

# Domestic kerbside waste and recycling in NSW

Results of the 2011 waste audits



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# Summary

During 2010–11, 66 councils from the Sydney Metropolitan Area (SMA), Extended Regulated Area (ERA) and Regional Regulated Area (RRA) carried out household waste and recycling kerbside bin audits as part of the Waste and Sustainability Performance Improvement Payment (WaSIP) program set up by the NSW Environment Protection Authority (EPA). This report analyses the data collected across all of the audits and presents the findings. It covers the generation and composition of household waste and recycling, as well as the proportion of potential recyclables in the residual waste stream, and contamination in the dry recycling and garden organics streams.

## Key findings

### Residual waste

- overall 13,783 households were audited across 66 local government areas (LGAs)<sup>1</sup>
- on average, each household generated 10.1 kg per week of residual waste
- there was no marked difference in average residual waste generation between the SMA, ERA and RRA compared to the overall average
- the average proportion of potential dry recyclables in residual waste streams was 22.1% based on materials typically recycled in the dry recycling stream
- the most significant materials in the residual waste bin were food and garden organics at 45%, followed by paper at 19.6%. Plastic and glass made up 10.5% and 3.7% respectively.

### Dry recycling

- overall 12,230 households were audited across 54 LGAs
- on average, each household generated 5.6 kg per week of dry recycling
- households in the SMA and ERA generated close to the overall average, while households in the RRA generated 0.6 kg more than the overall household average of dry recycling
- the average contamination rate in the dry recycling bin was 7.3%
- the major component of the dry recycling stream was recyclable paper at 55.1%, followed by recyclable glass at 30.1%

### Organics

Several councils within the regions now co-collect food with garden organics. These councils were treated separately for this analysis.

#### *Garden organics*

- overall 2,642 households were audited across 20 LGAs
- households on average generated 8.4 kg per week of garden organics
- the contamination rate in the garden organics bin was 2.1%

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<sup>1</sup> The overall household generation rate is based on the total number of households sampled and does not represent an average figure for NSW.

*Co-collection (food and garden organics)*

- overall 603 households were audited across 3 LGAs
- households on an average generated 8.9 kg per week of garden and food organics (co-collection)
- the contamination rate in the co-collection bin was 2.8%

## Introduction

This report presents the results of household kerbside residual waste, dry recycling and garden organics audits carried out across local government areas (LGAs) in NSW during 2010 and 2011. Altogether 66 audit reports, 38 from the Sydney Metropolitan Area (SMA), 13 from the Extended Regulated Area (ERA) and 15 from the Regional Regulated Area (RRA), councils were analysed for the results outlined in this report. Councils undertook kerbside waste audits as part of the Waste Service Performance Improvement Payment (WaSIP) program of the NSW Environment Protection Authority (EPA). Refer to Appendix 4 for a complete list of councils and corresponding audits undertaken.

A kerbside waste audit enables councils to determine household residual waste and resource recovery quantities as well as composition of each audited waste stream within their individual local government area. The data collected from the audits can also be used to monitor the progress towards the targets and outcomes set out in the *NSW Waste Avoidance and Resource Recovery Strategy 2007* (see: [www.epa.nsw.gov.au/warr/WARRStrategy2007.htm](http://www.epa.nsw.gov.au/warr/WARRStrategy2007.htm)).

The preferred methodology required by the EPA to meet the WaSIP standard was that prescribed in the *Guidelines for Conducting Household Kerbside Residual Waste, Recycling and Garden Organics Audits in NSW Local Government Areas, 2008* (DECC 2008) and its addendum (DECCW 2010). Appendix 2 details the prescribed methodology. The majority of all audits undertaken for this study complied with the prescribed methodology. Where this did not occur the data was assessed to determine fitness for purpose prior to its inclusion in the analysis.

## Overview

Although detailed information on material composition in each waste stream was measured, this report only aims to provide information on household generation (average overall, regional and waste stream figures), composition of each waste stream, potential recyclables in residual waste stream and contamination rates in dry recycling and organics stream. Refer to Appendix 1 for statistical approaches, calculations and data limitations.

This report details the results of analyses carried out for all major material categories as well as total bin weight, contamination in the dry recycling bin and potential recyclables in the residual waste bin. The calculations are based on total samples available for respective waste streams and representative of entire collected sample size. This report does not provide any analysis to distinguish between single unit dwellings (SUD) and multi unit dwellings (MUD).

## Household generation

Household generation characterises the quantity of waste generation of a typical household from the individual waste streams (residual waste, dry recycling and organics) presented at the kerbside from both SUD and MUD across NSW.

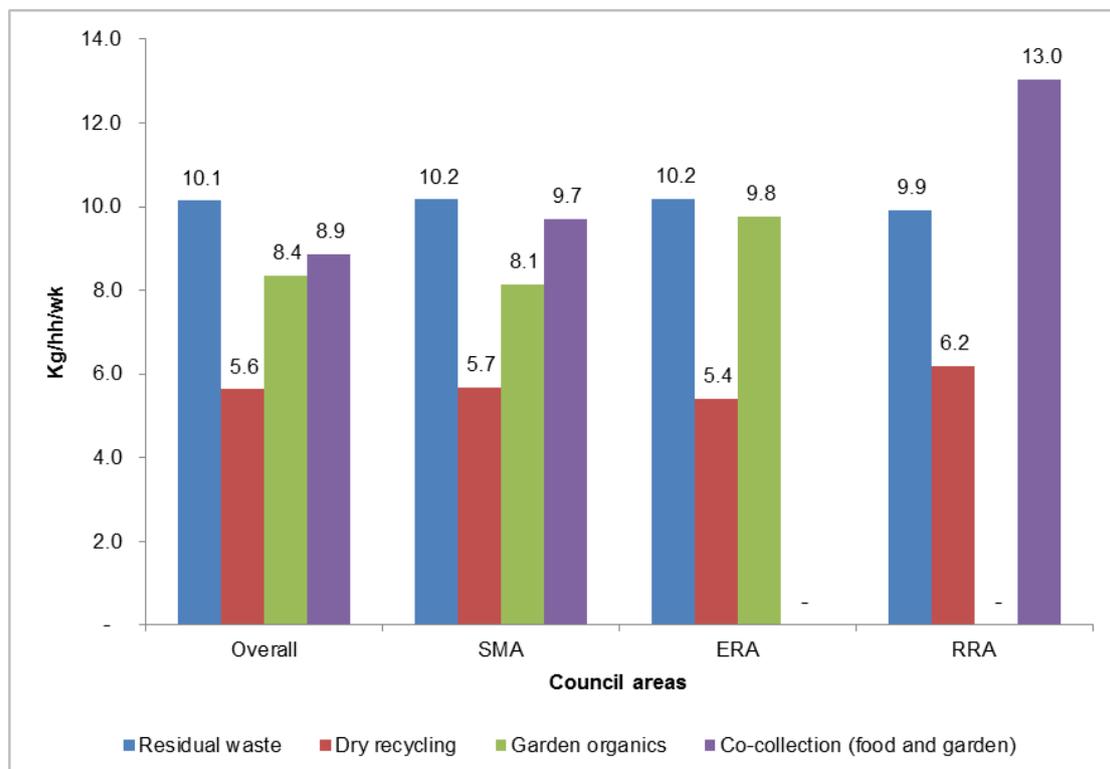
Household generation rates were calculated using the total weights of bin contents from respective collection systems divided by the number of contributing households for each stream.

$$\text{Generation rate} = \frac{\text{total weight of all bin content}}{\text{number of contributing households in unit time}}$$

The bin contents were recorded in kilograms and normalised for weekly collection across all waste streams. The number of contributing households is the total samples collected for audit purpose across the regions. The total sample size, breakdown for each region and waste stream is presented in Appendix 1. The overall generation figure is an average of all the collected samples and does not represent NSW as a whole.

The generation rates were then expressed in kilograms per household per week (kg/hh/wk). The average generation rate from each stream and region is presented in Figure 1.

**Figure 1: Average household waste generation from individual streams by council area**



On average 10.1 kg/hh/wk of residual waste was generated from 13,783 households audited across the 66 councils. There is no marked difference in average residual waste generation across the regions compared to the overall average. Councils within the RRA generated 9.9 kg/hh/wk whereas both the SMA and ERA councils on an average generated 10.2 kg/hh/wk.

The average weekly dry recycling generation from the SMA, ERA and RRA households was 5.7, 5.4 and 6.2 kg respectively. The overall household average of 5.6 kg/hh/wk is close to the amount generated from the SMA and ERA. However, households in the RRA generated 0.6 kg more than the overall household average. The dry recycling average figure is representative of 12,230 samples collected from 54 councils.

Households on an average generated 8.4 kg of garden organics weekly based on 2,642 samples collected from 20 councils within the SMA and ERA<sup>2</sup>. The average household generation rate of garden organics in the SMA is close to the overall average at 8.1 kg/hh/wk, whereas councils within the ERA generated 1.4 kg more than the overall average at 9.8 kg/hh/wk.

The overall average household generation of 8.9 kg/hh/wk for co-collection of garden/food organics is based on 603 sampled households. Only two councils from the SMA and one from the RRA had co-collection services among all the audited councils. The councils within the SMA generated 9.7 kg/hh/wk and the single council from the RRA generated 4.1 kg more than the overall average at 13.0 kg/hh/wk.

### Comparison to previous audit data

During 2007–08, councils in the SMA and the ERA carried out household residual waste audit as part of the WaSIP program. Data from all waste streams (residual waste, dry recycling and garden organics) were analysed from 51 LGAs in the Greater Sydney Region (GSR). The 2008 report (OEH 2011) on the results of waste audits of household kerbside collection systems 2007-08 presented household waste generation characteristics in terms of quantities and composition of a typical household bin. A comparison between the 2007–08 audit report and this one is made against the regional (SMA and ERA) average household generation and composition profile for each waste streams (Table 1).

The average household weekly generation rate for residual waste in SMA dropped by 1.4 kg in 2011 compared to the 2007 audits. The councils within the ERA exhibited better result than the SMA with a 2.3 kg drop in residual waste generation at 10.2 kg/hh/wk.

There was a slight increase (2%, 0.1 kg/hh/wk) in the average amount of dry recycling collected from household each week from councils within the SMA reaching 5.7 kg in 2011. Households in the ERA generated almost 1 kg less per week compared to the 2007 audit results.

**Table 1: Average generation rates for regions from 2007 and 2011 waste audits**

Waste stream	2011			2007	
	SMA	ERA	RRA <sup>3</sup>	SMA	ERA
Residual waste	10.2	10.2	9.9	11.6	12.5
Dry recycling	5.7	5.4	6.2	5.6	6.3
Garden organics	8.1	9.8	-	7.8	9.9

The garden organics generation in the SMA region was 8.1 kg/hh/wk in 2011 audits, an increase of 0.3 kg per household per week compared to the 2007 audits, while households in councils within the ERA region generated only 0.1 kg more garden organics per week compared to the 2007 audits.

<sup>2</sup> Excludes councils with co-collected food and garden organics

<sup>3</sup> No councils within RRA were audited in 2007 for garden organics

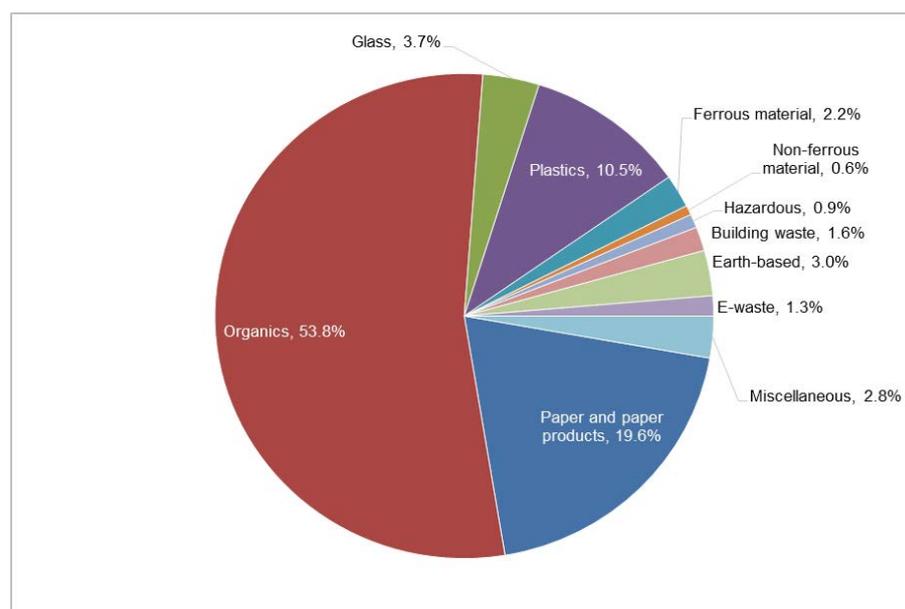
## Composition profile

The composition profile of each household kerbside waste stream is calculated using the total weight of individual waste materials and subsequently categorised into major components. Appendix 3 lists waste materials and the categories for each waste stream, while Appendix 6 provides a more complete description of items within each category. The weight of individual waste materials summed to major components is then proportioned based on the total weight of all materials generated from respective waste streams. For reporting purposes, only data for major material categories is presented for each waste stream.

### Residual waste

Total organics made up the largest component of residual waste composition at 53.8%, followed by total paper and paper products at 19.6%. Plastic and glass constituted the other major categories at 10.5% and 3.7% respectively. The remaining major material component (combined) contributed 12.5% of the residual waste composition with total earth-based material contributing the most at 3.0%. The total miscellaneous component comprising mostly of containerised food and liquid contributed 2.8% to the total composition.

**Figure 2: Residual waste composition profile**



The overall composition profile from 2011 audits as well as 2007 audits and regions are presented in Table 2. To facilitate comparison with the previous audit, material categories, without matching material type and number, are grouped as total other<sup>4</sup>. These materials were either categorised as miscellaneous or non-requisite for the previous audit.

Comparing the 2007 and 2011 audit results, there are no significant changes in the overall composition of the main contributing material categories. Similarly, the composition profile for each region in the 2011 audits is close to the corresponding overall profile.

<sup>4</sup> Total other constitutes total of hazardous, building waste, earth-based, e-waste and miscellaneous materials.

**Table 2: Overall and regional residual waste composition profile for major material category**

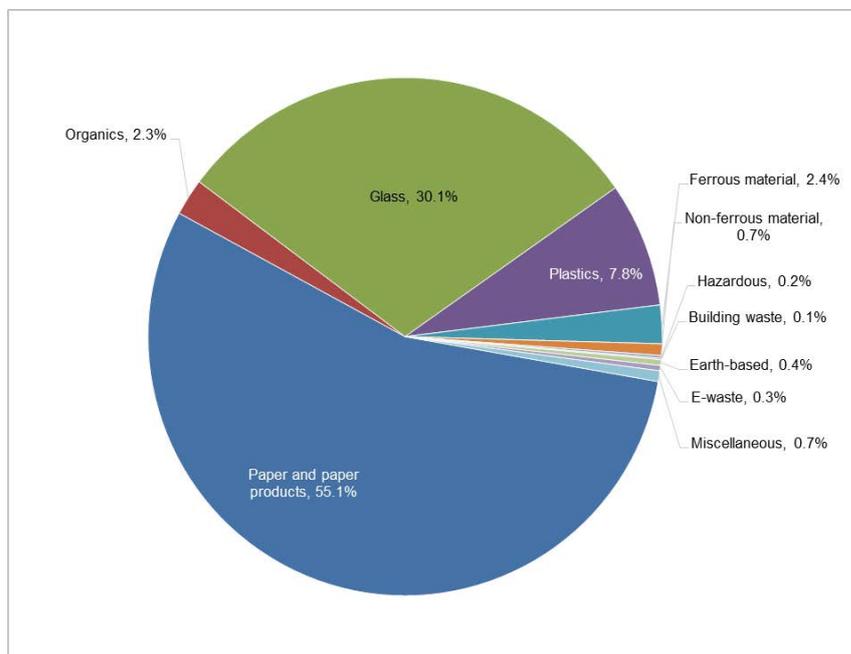
Material category	Overall (2007)	Overall (2011)	Regions (2011)		
			SMA	ERA	RRA
Total paper and paper products	19.7%	19.6%	21.2%	16.3%	17.5%
Total organics	56.0%	53.8%	53.2%	56.0%	53.4%
Total glass	4.1%	3.7%	3.3%	4.3%	4.5%
Total plastics	10.0%	10.5%	10.4%	10.3%	11.0%
Total ferrous material	2.4%	2.2%	2.1%	2.3%	2.5%
Total non-ferrous material	0.6%	0.6%	0.6%	0.7%	0.9%
Total other *	7.3%	9.6%	9.3%	10.3%	10.4%

\* Total other constitutes total of hazardous, building waste, earth based, e-waste and miscellaneous materials.

## Dry recycling

Recyclable paper and paper products made up the largest component in the dry recycling stream at 55.1% followed by glass and plastic at 30.1% and 7.8% respectively. The other material categories constituted the remaining 7% with total organics and ferrous materials contributing 2.3% and 2.4% respectively (Figure 3).

**Figure 3: Dry recycling composition profile**



Apart from a drop in the total paper (from 60.6% in 2007 to 55.1% in 2011) collected, the proportion of all the other contributing materials in the dry recycling stream increased in 2011 compared to the 2007 audits, as shown in Table 3.

**Table 3: Overall and regional dry recycling composition profile for major material category**

Material category	Overall (2007)	Overall (2011)	Regions (2011)		
			SMA	ERA	RRA
Total paper and paper products	60.6%	55.1%	57.1%	50.7%	50.1%
Total organics	2.2%	2.3%	2.5%	1.9%	1.6%
Total glass	26.8%	30.1%	28.5%	34.5%	34.2%
Total plastics	6.8%	7.8%	7.7%	7.8%	9.2%
Total ferrous material	2.0%	2.4%	2.3%	2.6%	3.3%
Total non-ferrous material	0.6%	0.7%	0.6%	1.0%	0.9%
Total other*	1.1%	1.6%	1.7%	1.5%	0.8%

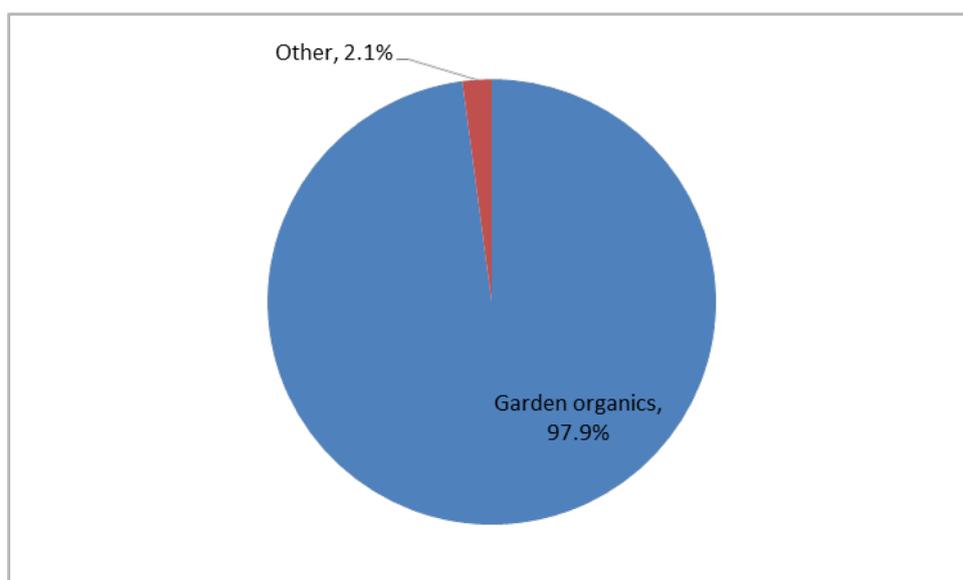
\* Total other constitutes total of hazardous, building waste, earth based, e-waste and miscellaneous materials.

## Organics

### Garden organics

Of the audits undertaken, 18 councils included audits of households where bins were provided for garden organics only (16 in the SMA and 2 in the ERA). There were no audits from the RRA. The proportion of constituent materials in these audits is presented in Figure 4. The garden and vegetation component made up 97.9% of the composition. The remaining 2.1% was either potentially recyclables organics, like food waste (1%) or non recyclable materials. In these bins, other organic material (including food) and non recyclables were considered contamination.

**Figure 4: Garden organics composition profile**



The proportion of garden organics in the overall composition profile increased to 97.9% in the 2011 audits compared to the 2007 audits (96.7%) as shown in Table 4. The proportion of other organic materials including food waste, dropped from 2.2% in

2007 to 1.0% in 2011. The composition of other contributing recyclable and non-recyclable material category remained almost similar in both the audits.

**Table 4: Overall and regional garden organics composition profile for major material category**

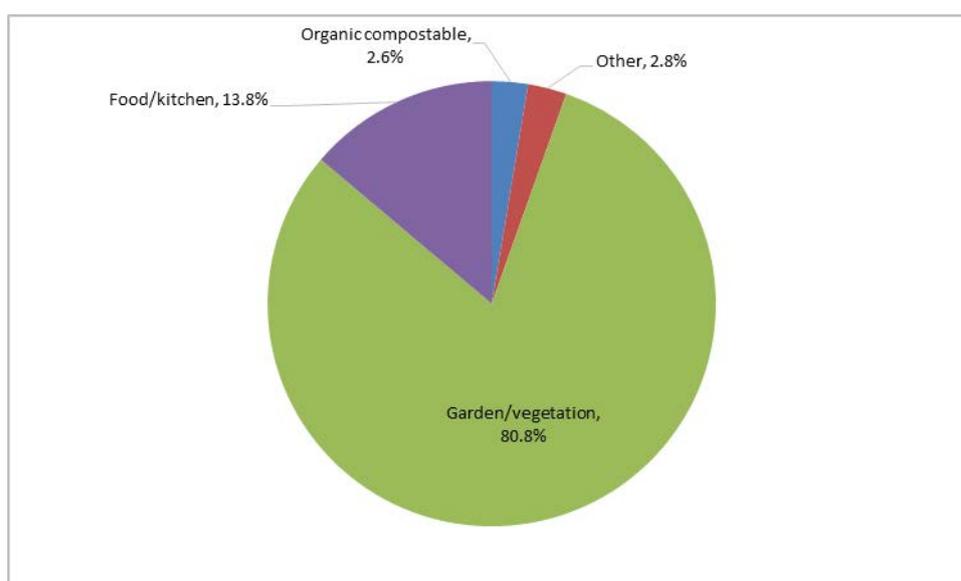
Material category	Overall (2007)	Overall (2011)	Regions (2011)		
			SMA	ERA	RRA
Garden organics	96.7%	97.9%	97.8%	98.8%	-
Other organics	2.2%	1.0%	0.9%	1.1%	-
Total paper and paper products	0.1%	0.1%	0.1%	0.0%	-
Total glass	0.0%	0.0%	0.0%	0.0%	-
Total plastics	0.1%	0.1%	0.1%	0.1%	-
Total ferrous	0.0%	0.0%	0.0%	0.0%	-
Total non-ferrous	0.0%	0.0%	0.0%	0.0%	-
Total other *	0.7%	0.8%	0.9%	0.1%	-

\*Total other includes total of hazardous, building, earth based, e-waste and miscellaneous waste.

### Co-collection (food and garden organics)

Two councils in the SMA region and one from the RRA region conducted a waste audit on co-collection service provided by their council. No council in the ERA provided data on co-collection. The composition profile of co-collection services constituted mainly of garden/vegetation at 80.8% followed by food organics at 13.8%. The remaining proportion constituted other recyclable organic materials at 2.6% and other materials considered as contaminants at 2.8%. The contamination mainly consisted of paper products at 1.8% of the composition.

**Figure 5: Co-collection (food and garden organics) composition profile**



The proportion of garden/vegetation and compostable organics in co-collection composition was higher in RRA at 84.1% and 4.3% respectively compared to the overall and SMA region. The SMA had the highest proportion of food/kitchen waste at 18.5% as shown in Table 5.

**Table 5: Overall and regional co-collection composition profile for major material category**

Material category	Overall (2007)*	Overall (2011)	Regions (2011)		
			SMA	ERA*	RRA
Garden / Vegetation Organics	-	80.8%	77.5%	-	84.1%
Organics (Food / Kitchen)	-	13.8%	18.5%	-	9.1%
Organic compostable	-	2.6%	0.9%	-	4.3%
Total Paper and Paper Products	-	1.8%	1.6%	-	2.0%
Total Glass	-	0.1%	0.2%	-	0.1%
Total Plastics	-	0.1%	0.1%	-	0.1%
Total Ferrous	-	0.1%	0.1%	-	0.1%
Total Non-Ferrous	-	0.0%	0.0%	-	0.0%
Total Other **	-	0.7%	1.0%	-	0.3%

\*No co-collection service audit was carried out in 2007

\*\*Total other includes total of hazardous, building, earth based, e-waste and miscellaneous waste.

## Potential recyclables profile

While there may be other materials considered as recyclable, only those materials considered recyclable in the dry recycling stream have been used to calculate the potentially recyclable percentage in the residual waste stream (see Appendix 5 for the nominated list of recyclable materials).

The proportion of potentially recyclable material present in the residual waste stream is calculated as:

$$\% \text{ potential recyclable} = \frac{\text{Weight of recyclable material in residual waste bin content} \times 100}{\text{Total weight of residual waste bin content}}$$

## Recyclables in residual waste

Figure 6 illustrates the proportion of potentially recyclable material that was present in the residual waste stream. These were categorised as recyclable paper, plastic, glass, ferrous and non-ferrous material. The residual waste stream constituted 22.1% of potential dry recyclable materials consisting mainly of recyclable paper and plastic at 8.2% and 8.4% respectively. The other recyclables made up the remaining 5.5% of potential recyclables materials with recyclable glass contributing the most at 3.2%, as shown in Figure 6.

**Figure 6: Potential dry recyclable materials in residual waste stream**

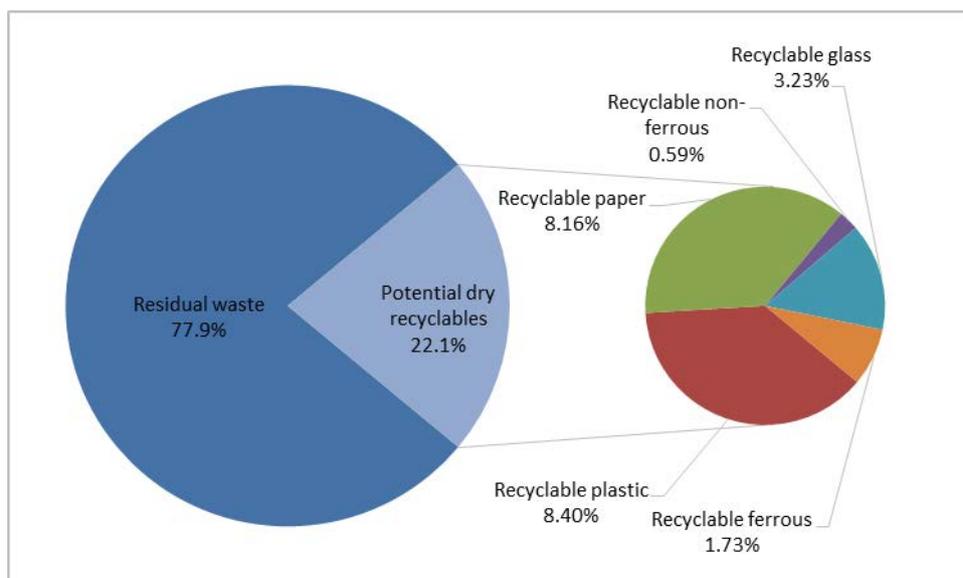


Table 6 shows that the proportion of potentially recyclable materials in the residual waste stream dropped by almost one percent in 2011 compared to the 2007 audits. The proportion of potential dry recyclables in both the ERA and RRA regions were higher than the overall figure at 22.4% and 24.0% respectively.

**Table 6: Overall and regional potential dry recyclables materials in residual waste stream**

Category	Overall (2007)	Overall (2011)	Regions (2011)		
			SMA	ERA	RRA
Potential dry recyclables	23.0%	22.1%	21.6%	22.4%	24.0%
Residual waste	77.0%	77.9%	78.4%	77.6%	76.0%

### Garden and food organics in residual waste stream

With the addition of food and garden organic materials, the residual waste stream contained a combined total of 67.1% of potential dry recycling and organic materials. The proportion of potential food organics was the largest component at 35.3%, followed by dry recyclables at 22.1% and garden/vegetation at 9.7% (Figure 7).

**Figure 7: Potential garden and food organics in residual waste stream**

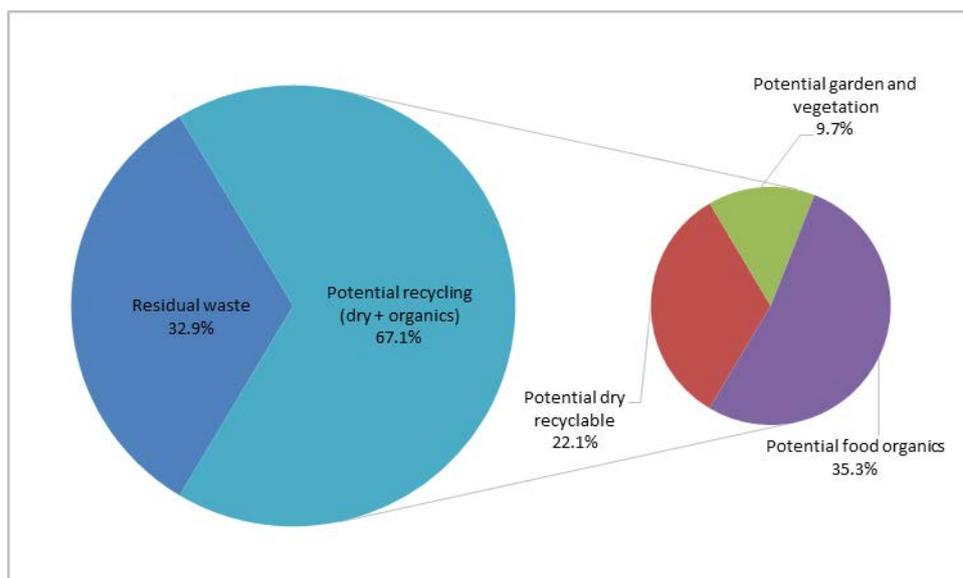


Table 7 shows that the proportion of potentially recyclable food organics in the residual waste stream dropped to 35.3% in 2011 from 40.3% in the 2007 audits. Similarly, the potentially recyclable garden and vegetation proportion dropped from 11.0% in 2007 to 9.7% in 2011. However, in 2011, councils within the ERA and RRA regions generated, on average, 29.1% and 30.2% respectively of potentially recyclable food organics, which was less than the overall average for 2011.

**Table 7: Overall and regional potential garden and food organic materials proportion in residual waste stream**

Category	Overall (2007)	Overall (2011)	Regions (2011)		
			SMA	ERA	RRA
Potential dry recyclables	23.0%	22.1%	21.6%	22.4%	24.0%
Potential garden and vegetation	11.0%	9.7%	6.8%	17.2%	11.9%
Potential food organics	40.3%	35.3%	38.5%	29.1%	30.2%
Residual waste	25.7%	32.9%	33.2%	31.2%	34.0%

## Contamination rate

Similar to the calculation of potential recyclables, contamination rates are determined by the amount of any non-recyclable materials present in the dry recycling or garden organics as a proportion of the total bin weight in those streams.

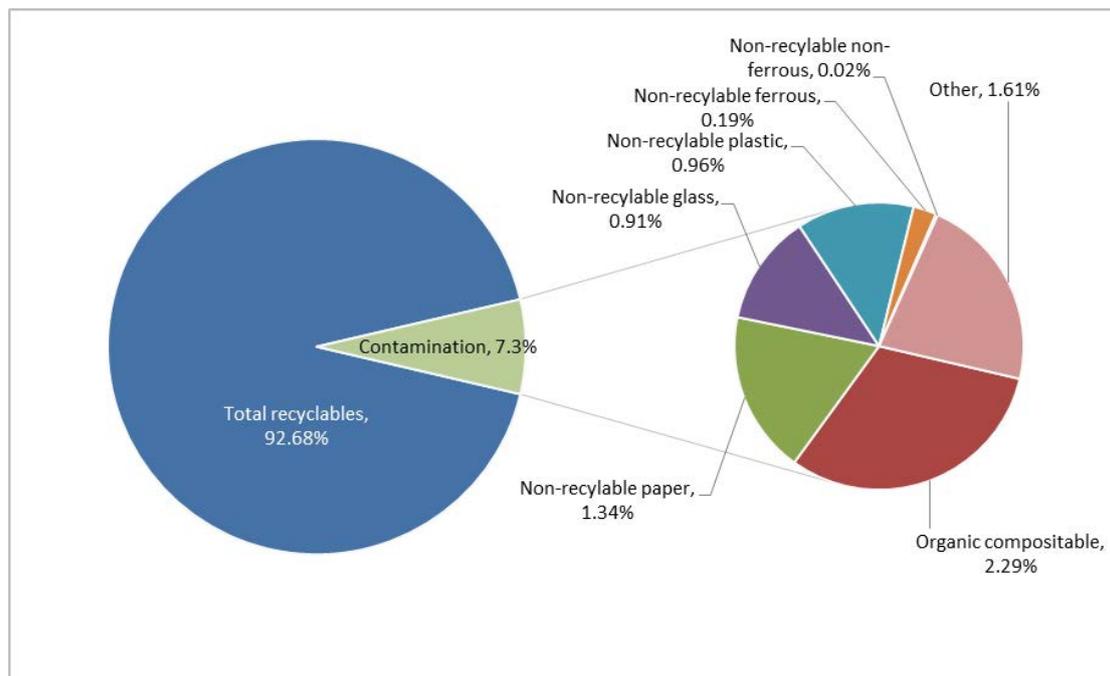
The contamination rates in dry recycling and garden organics waste stream is calculated as:

$$\% \text{ contamination} = \frac{\text{Total weight of non-recyclable material in bins} \times 100}{\text{Total weight of bin contents}}$$

## Dry recycling

As shown in Figure 8, contamination in the dry recycling stream was 7.3% of the overall bin content. Organic compostable materials constituted most of the contamination in dry recycling stream at 2.3% followed by a collective total for hazardous, building, earth-based, e-wastes and other specified miscellaneous wastes at 1.6%. The remaining 3.4% constituted other non-complaint materials, including non-recyclable paper, glass and plastic.

**Figure 8: Contamination in the dry recycling stream**



As shown in Table 8, the contamination rate increased to 7.3% in 2011 from 5.4% in the 2007 audits. Notable differences were the rise in non-recyclable plastic and glass in the dry recycling waste stream. At 8.0%, contamination was highest in the SMA but this was offset by lower than average contamination in the ERA and RRA.

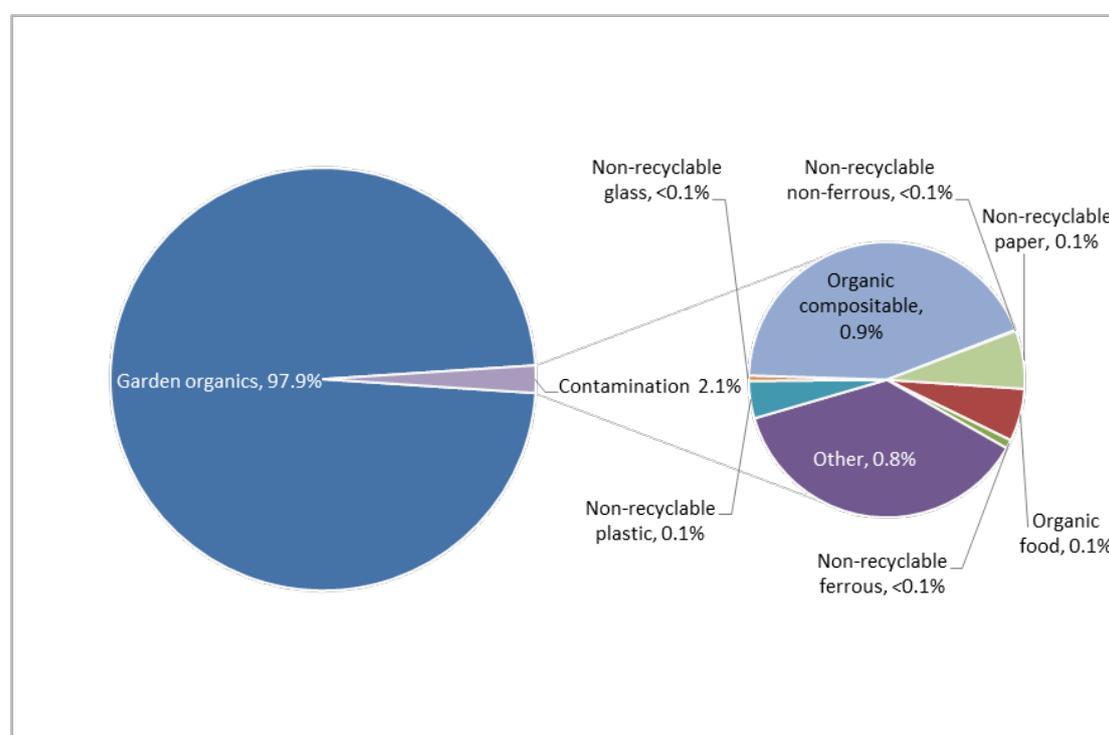
**Table 8: Overall and regional contamination rate in dry recycling stream**

Category	Overall (2007)	Overall (2011)	Regions (2011)		
			SMA	ERA	RRA
Contamination rate	5.4%	7.3%	8.0%	6.1%	4.2%

## Garden organics

The contamination rate for the garden organics waste stream was 2.1% (Figure 9). Organic matter, mainly food and other compostable comprised almost half of the contamination at 1% in total. The remaining 1.1% was of other non-complaint materials.

**Figure 9: Contamination in garden organics stream**



Compared to the 2007 audits, the garden organics waste stream contamination rate dropped from 3.3% to 2.1% in 2011. The contamination rate for the SMA is close to the overall figure at 2.2% in 2011, however, the ERA region had a lower contamination rate at 1.2% (Table 9).

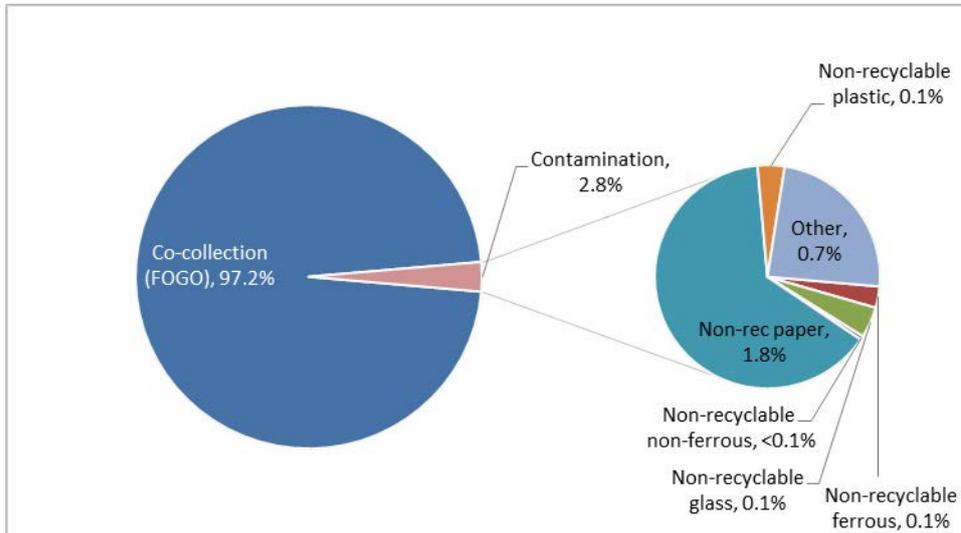
**Table 9: Overall and regional contamination rate in garden organics stream**

Category	Overall (2007)	Overall (2011)	Regions (2011)		
			SMA	ERA	RRA
Contamination rate	3.3%	2.1%	2.2%	1.2%	-

## Co-collection (food and garden organics)

The contamination rate for the co-collection (food and garden organics) stream was 2.8% as illustrated in Figure 10. Non recyclable paper constituted a major part of the contamination at 1.8% and the remaining one percent was other non complaint materials also commonly found in dry recycling waste streams.

**Figure 10: Contamination in co-collection (food and garden organics) stream**



The contamination rate in the co-collection waste stream in the SMA was higher than the overall figure at 3.0%, but was offset by a lower 2.5% contamination rate in the RRA (Table 10).

**Table 10: Overall and regional contamination rate in co-collection (food and garden organics) stream**

Category	Overall (2007)	Overall (2011)	Regions (2011)		
			SMA	ERA	RRA
Contamination rate	NA	2.8%	3.0%	NA	2.5%

## Appendix 1: Statistical approaches, calculations and data limitations

### Statistical approach

Using statistical methodologies determined from previous waste audit data analyses (OEH2011) optimal sample sizes for kerbside residual waste, dry recycling and garden organics streams (representative of a specified geographical area being audited) were calculated for individual councils. Calculations were based on the coefficient of variation (CV) values for total weights of bin contents. The basis for this determination has been previously reported (OEH 2011) and relies upon the average of all weighed samples and the standard deviation within the sample. All statistical analyses assumed, as for previous studies, a confidence interval level of 90% with 10% uncertainty in the result.

The sample size (n) in terms of the number of households to be audited within an LGA was calculated using the formula:

$$n = \left( \frac{1.645 \times x}{10} \right)^2$$

where,

- 1.645 is the two-tailed z-score ( $z_{0.05}$ ) corresponding to the desired 90% confidence level in the sample size
- 10 is the desired % uncertainty (U) in the audit data
- CV is the coefficient of variation (expressed as a percentage in this equation) and is defined as the ratio of the standard deviation to the mean

Minimum sample sizes were made available to all councils where data was available from previous audits. In the absence of previous audit data, minimum sample sizes were based on the original minimum sample size recommended in the Guidelines, i.e. 220 (DECC 2008).

In addition to using this statistical methodology, the aggregation of data from multiple audits allowed the EPA to determine for which materials in the overall, and regional, sample sizes were sufficient to accurately calculate, within a 90% confidence interval, the true proportion of those materials within the waste stream.

For a major component, the number of samples contributing to the dataset was sufficient to accurately determine the mean composition of the majority of those components<sup>5</sup>. In addition, samples contributing to the overall bin weight and the weight of potential dry recycling in the residual waste stream were shown to be sufficient to provide an accurate mean value for those categories.

The results are summarised in Table A1.1.

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<sup>5</sup> Except for total building waste in residual waste stream, and for dry recycling stream, total hazardous, building waste, earth based, and miscellaneous components did not have sufficient sample sizes.

**Table A1.1: Minimum sample size (number of audited households) for waste streams based on major material component, total weight, potential recycling and contamination rate (%)**

Category	Waste streams							
	Residual waste				Dry recycling			
	Overall	SMA	ERA	RRA	Overall	SMA	ERA	RRA
Total Paper and Paper Products	373	319	458	547	690	575	178	205
Total organics	246	232	267	276	9,781	11,442	5,894	11,192
Total glass	1,471	1,025	1,757	1,954	745	662	511	464
Total plastics	192	166	196	286	508	441	298	228
Total ferrous	1,710	1,579	1,885	1,877	951	830	1,517	564
Total non-ferrous	1,370	996	2,126	1,286	3,536	3,723	1,191	1,709
Total hazardous	8,583	8,345	12,213	5,770	67,505	51,197	25,016	35,142
Total building waste	23,037	21,234	30,649	22,305	73,779	57,925	219,723	33,701
Total earth based	8,927	9,325	9,322	7,223	20,672	17,192	26,276	9,500
Total e-waste	7,888	6,328	7,388	11,121	9,815	8,078	16,893	17,015
Total miscellaneous	2,170	1,876	2,363	3,657	33,155	27,119	70,208	40,814
<b>Total</b>	<b>153</b>	<b>149</b>	<b>153</b>	<b>170</b>	<b>590</b>	<b>504</b>	<b>152</b>	<b>114</b>
Potential recyclables in residual waste	213	180	265	261				
Contamination rate in dry recycling					2,602	2,102	2,054	3,235
<b>Actual sample size</b>	<b>13,782</b>	<b>8,806</b>	<b>2,798</b>	<b>2,178</b>	<b>12,230</b>	<b>8,806</b>	<b>2,794</b>	<b>630</b>

Note: The shaded areas indicate insufficient sample size for respective waste stream and material category.

## Calculations

All statistical analyses were conducted on waste audit raw data sourced from 66 Local Government Areas (LGA) in the SMA, ERA and the RRA regions across NSW. Residual waste audits were carried out by all the 66 councils, 54 councils conducted residual waste and dry recycling audits and 23 councils conducted residual waste, dry recycling and garden organics (also includes co-collection service) audits.

The sample numbers (number of households) for each waste stream and regional breakdown used for the above calculations is provided in Table A1.2.

**Table A1.2: Number of households audited for each waste stream**

Waste stream	Number of households audited			
	Overall	SMA	ERA	RRA
Residual waste	13,783	8,806	2,798	2,179
Dry recycling	12,230	8,806	2,794	630
Garden organics	2,642	2,285	357	-
Co-collection (food and garden)	603	347	-	256

The nominated list of materials and aggregated category (see Appendix 3) were used in all calculations of averages and percentage figures.

It was assumed that total material weights recorded by the auditors were in kilograms per week for weekly collections (all residual waste audits), and in the cases where collections were on a fortnightly basis (some recycling and all garden organics) the weights were recorded as kilograms per fortnight. The total bin content weights for all waste streams were then normalised to weekly collection ahead of any analysis and further calculations.

### Data limitations

For the purposes of this report no analysis has been carried out to distinguish between single unit dwelling (SUD) and multi unit dwelling (MUD) households. If the prescribed methodology was followed, data from MUD households was treated as being representative of the entire number of household within the MUD complex and each household was treated as one sample in the overall sample count, for example, if a unit block of 4 units was encountered and waste was collected for all units then the overall total weight was considered as emanating from 4 households and the MUD considered to contribute 4 samples (of equal value) to the overall sample count.

Household generation rates, expressed in kg/hh/wk, for each waste stream were calculated on the total samples available for that waste stream, whether or not they were paired with corresponding bins from that household. Generation rates for each waste stream are therefore representative of the entire sample and the addition of the individual values for each stream should not be assumed to represent the total for households where all bins were collected.

Similarly, for waste streams, composition data was determined on the total samples for individual waste streams and are representative of the entire sample for a particular region.

## Appendix 2: Audit methodology

Waste audits were carried out in accordance with the EPA procedures outlined in the *Guidelines for Conducting Household Kerbside Residual Waste, Recycling and Garden Organics Audits in NSW Local Government Areas, 2008* (DECC 2008) and its addendum (DECCW 2010)

The audits were weight based physical audits and aimed to provide councils with cost-effective, accurate and repeatable audit methodology.

The guideline stipulated a minimum 220 sample size where previous results were not available. This was preferred for combined domestic residual waste and recycling (and/or garden organics) audit. The recommended sample size provided acceptable levels of accuracy for common material categories including food / garden organics, paper, plastics, metals, and glass.

The guideline also recommended household-by-household (also referred to as bin-by-bin) sampling technique was preferred, which involved collection of the contents of all residual waste and/or dry recycling and/or organics presented by households. The household bin contents were bagged and labelled to gather data for differences in household generation and management of waste. The preferred sampling technique provides better quality and accurate data for assessments and also enables exclusion of outliers biasing the sample. It also allows observation about different types of waste generation and resource recovery behaviours across the community.

Simple random sampling was used to select households to be audited. Both single unit dwellings (SUD) and multi unit dwellings (MUD) households were sampled for the audit.

## Appendix 3: Nominated materials, codes and categories of the domestic kerbside waste stream

Code	Material description	Category
A01	Newspaper	Total Paper and paper products
A02	Magazines/ brochures	
A03	Misc. Packaging	
A04	Corrugated cardboard	
A05	Cardboard / package board	
A06	Liquid paperboard containers	
A07	Disposable paper product	
A08	Print/ writing/ office paper	
A09	Composite (mainly paper)	
A90	Nappies disposable	
A092	Contaminated soiled paper	
B01	Food/ kitchen	Total Organics
B02	Garden/ vegetation	
B03	Other putrescible	
C01	Wood/ timber	
C02	Textile/ rags	
C03	Leather	
C04	Rubber	
C05	Oils	
D012	Glass beverage containers	Total Glass
D012	Glass non beverage containers / other packaging glass	
D02	Miscellaneous/ other glass	
D050	Mixed glass / fines	

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Code	Material description	Category
E01	PET beverage containers	Total Plastics
	PET packaging (excluding beverage containers)	
	PET other non beverage / non packaging	
E02	HDPE beverage containers	
	HDPE packaging (excluding beverage containers)	
	HDPE other non beverage / non packaging	
E03	PVC beverage containers	
	PVC packaging (excluding beverage containers)	
	PVC other non beverage / non packaging	
E04	LDPE packaging	
	LDPE non-packaging	
E05	PP packaging	
	PP non-packaging	
E06	PS packaging *	
	PS & EPS non-packaging	
	EPS packaging *	
E07	Other plastics	
E08	Composite (mostly plastic)	
	Plastic bags *	
	Plastic film *	
F01	Steel beverage containers	Total Ferrous
	Steel packaging (excluding beverage containers)	
F02	Steel other non-packaging	
F03	Composite (mostly ferrous)	

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Code	Material description	Category
G01	Aluminium beverage containers	Total Non-ferrous
	Aluminium packaging (excluding beverage containers)	
	Aluminium non-packaging	
G02	Other non-packaging non-ferrous	
G03	Composite (mostly non-ferrous)	
H01	Paint	Total Hazardous
H02	Fluorescent tubes *	
H03	Dry cell and car batteries (non-rechargeable)*	
H03	Dry cell and car batteries (rechargeable) *	
H04	Vehicle batteries *	
H05	Household chemicals	
H061	Asbestos	
H07	Clinical pathogenic infectious	
H08	Gas bottles *	
H00	Hazardous other	
I50	Building materials and fittings (NEC)**	
I0	Ceramics dust dirt rock inert ash	Total Earth-based
	Computer equipment *	Total E-waste
	TVs *	
	Mobile phones *	
	Electrical items and peripherals*	
Y571	Toner cartridges *	Total Miscellaneous
	Containerised food & liquid *	
XX00	Other (specify)	

\* Plastic shopping bags

\*\* Not elsewhere considered

## Appendix 4: List of councils

Residual waste audit				Residual waste and dry recycling				Residual waste, dry recycling and organics			
S.N	ABS	Region	Council	S.N	ABS	Region	Council	S.N	ABS	Region	Council
1	150	S	Ashfield Municipality	1	150	S	Ashfield Municipality	1	150	S	Ashfield Municipality
2	200	S	Auburn Council	2	200	S	Auburn Council	2	350	S	Bankstown City Council
3	350	S	Bankstown City Council	3	350	S	Bankstown City Council	3	500	S	Hills Shire Council
4	500	S	Hills Shire Council	4	500	S	Hills Shire Council	4	1300	S	Burwood Council
5	750	S	Blacktown City Council	5	750	S	Blacktown City Council	5	1550	S	Canterbury Council
6	1100	S	Botany Bay City Council	7	1100	S	Botany Bay City Council	6	4150	S	Hurstville City Council
7	1300	S	Burwood Council	8	1300	S	Burwood Council	7	4450	S	Kogarah Municipal Council
8	1450	S	Camden Council	9	1450	S	Camden Council	8	4700	S	Lane Cove Municipal Council
9	1500	S	Campbelltown City Council	10	1500	S	Campbelltown City Council	9	4800	S	Leichhardt Municipal Council
10	1520	S	Canada Bay Council	11	1520	S	Canada Bay Council	11	4900	S	Liverpool City Council
11	1550	S	Canterbury Council	12	1550	S	Canterbury Council	12	5150	S	Manly Council
12	2850	S	Fairfield City Council	14	2850	S	Fairfield City Council	13	5200	S	Marrickville Council
13	3950	S	Holroyd City Council	17	3950	S	Holroyd City Council	14	5350	S	Mosman Municipal Council
14	4000	S	Hornsby Shire Council	18	4000	S	Hornsby Shire Council	15	6350	S	Penrith City Council *
15	4100	S	Hunters Hill Municipality Council	19	4100	S	Hunters Hill Municipality Council	16	6370	S	Pittwater Council
16	4150	S	Hurstville City Council	20	4150	S	Hurstville City Council	17	6550	S	Randwick City Council
17	4450	S	Kogarah Municipal Council	22	4450	S	Kogarah Municipal Council	19	7150	S	Sutherland Shire Council
18	4500	S	Ku-ring-gai Council	23	4500	S	Ku-ring-gai Council	20	8000	S	Warringah Council
19	4700	S	Lane Cove Municipal Council	25	4700	S	Lane Cove Municipal Council	21	8050	S	Waverley Council
20	4800	S	Leichhardt Municipal Council	26	4800	S	Leichhardt Municipal Council	22	8250	S	Willoughby City Council
21	4900	S	Liverpool City Council	28	4900	S	Liverpool City Council	24	8500	S	Woollahra Municipal Council *
22	5150	S	Manly Council	30	5150	S	Manly Council	10	4850	R	Lismore City Council *
23	5200	S	Marrickville Council	31	5200	S	Marrickville Council	18	6900	E	Shellharbour City Council
24	5350	S	Mosman Municipal Council	32	5350	S	Mosman Municipal Council	23	8450	E	Wollongong City Council
25	5950	S	North Sydney Council	34	5950	S	North Sydney Council				
26	6250	S	Parramatta City Council	35	6250	S	Parramatta City Council				
27	6350	S	Penrith City Council	36	6350	S	Penrith City Council				
28	6370	S	Pittwater Council	37	6370	S	Pittwater Council				

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Residual waste audit				Residual waste and dry recycling			
S.N	ABS	Region	Council	S.N	ABS	Region	Council
29	6550	S	Randwick City Council	39	6550	S	Randwick City Council
30	6650	S	Rockdale City Council	40	6650	S	Rockdale City Council
31	6700	S	Ryde City Council	41	6700	S	Ryde City Council
32	7100	S	Strathfield Municipal Council	44	7100	S	Strathfield Municipal Council
33	7150	S	Sutherland Shire Council	45	7150	S	Sutherland Shire Council
34	7210	S	Sydney City Council	46	7210	S	Sydney City Council
35	8000	S	Warringah Council	47	8000	S	Warringah Council
36	8050	S	Waverley Council	48	8050	S	Waverley Council
37	8250	S	Willoughby City Council	49	8250	S	Willoughby City Council
38	8500	S	Woollahra Municipal Council	53	8500	S	Woollahra Municipal Council
39	900	R	Blue Mountains City Council	6	900	R	Blue Mountains City Council
40	2700	R	Dungog Shire Council	27	4850	R	Lismore City Council
41	4850	R	Lismore City Council	51	8400	R	Wollondilly Shire Council
42	5650	R	Muswellbrook Shire Council	13	1720	E	Cessnock City Council
43	7000	R	Singleton Shire Council	15	3100	E	Gosford City Council
44	7620	R	Upper Hunter Shire Council	16	3800	E	Hawkesbury City Council
45	8400	R	Wollondilly Shire Council	21	4400	E	Kiama Municipality Council
46	C3751	R	Port Macquarie-Hastings Council	24	4650	E	Lake Macquarie City Council
47	C4350	R	Kempsey Shire Council	29	5050	E	Maitland City Council
48	N1800	R	Coffs Harbour City Council	33	5900	E	Newcastle City Council
49	N5700	R	Nambucca Shire Council	38	6400	E	Port Stephens Council
50	N600	R	Bellingen Shire Council	42	6900	E	Shellharbour City Council
51	S3050	R	Gloucester Shire Council	43	6950	E	Shoalhaven City Council
52	S3350	R	Greater Taree City Council	50	8350	E	Wingecarribee Shire Council
53	S3400	R	Great Lakes Council	52	8450	E	Wollongong City Council
54	1720	E	Cessnock City Council	54	8550	E	Wyong Shire Council
55	3100	E	Gosford City Council				
56	3800	E	Hawkesbury City Council				
57	4400	E	Kiama Municipality Council				
58	4650	E	Lake Macquarie City Council				

<b>Residual waste audit</b>			
<b>S.N</b>	<b>ABS</b>	<b>Region</b>	<b>Council</b>
59	5050	E	Maitland City Council
60	5900	E	Newcastle City Council
61	6400	E	Port Stephens Council
62	6900	E	Shellharbour City Council
63	6950	E	Shoalhaven City Council
64	8350	E	Wingecarribee Shire Council
65	8450	E	Wollongong City Council
66	8550	E	Wyong Shire Council

*Note: \* Councils with co-collection service*

## Appendix 5: Nominated potentially recyclable materials

Code	Material description	Aggregated category
A01	Newspaper	Recyclable paper
A02	Magazines/ brochures	
A03	Misc. Packaging	
A04	Corrugated cardboard	
A05	Cardboard / package board	
A06	Liquid paperboard containers	
A07	Disposable paper product	
A08	Print/ writing/ office paper	
D012	Glass Beverage Containers	Recyclable glass
D012	Glass Non Beverage Containers / Other Packaging Glass	
E01	PET beverage containers	Recyclable plastic
	PET packaging (excluding beverage containers)	
	PET other non beverage / non packaging	
E02	HDPE beverage containers	
	HDPE packaging (excluding beverage containers)	
	HDPE other non beverage / non packaging	
E03	PVC beverage containers	
	PVC packaging (excluding beverage containers)	
	PVC other non beverage / non packaging	
E04	LDPE packaging	
	LDPE non-packaging	
E05	PP packaging	
	PP non-packaging	

Code	Material description	Aggregated category
E06	PS Packaging *	
	PS & EPS non-packaging	
	EPS packaging *	
	Plastic bags *	
	Plastic film *	
F01	Steel beverage containers	Recyclable ferrous
	Steel packaging (excluding beverage containers)	
F02	Steel other non-packaging	
F03	Composite (mostly ferrous)	
G01	Aluminium beverage containers	Recyclable non-ferrous
	Aluminium packaging (excluding beverage containers)	
	Aluminium non-packaging	
G02	Other non-packaging non-ferrous	

Materials that are not listed in the above table, but appear in the full list of materials provided in Appendix 3, are considered as contaminants in the dry recycling stream.

Apart from E02 – Garden/vegetation, all other materials listed in Appendix 3 are considered as contaminants in the garden organics stream.

## Appendix 6: Material types and items within waste categories

AWD Code	Material type	Material items
<b>Paper</b>		
A01	Newspaper	Newspapers, newspaper like pamphlets
A02	Magazines, brochures	Magazines (glossy and non-glossy), pamphlets,
A03	Miscellaneous packaging	Paper napkins, paper packaging (no plastic or wax coatings)
A04	Corrugated cardboard	Cardboard with corrugation
A05	Package board	Cardboard without corrugation (glossy and non glossy), cereal boxes, business cards
A06	Liquid paper containers	Soy milk cartons, some fruit juice cartons, UHT / Long life milk,
A07	Disposable paper product	Hand towels, tissues, coffee cups, paper food bags (unsoiled)
A08	Print / Writing office paper	A4 document paper, writing pads, letters, envelopes, books
A09	Composite (mostly paper)	Composite paper items where the weight of the paper is estimated to be greater the weight of the other materials
A90	Nappies	Used disposable nappies
A092	Contaminated soiled paper	Paper not suitable for dry recyclables, mixed and other paper
<b>Organic (compostables) waste</b>		
B01	Food / Kitchen	Vegetable scraps, meat scraps, animal food, left over food.
B02	Garden / Vegetation	Grass clippings, tree trimmings / prunings, flowers, tree wood (<20ml)
B03	Other putrescible	Animal excrement, mixed compostable items, cellophane
<b>Other organic waste</b>		
C01	Wood / Timber	Milled wood / timber, children's wooden toys, wooden skewers, garden tree (>20ml)
C02	Textile / Rags / Carpet (Organic)	Wool, cotton and natural fibre materials
C03	Leather	Leather clothing, craft leather, some shoes, belts with belt buckle
C04	Rubber	Rubber bands, rubber toys, shoes, latex gloves
C05	Oils	Used car oil, Motor and other, vegetable, cooking oil
<b>Glass</b>		
D01	Glass beverage containers	Beer bottles, wine bottles (clear, green and amber glass)
	Glass non beverage containers	Food and sauce jars
D02	Miscellaneous / Other glass	Plate glass (window and windscreen), Pyrex, corning ware, light globes, laboratory and medical glass, white opaque glass (i.e. Malibu alcohol bottles)
D050	Mixed glass / Fines	Mixed Glass or Glass fines, non recyclable

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AWD Code	Material type	Material items
<b>Plastics</b>		
E01	PET beverage containers	(Polyethylene) Soft drink bottles, juice bottles
	PET packaging (excluding beverage containers)	Some food containers (e.g. jam & sauce bottles), mouthwash containers, peanut butter jars,
	PET other non beverage or packaging	Pillows, laminated sheets, carpets
E02	HDPE beverage containers	(High Density Polyethylene) Milk bottles.
	HDPE packaging (excluding beverage containers)	Cream bottles, shampoo and cleaner bottles
	HDPE other non beverage or packaging	Buckets, crates, ag pipes, household bags
E03	PVC beverage containers	(Polyvinyl Chloride) Clear cordial and juice bottles, blister packs, plumbing pipes and fittings
	PVC PACKAGING (excluding beverage containers)	Blister packs, bold bags (unused)
	PVC other non beverage or packaging	Electrical conduits, pipes, hoses
E04	LDPE packaging	(Low Density Polyethylene) Ice cream container lids, cream bottle lids, squeeze bottles, lids, , bread bags,
	LDPE non packaging	poly pipe, black mulch film, plant nursery bags, builders, black plastic
E05	Polypropylene packaging	Ice cream containers,
E05	Polypropylene non-packaging	drinking straws, pot plant pots, some bottle caps, microwave oven ware, plastic garden settings, potato crisp bags, compost bins, worm farms
E06	Polystyrene (PS) and Expanded PS packaging	Yoghurt / sour cream containers, , hot drink cups, take away containers, meat trays, packaging foam
E06	PS and Expanded PS non packaging	plastic cutlery imitation crystal glassware, clothes pegs, coat hangers, office accessories, video/CD boxes
E07	Other plastics	Tupperware, Mixed unidentifiable plastics, low cost brittle toys, all other resins and multi-blend plastic materials, synthetic textiles all other containers
E08	Plastic – Composite ( mostly plastic)	Cigarette butts, composite plastic items where the weight of the plastic is estimated to be greater than the other material items.
<b>Ferrous materials</b>		
F01	Steel beverage containers	Steel cans for beverages, e.g. juice
F01	Steel Packaging (excluding beverage containers)	Food cans, pet food cans, tins, Aerosol cans
F02	Steel – other non packaging	Nails, Steel items
F03	Ferrous – Composite (mostly ferrous)	Composite ferrous items where the weight is estimated to be greater than the other material items.
<b>Non-ferrous materials</b>		
G01	Aluminium beverage containers	Alcoholic mixers, beer and soft drinks
G03	Aluminium packaging (excluding beverage containers)	Pet food cans, aerosol cans, industrial cans.
G02	Aluminium non packaging	Foils which are not packaging, rigid aluminium items
	Other non ferrous non packaging	Copper, brass, bronze items (non ferrous or aluminium)
	Non ferrous – Composite	Composite non ferrous items where the weight is estimated to be greater than the other material items.

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AWD Code	Material type	Material items
<b>Hazardous waste</b>		
H01	Paint	Paint (dry or wet)
H02	Fluorescent tubes *	Fluorescent tubes; compact fluorescent lamps (CFLs)
H03	Dry cell batteries – Non rechargeable *	Common batteries, AAA, AA etc, single use
H04	Dry cell batteries - Rechargeable *	Common batteries, AAA, AA etc, rechargeable
H05	Vehicle batteries *	Car batteries
H06	Household chemicals	Bleach, shampoo, cleaning products, (unused medical pills.
H07	Asbestos	Asbestos
	Pathogenic Infectious	Band aids, bandages, used tissues (items with any bodily fluids), tampons/pads,
	Gas bottles *	Gas bottles
	Hazardous – Other	Any other hazardous material, candle wax,
<b>Building waste</b>		
	Building materials and fittings	Bricks and other building materials
<b>Earth based waste</b>		
I0	Ceramics/ Dust / Dirt / Rock / Inert / Ash	Ceramics(Cups, bowls, pottery items) Dust/Dirt/Rock/Inert ( Vacuum bag contents, soil, rocks, dirt, concrete, plasterboard) and Ash
<b>E waste</b>		
Y57	Computer equipment *	Keyboard, monitor, cables, printers etc
	TVs *	
	Mobile phones *	Mobile Phones
	Electrical items *	Toaster, radio, ipod, gameboys, stereos, speakers, TVs, VCR, DVD players, small electrical, Power tools
	Toner cartridges *	Printer and toner cartridges
<b>Miscellaneous waste</b>		
XX00	Other	Other please specify

## References

- DECC 2007, *NSW Waste Avoidance and Resource Recovery Strategy 2007*, Department of Environment and Climate Change, Sydney (available at [www.epa.nsw.gov.au/warr/WARRStrategy2007.htm](http://www.epa.nsw.gov.au/warr/WARRStrategy2007.htm)).
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