Plastic films (clean or contaminated)	6.4%	13.6%	7%
10	Nappies and hygiene products	0.0%	2.5%	2%
11	Hazardous materials	0.4%	0.1%	0%
12	E-Waste	0.1%	1.1%	1%
13	Glass	1.1%	2.2%	1%
14	Non-ferrous metals	0.7%	0.5%	0%
15	Ferrous metals	1.1%	2.0%	1%
16	Inert materials / misc. non-combustibles (e.g. bricks/concrete)	11.6%	1.5%	-10%
17	Fines / sweepings / dust / dirt / glass fines	1.9%	3.0%	1%
18	Other (not allocated to the above)	6.7%	2.7%	-4%

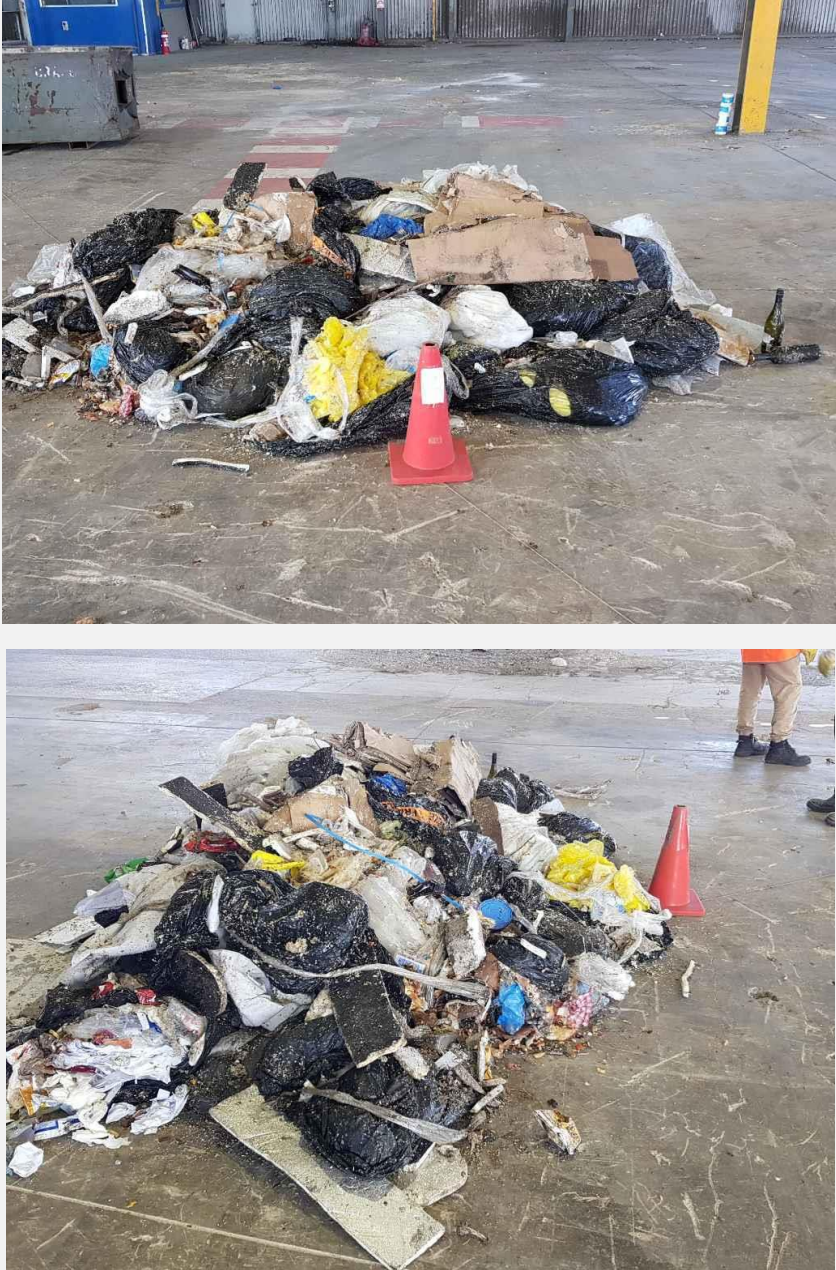
Notable changes from the 2007 to the 2022 audit include:

- decrease in food organics (-13 % points)
- decrease in inert materials (-10 % points)
- increase in plastics (+14 % points)
- increase in wood (+5 % points).

## 5. Audit Photos

Table 9 shows example photos of initial audit piles at various sites. Table 10 shows example photos of the post-audit piles from across different samples and sites.

*Table 9: Example photos of initial audit piles*

Sample	Photos
Sample A	

Sample B



Sample C

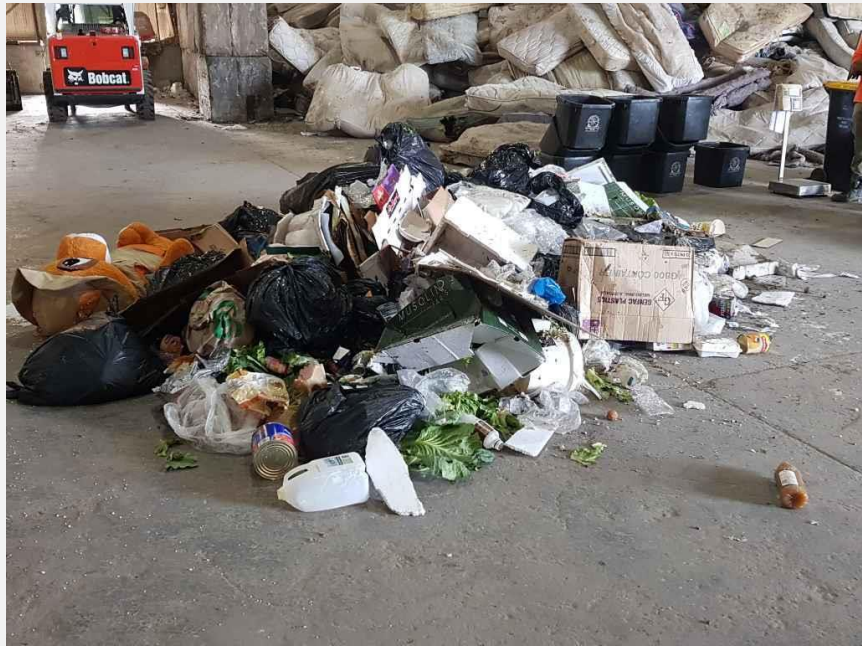





Table 10: Example photos of the post-audit piles

#	Audit category	Photos
1	Paper and cardboard	 <p>The top photograph shows a large, messy pile of cardboard boxes and crumpled paper on a concrete floor. In the background, a white wall features a 'WARNING' sign that reads 'ONLY TRANSPORT WHEN EMPTY'. To the left, there is a partially visible sign with the text 'MILLER/MECA', 'UNDESIRABLE', 'AL', 'TOP', and 'IDE'. The bottom photograph shows another large pile of similar waste, including flattened cardboard boxes, crumpled paper, and other debris, situated in a similar industrial environment.</p>



2 Food organics  
(loose)





**3** Food organics  
(packaged in steel &  
glass, plastic)





4 Green waste and garden waste





- 5 Wood (all including treated and untreated)





**6** Textile materials







7 Recyclable plastics  
(coded plastic 1 - 5)





**8** Plastic films (clean or contaminated)





9 Non-recyclable plastic / expanded polystyrene





**10** Nappies and hygiene products





11 Hazardous materials





12 E-Waste



13 Glass





**14** Non-Ferrous Metals





**15** Ferrous Metals





**16** Inert materials /  
misc. non-  
combustibles (e.g.  
bricks/ concrete)





**17** Fines / sweepings /  
dust / dirt / glass  
fines







**18** Other (not allocated to the above)





(08) 8294 5571  
11 Paringa Ave, Somerton Park, South  
Australia 5044

