Zero Waste South Australia

Government of South Australia
Zero Waste SA

Review of Recycling Activity in South Australia

2006-2007

Thursday, 22 May 2008

Hyder
Consulting

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Report no: 05 **Date:** Thursday, 22 May 2008

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Overview

In 2006–07 2.43 million tonnes of materials, ranging from asphalt to textiles was diverted from landfill to recycling in South Australia. This was up from the 2.40 million tonnes recycled in 2005-06 and is an increase in tonnes of material recycled of 1.6%.

The SA diversion rate increased (0.6%) and the SA per capita recycling rate is the highest for any State (exceeded only by the ACT).

The waste to landfill figure has dropped from 2005-06 to its lowest level in the last 4 years.

The highest recorded reprocessing quantities, by weight and in decreasing order, were concrete, steel, timber, fly ash and garden organics.

Recycling activity in South Australia continues to trend upwards. As the population continues to grow, the recycling and reprocessing industry needs to grow with it.

Table E-1 Annual South Australian landfill diversion and overall waste recycling[1]

	2003–04	2004–05	2005–06	2006-07	Change
Diversion from landfill (tonnes)	2 041 776	2 623 367	2 395 582	2 434 128	1.6%
Waste to landfill (tonnes)	1 277 892	1 180 128	1 157 925	1 144 429	-1.2%
Total waste generation (tonnes)	3 319 668	3 803 495	3 553 507	3 578 557	0.7%
SA diversion rate (%)	**61.5%**	**69.0%**	**67.4%**	**68.0%**	**0.6%**
South Australian population	1 534 000	1 542 000	1 550 042	1 584 500	2.2%
Per capita diversion (kg/person)	1 331	1 701	1 545	1 536	-0.6%
Per capita landfill (kg/person)	833	765	747	722	-3.3%
Per capita total waste (kg/person)	2 164	2 467	2 293	2 258	-1.5%

A unknown proportion of the apparent decrease in recycling from 2004–05 to 2006–07 is due to the modification of the reprocessor survey to specifically identify and exclude any recyclate material generated interstate or overseas which is then imported for reprocessing in South Australia. In 2006–07 there was 70 757 tonnes of these recyclate materials imported into South Australia for reprocessing or 2.8% of total local reprocessing. These materials were mostly fly ash (38 987 tonnes), glass (18 000 tonnes) and steel (8 349 tonnes).

The composition of recycled materials is outlined in Figure E-1.

[1] The waste to landfill figure for years 2003-04 to 2005-06 identified here differs from that published in previous reports due to new data on non-metro council waste becoming available. This lowers the diversion rate for these years by a small margin.

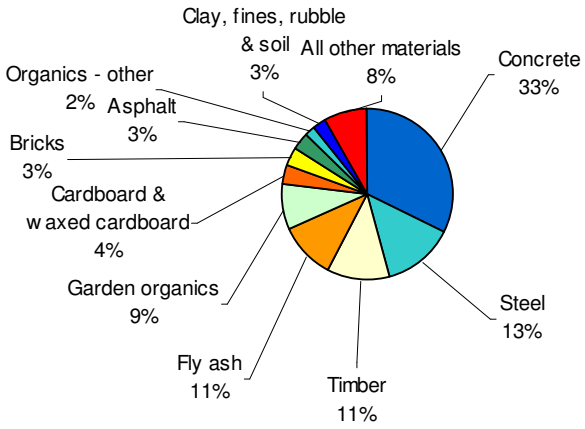

Figure E-1 Composition of recovered materials (by weight), SA 2006–07

Presented in Figure E-2 is a comparison of per capita recycling activity nationally.

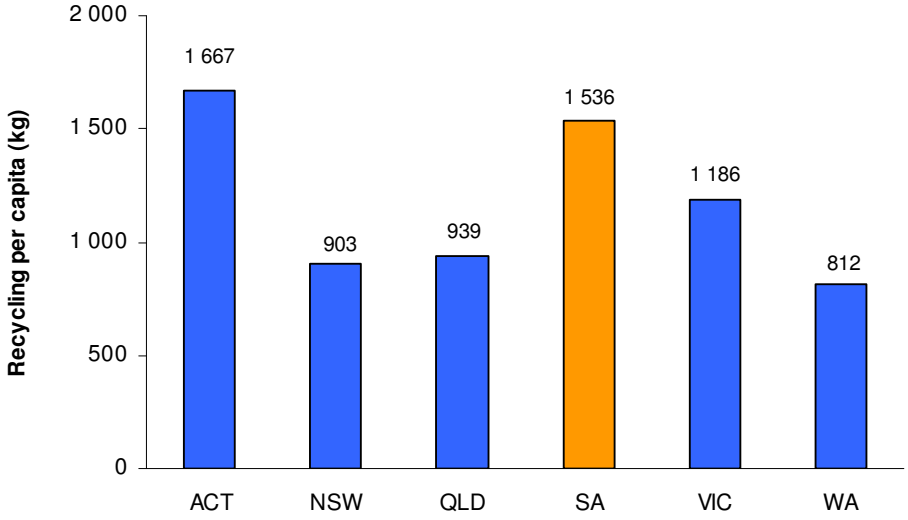

Figure E-2 Comparison of reported per capita recycling activity, by State

All data is the latest available for each of the States. The SA and ACT data is for 2006-07. The QLD, VIC and WA data is for 2005-06. Data presented for NSW is for 2002-03. The ACT data is sourced from the *2008 progress update towards No Waste*. The QLD data is sourced from *The state of waste and recycling in Queensland 2006* report. The VIC data is sourced from the *Towards Zero Waste 2005-2006* report. The WA data is sourced from *Review of Total Recycling Activity in WA 2006* report. Population statistics sourced from the ABS were also used. Note that materials included in recycling data in some states may be excluded from others. This variability is not believed to significantly affect the relativities shown.

A survey of total recycling activity in South Australia was coordinated in from September 2007 to January 2008 by Hyder Consulting. The survey covered all materials recovered for reprocessing in South Australia, as well as exported materials. Any materials imported into the state for reprocessing were excluded.

All known local (South Australian based) and interstate reprocessing destinations were identified, as well as exports overseas.

Recycling data was obtained from the following sources:

1 Reprocessors

- site visits of the key reprocessing sites in the Adelaide metropolitan area
- telephone / e-mail surveys of all other recycling companies

2 Data collated from pre-existing annual surveys, undertaken by the following national organisations:

- Ash Development Association of Australia (ADAA)
- Compost Australia
- Plastics and Chemicals Industries Association (PACIA)
- Publishers National Environment Bureau (PNEB)

3 Australian Customs Service export data.

Data on reprocessed materials was sought for the 2006–07 financial year on the quantity (by weight), and origin and destination of reprocessed materials. The full questionnaire sent to reprocessors is provided in Appendix A.

Data from all known reprocessing destinations of material generated in South Australia has been compiled into this report and as such the reported recovery data is believed to be comprehensive. It is possible that some smaller South Australian based material reprocessors or interstate destinations may have been overlooked, in which case the reported recovery quantities would be slightly conservative.

Sector origins have been split into the following categories:

- household/municipal
- commercial and industrial (C&I)
- construction and demolition (C&D).

Table E-2 Sector origins of SA sourced reprocessed materials, SA 2006–07

Sector origin	Quantity	
	(tonnes)	(%)
Municipal	408 338	16.8%
C&I	870 636	35.8%
C&D	1 155 154	47.5%
Total	2 434 128	100.0%

The breakdown of the destination of reprocessed materials is provided in the table below.

Table E-3 Destination of SA sourced reprocessed materials, SA 2006–07

Reprocessing destination	Number of destinations	Reprocessed material destination	
		(tonnes)	(%)
South Australia	56	1 950 568	80.1%
Interstate	24	101 734	4.2%
Export	N/A	381 826	15.7%
Total	80	2 434 128	100.0%

Table E-4 Reprocessed material quantities, SA 2003–04 to 2006–07

	Material	Material category	Total recovery 2003–04 (tonnes)	Total recovery 2004–05 (tonnes)	Total recovery 2005–06 (tonnes)	Total recovery 2006-07 (tonnes)
1	Asphalt	Masonry materials	100 000	92 000	85 900	83 640
2	Bricks	Masonry materials	165 000	85 700	102 475	43 962
3	Concrete	Masonry materials	877 000	899 492	762 134	793 710
4	Soil, fines waste, clay & clean fill	Masonry materials	162 400	132 400	70 989	63 251
5	Steel	Metals	264 200	247 840	278 028	323 850
6	Aluminium	Metals	19 000	20 443	22 171	20 845
7	Non-ferrous metals (ex. Al)	Metals	13 000	16 639	19 470	24 300
8	Food organics	Organics	0	10 540	6 005	3 981
9	Garden organics	Organics	130 100	188 610	222 499	209 725
10	Timber	Organics	116 700	300 980	255 728	275 385
11	Organics - other	Organics	0	89 790	81 625	82 636
12	Cardboard & waxed cardboard	Paper & cardboard	91 000	72 117	106 943	96 436
13	Liquid paperboard	Paper & cardboard	0	971	1 239	1 373
14	Magazines	Paper & cardboard	0	4 650	5 918	4 680
15	Newsprint	Paper & cardboard	31 398	35 917	40 607	40 000
16	Phonebooks	Paper & cardboard	1 303	1 685	2 042	2 042[1]
17	Printing & writing papers	Paper & cardboard	12 300	12 593	18 803	30 574
18	Polyethylene terephthalate (PET)	Plastics[2]	0	5 544	4 753	5 704
19	High density polyethylene (HDPE)	Plastics[2]	0	2 728	3 036	2 779
20	Polyvinyl chloride (PVC)	Plastics[2]	0	329	365	363
21	Low density polyethylene (LDPE)	Plastics[2]	0	4 063	5 043	5 403
22	Polypropylene (PP)	Plastics[2]	0	1 272	1 252	1 542
23	Polystyrene (PS)	Plastics[2]	0	613	332	167
24	Other plastics	Plastics[2]	8 607	792	1 107	922
25	Glass	Glass	45 600	49 500	50 067	50 110
26	Fly ash	Other materials	0	335 000	236 343	260 913
27	Foundry sands	Other materials	0	9 006	6 755	2 000
28	Leather & textiles	Other materials	4 080	1 564	2 419	2 348
29	Tyres & other rubber	Other materials	88	590	1 535	1 486
Total			**2 041 776**	**2623 368**	**2 395 582**	**2 434 128**

1. The phonebook figure listed in this table is a provisional figure based on the figure provided for the 2005-2006 survey. At the time of the audit and production of this report the 2006-07 financial year data was not available.
2. All plastics data is sourced from the 2006 calendar year PACIA report.

While not assessed in detail as part of this study, it is recognised that direct reuse of many products occurs on a significant scale without reprocessing. Where possible throughout this report, any reuse activity has been identified in general terms, but not quantified.

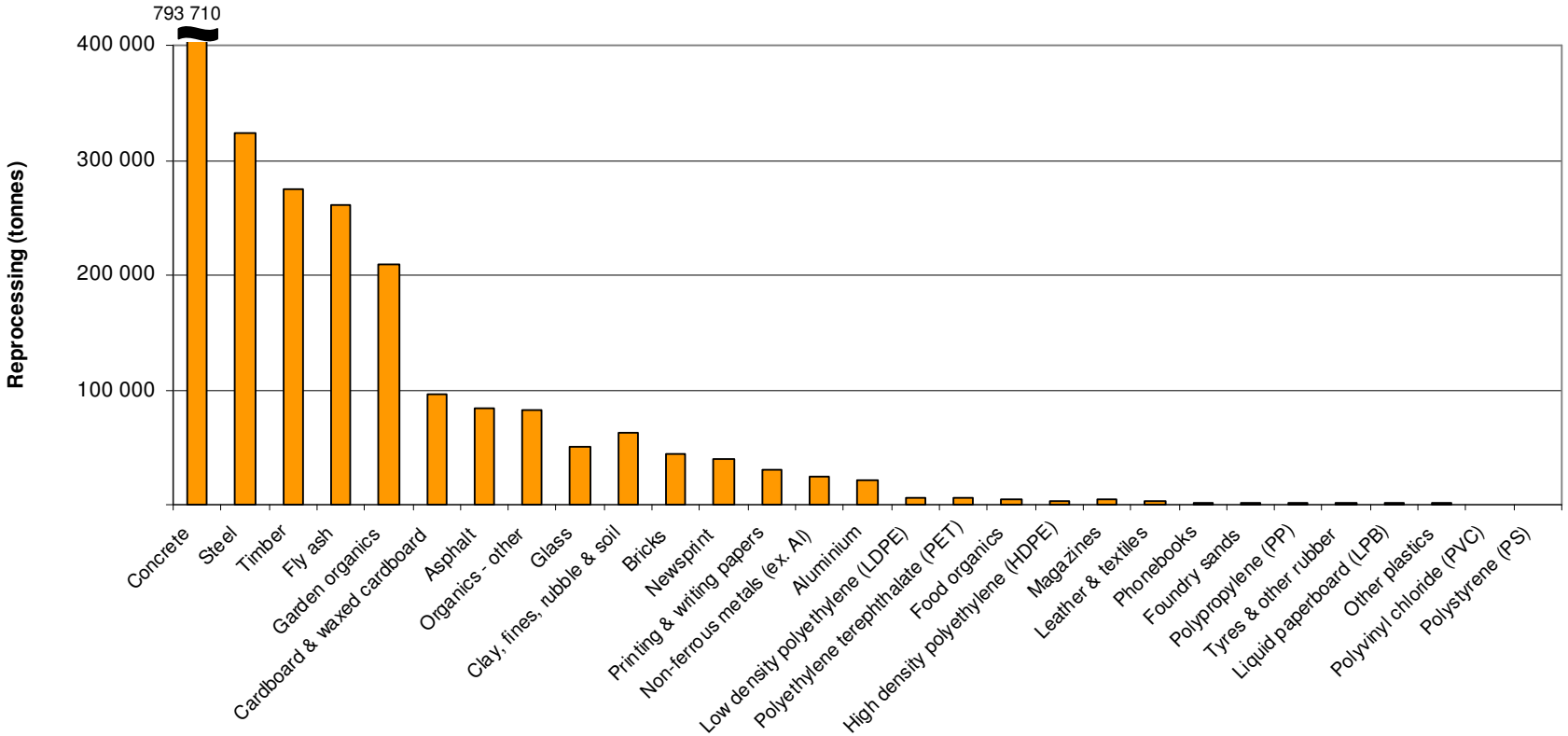

Figure E-3 Reprocessing by material (by weight), SA 2006–07

1 Masonry materials

1.1 Quantity recovered and reprocessing location

The masonry materials recovery data presented in this report has been provided by reprocessors. It includes concrete, asphalt, brick & rock and rubble.

The quantity of masonry materials recovered in SA and the location of reprocessing, during 2006–07, is presented in Table 1-5. The quantity recovered was 984 563 tonnes, 80% of which was concrete (Figure 1-4). This material was recovered primarily through commercial collections, direct drop-offs and at transfer stations (e.g. skips and bins).

Table 1-5 Masonry materials recovery, SA 2006–07

Material	Net recovery[1]	Reprocessing location		
	(tonnes)	SA	Interstate	Export
Asphalt	83 640	100.0%	0.0%	0.0%
Bricks	43 962	100.0%	0.0%	0.0%
Concrete	793 710	100.0%	0.0%	0.0%
Clay, fines, rubble & soil[2]	63 251	100.0%	0.0%	0.0%
Total	**984 563**	**100.0%**	**0.0%**	**0.0%**

1. Net recovery excludes reprocessing losses.
2. The "Clay, fines, rubble & soil" material category only relates to material that has been diverted from landfill, and is consistent with reporting categories used in NSW, Victoria and WA.

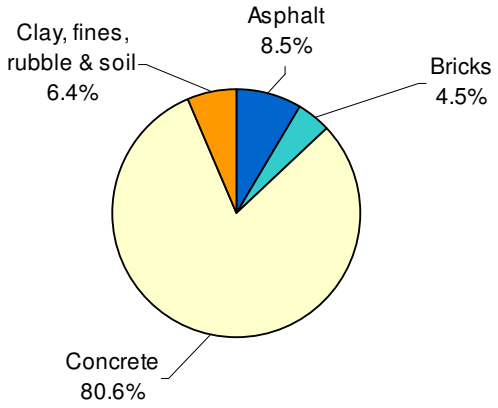

Figure 1-4 Composition of recovered masonry materials (by weight), SA 2006–07

All this recovered material was derived from the construction and demolition sector (see Table 1-6).

Table 1-6 Masonry materials recovery – by source sector, SA 2006–07

Material	Source sector (tonnes)			
	Municipal	C&I	C&D	Total
Asphalt	0	0	83 640	83 640
Bricks	0	0	43 962	43 962
Concrete	0	0	793 710	793 710
Clay, fines, rubble & soil	0	0	63 251	63 251
Total	**0**	**0**	**984 563**	**984 563**

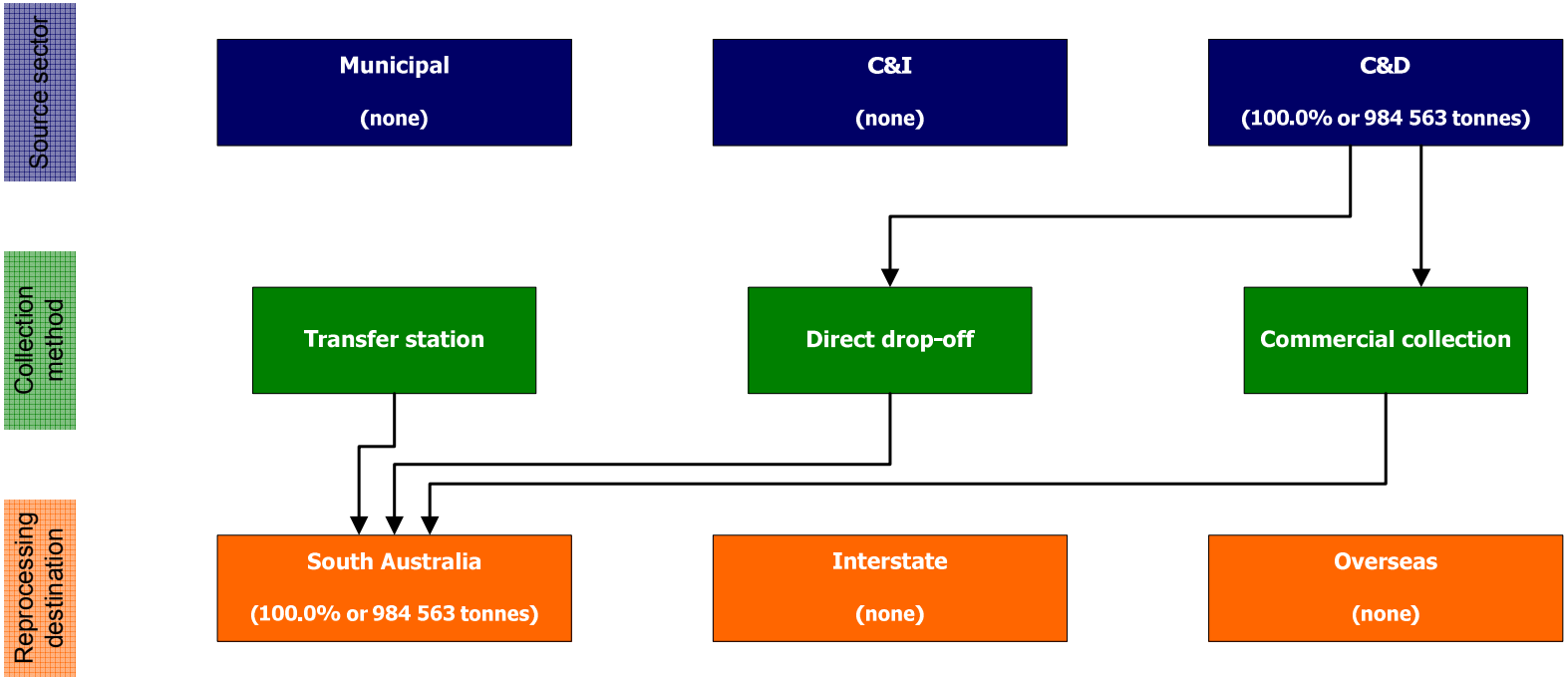

Figure 1-5 Flow of masonry materials reprocessing, SA 2006–07

1.2 Source and end products

Table 1-7 Masonry materials source products, SA 2006–07

Material	Source products
Asphalt	Roads, footpaths, car parks and kerbing
Bricks	Mainly walls and other general C&D activity
Concrete	Slabs, footings, kerbing, channel and wall
Clay, fines, rubble & soil	General C&D

Table 1-8 Masonry materials end products, SA 2006–07

Material	End products
Asphalt	Road base
Bricks	Primarily crushed for road base and drainage, however some are also cleaned for reuse
Concrete	Road base and drainage
Clay, fines, rubble & soil	Road base, batters/bunds and compost (bulking agents)

1.3 Recycling activity trends, barriers and reuse

1.3.1 Trends

Presented in Figure 1-6 and Table 1-9 is the annual masonry materials recycling data for SA for the period of 2003–04 to 2006–07. The recovery of masonry materials has been on a steady decline since 2003 – 04. The largest decrease occurred between 2004-05 and 2005-06.

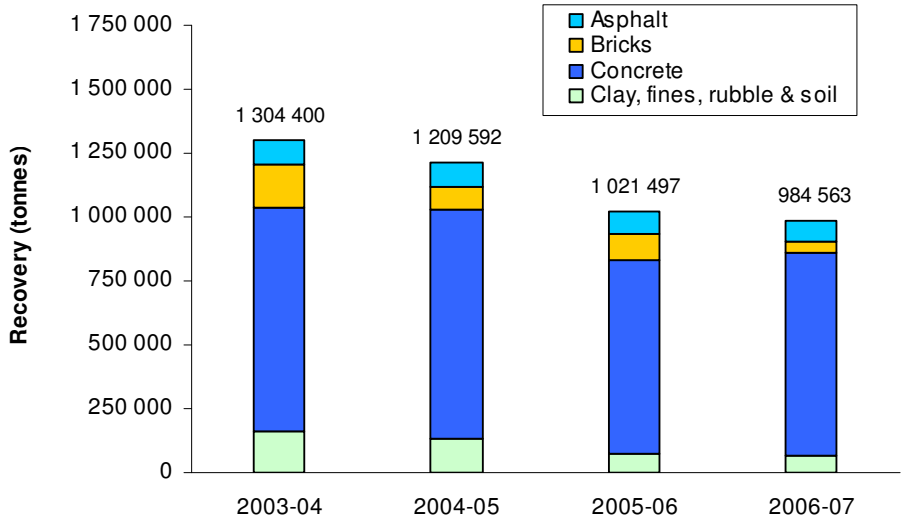

Figure 1-6 Annual masonry materials recovery, SA 2003-04 to 2006–07

Anecdotal reports from reprocessors indicate a reduction in the number of construction projects in SA may have contributed to the decrease in the quantities of masonry materials reprocessed during 2006–07. Also, increased competition from virgin materials may have contributed to the decrease in market outlets for reprocessed material. This is particularly the case for brick rubble as the market is dictating an aggregate of concrete without brick rubble content. In turn reprocessors have reduced their recovery of bricks for crushing.

This reduction of almost 60 000 tonnes is the most significant change in the 2006/2007 recycling activity.

Table 1-9 Annual masonry materials recovery, SA 2003–04 to 2006-07

Material	2003–04 recovery (tonnes)	2004–05 recovery (tonnes)	2005–06 recovery (tonnes)	2006-07 recovery (tonnes)
Asphalt	100 000	92 000	85 900	83 640
Bricks	165 000	85 700	102 475	43 962
Concrete	877 000	899 492	762 134	793 710
Clay, fines, rubble & soil	162 400	132 400	70 989	63 251
Total	**1 304 400**	**1 209 592**	**1 021 497**	**984 563**

1.3.2 Barriers

The following were identified by the masonry reprocessing industry as some of the barriers to increasing recovery rates:

- the reprocessing of masonry materials is an economically marginal exercise, with few incentives or grants
- access limitations to some materials for recycling
- recycled materials are obtaining only a small share of potential market outlets
- tough competition from landfill operators on disposal charges
- market resistance to crushed brick in aggregate

1.3.3 Reuse

There is a significant amount of brick cleaning for reuse, some of which has been captured within the 43 962 tonnes reported as being reprocessed. The full scale of brick reuse is unknown.

1.4 Market Summary

1.4.1 Market Size

The amount of masonry material sold into the market is highly influenced by demand in the road building and civil works sector. Recycled concrete aggregate fills only a small proportion of the total requirement of this sector and therefore there remains potential for expansion of market outlets as material becomes available.

The road base aggregate market is highly competitive and a constraint on market size if the ability to be price competitive with the quarry product sector.

1.4.2 Market Strength

The demand for recycled concrete aggregate remained strong through 2006 / 2007. The market competitiveness is also linked to where the end market destination is sited. If it is close to major reprocessing sites in the city's north or south, the recycled concrete is more competitive than if the sites are more closely linked to quarry sites beyond the city.

The market strength for crushed bricks is now very weak and has resulted in a much lower acceptance and throughput. This relates to its exclusion from road base and sub-base specifications. This has meant recyclers have had to exclude bricks from their mixed material aggregate and this has resulted in a dramatic drop in market strength for bricks.

2 Metals

2.1 Quantity recovered and reprocessing location

The metals recovery data presented in this report has been provided by a range of industry sources, including manufacturers, industry groups and reprocessors.

The quantity of metals recovered in SA and the location of reprocessing, during 2006–07, is presented in Table 2-10. Metals recovery was 368 995 tonnes, of which almost 90% was steel (Figure 2-7). Metals recovery was up significantly in 2006/07, by almost 50,000 tonnes. This material was recovered through commercial collections, direct drop-offs and household recycling collections.

The metal recycling data is an underestimate as one scrap metal company declined providing data to the survey. It is known that this company sends ferrous and non-ferrous metals to Victoria.

Table 2-10 Metals recovery, SA 2006–07

Material	Net recovery[1]	Reprocessing location		
	(tonnes)	SA	Interstate	Export
Steel[2]	**323 850**	**20.8%**	**2.8%**	**76.4%**
Aluminium	**20 845**	**0.9%**	**25.3%**	**73.8%**
Non-ferrous metals (ex. Al) [3]	**24 300**	**3.9%**	**37.8%**	**58.3%**
Total	**368 995**	**18.5%**	**6.4%**	**75.1%**

1. Net recovery excludes reprocessing losses
2. Includes steel can packaging – refer to Section 8 (Packaging Summary) for more details
3. Primarily lead and copper

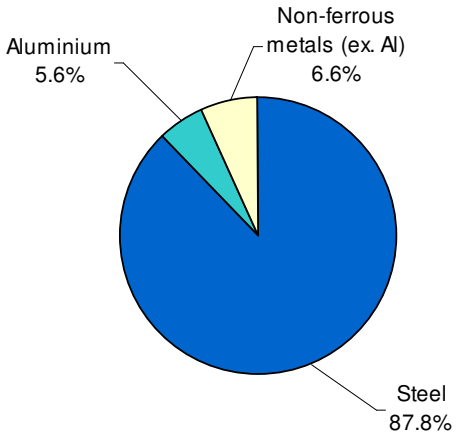

Figure 2-7 Composition of recovered Metals (by weight), SA 2006–07

The majority of metals reprocessed in SA were sourced from the commercial and industrial sector (Figure 2-8). Less than 15% of metal recycling was sourced form the municipal sector (Table 2-11).

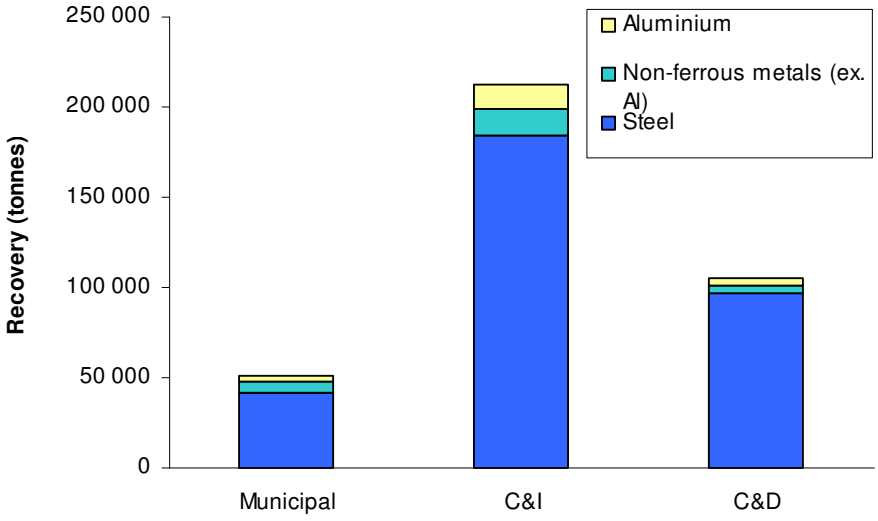

Figure 2-8 Metals recovery – by source sector, SA 2006-07

Table 2-11 Metals recovery – by source sector, SA 2006-07

Material	Source sector (tonnes)			
	Municipal	C&I	C&D	Total
Steel	**42 067**	**184 628**	**97 155**	**323 850**
Aluminium	**2 701**	**14 009**	**4 135**	**20 845**
Non-ferrous metals (ex. Al)	**6 078**	**13 997**	**4 225**	**24 300**
Total	**50 846**	**212 634**	**105 515**	**368 995**

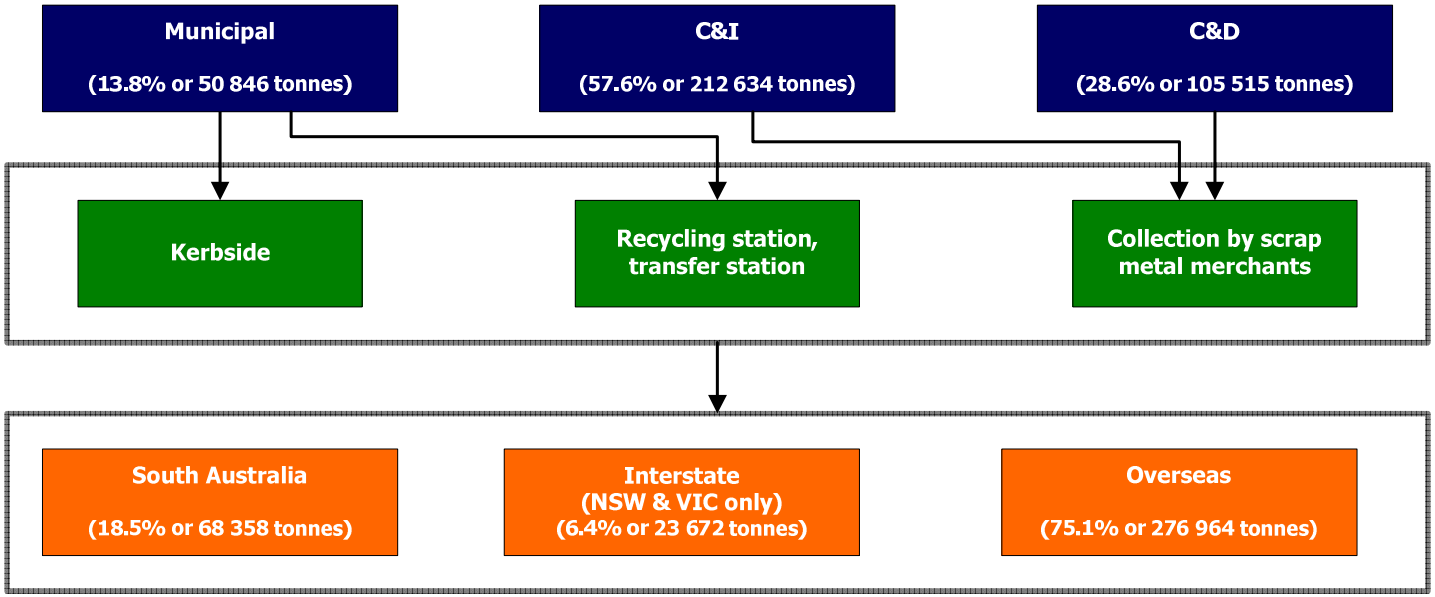

Figure 2-9 Flow of Metals recovered for reprocessing, SA 2006-07

2.2 Source and end products

Table 2-12 Metals source products, SA 2006-07

Material	Source products
Steel	Automotive (car bodies), general heavy steel and structural, appliances, iron roofing, steel packaging
Aluminium	Windows & doors, auto engines, assorted industrial scrap and production scrap, aluminium cans, electrical cable, and some electrical & electronic waste
Non-ferrous metals (ex. Al)	Copper pipe, automotive batteries and cable auto, general industrial and production scrap, electrical cable

Table 2-13 Metals end products, SA 2006-07

Material	End products
Steel	Many end-products, including car parts, general rod and sheet, and mining equipment, most to export
Aluminium	Valves & extrusions, automotive parts, building industry and aluminium cans, most to export
Non-ferrous metals (ex. Al)	Many end-products, including batteries and valves & extrusions, most to export

2.3 Recycling activity trends, barriers and reuse

2.3.1 Trends

Presented in Figure 2-10 and Table 2-14 is annual metals recycling data for SA for the period 2003–04 to 2006–07. The total weight of metals reprocessed in SA has fluctuated since 2003–04. The largest change occurred between 2005–06 and 2006–07, with an increase of 49 326 tonnes. The increased metal shredding capacity in SA has helped to facilitate the almost 50,000 tonne increase in recycling.

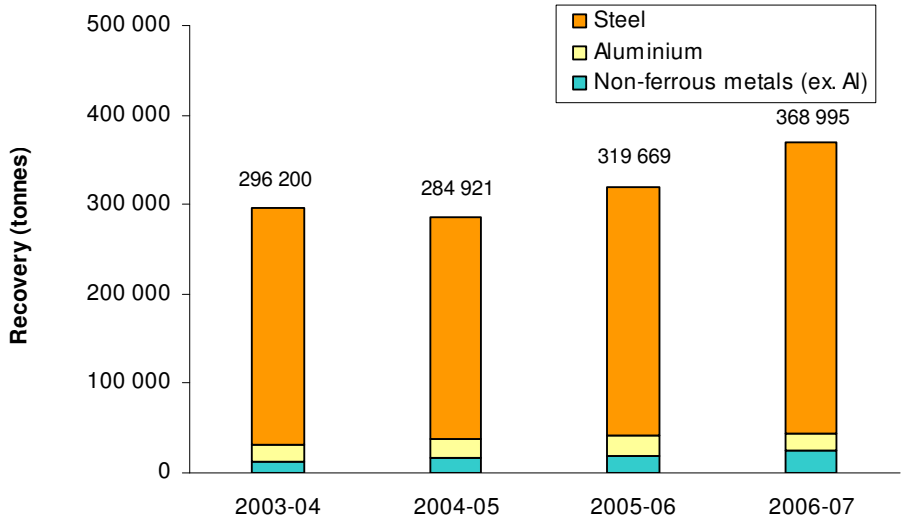

Figure 2-10 Annual metals recovery, SA 2003–04 to 2006-07

Table 2-14 Annual metals recovery, SA 2003–04 to 2006-07

Material	2003–04 recovery (tonnes)	2004–05 recovery (tonnes)	2005–06 recovery (tonnes)	2006-07 recovery (tonnes)
Steel	264 200	247 840	278 028	**323 850**
Aluminium	19 000	20 443	22 171	**20 845**
Non-ferrous metals (ex. Al)	13 000	16 639	19 470	**24 300**
Total	**296 200**	**284 921**	**319 669**	**368 995**

2.3.2 Reuse

There was little direct reuse of metals identified.

2.4 Market summary

2.4.1 Market size and economies

The steel and non-ferrous markets are structured to absorb all available scrap metal diverted for recycling. The only inhibitor to this previously was the limitation of having only one Adelaide based shredder. This has changed with the introduction of a second shredder at Smorgon Steel (now OneSteel) and the more aggressive role in the market of Southern Rocycling. Driven by worldwide demand for scrap metal there is no significant barrier to metals recovery.

Despite the high metal prices for all ferrous and non-ferrous metals in 2006/2007, this has had very little impact on the volume of material collected and processed. Fundamentally it just means metals are bought and sold at higher levels. At the margin it may trigger the presentation of a small amount of previously stockpiled materials.

2.4.2 Market strength

The market for metals into export markets in Asia remains very strong. There is also a major outlet for aluminium and non-ferrous metals into the interstate (NSW and Victoria) markets.

For steel there remain smelters outside Adelaide that can utilise scrap metals. In 2006/2007, 20% of steel was recycled within the State.

Looking to 2007/2008, changes to the automotive industry with Mitsubishi's closure and the retendering of the GMH metals contract could have some domestic impact on metal recycling demand.

3 Organics

3.1 Quantity recovered and reprocessing location

The organics recovery data presented in this report has been provided by Compost Australia. Compost Australia undertakes an annual *Organics Industry Survey* of organics reprocessors across SA, New South Wales, Victoria and Western Australia. The data generated by the Compost Australia exercise for the 2006–07 financial year has been used in this report. In addition, timber recovery into waste to energy processes has been provided separately by the C&D industry.

Organics recovery in SA and the location of reprocessing, during 2006–07, is presented in Table 3-14. The major organic material recovered was 275 385 tonnes of timber (Figure 3-11), the next most significant organic recovery stream was garden organics (209 725 tonnes) from municipal sources.

Table 3-15 Organics recovery, SA 2006–07

Material	Net recovery	Reprocessing location		
	(tonnes)	SA	Interstate	Export
Food organics	3 981	100.0%	0.0%	0.0%
Garden organics	209 725	100.0%	0.0%	0.0%
Timber	275 385	100.0%	0.0%	0.0%
Organics – other	82 636	100.0%	0.0%	0.0%
Total	**571 727**	**100.0%**	**0.0%**	**0.0%**
Net recovery excludes reprocessing losses				

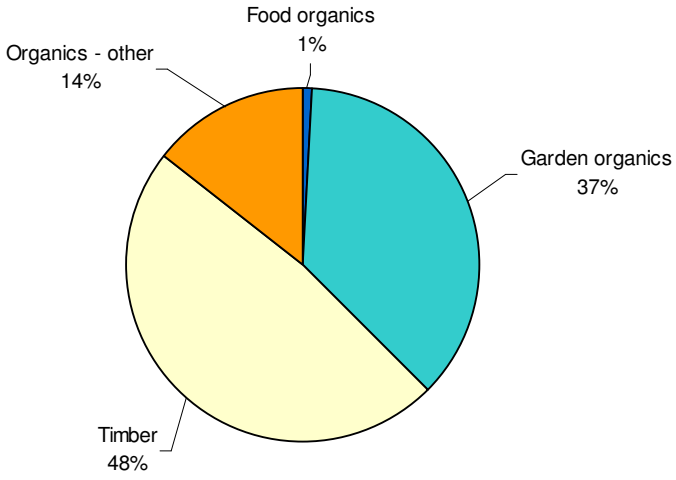

Figure 3-11 Composition of recovered organics (by weight), SA 2006-07

Garden organics are recovered through kerbside collection systems in many Adelaide municipalities, and from drop off sites at transfer stations and most is delivered directly to composting facilities. Only composted garden organics are considered to have been recycled in this survey, and as such data for organic material that has been shredded by mobile shredder, used directly on parks and gardens and manures spread directly onto land have not been included in this survey.

Waste timber is generated in a number of forms. Structural timber is recovered from both residential and commercial demolition projects. Pallets, fencing and furniture are also sources of timber waste. There is also timber off-cuts and sawdust generated from manufacturing processes and building construction sites.

The *organics – other* category is primarily composed of paper pulp / sludge (60.5% by weight), general agricultural organics (19.8%) and animal bedding (9.1%). Small quantities of animal mortalities (150 tonnes) and paunch (7 300 tonnes) are also included in the *organics – other* category. The breakdown of organics recovery by source sector and material type is presented in Figure 3-12 and Table 3-16.

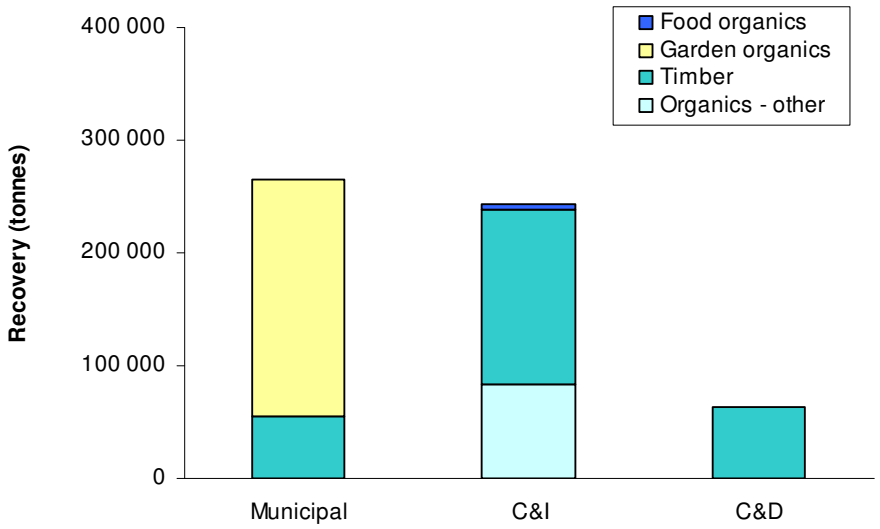

Figure 3-12 Organics recovery – by source sector, SA 2006-07

Table 3-16 Organics recovery – by source sector, SA 2006-07

Material	Source sector (tonnes)			
	Municipal	C&I	C&D	Total
Food organics	0	3 981	0	3 981
Garden organics	209 725	0	0	209 725
Timber	55 077	156 274	64 034	275 385
Organics – other	0	82 636	0	82 636
Total	**264 802**	**242 891**	**64 034**	**571 727**

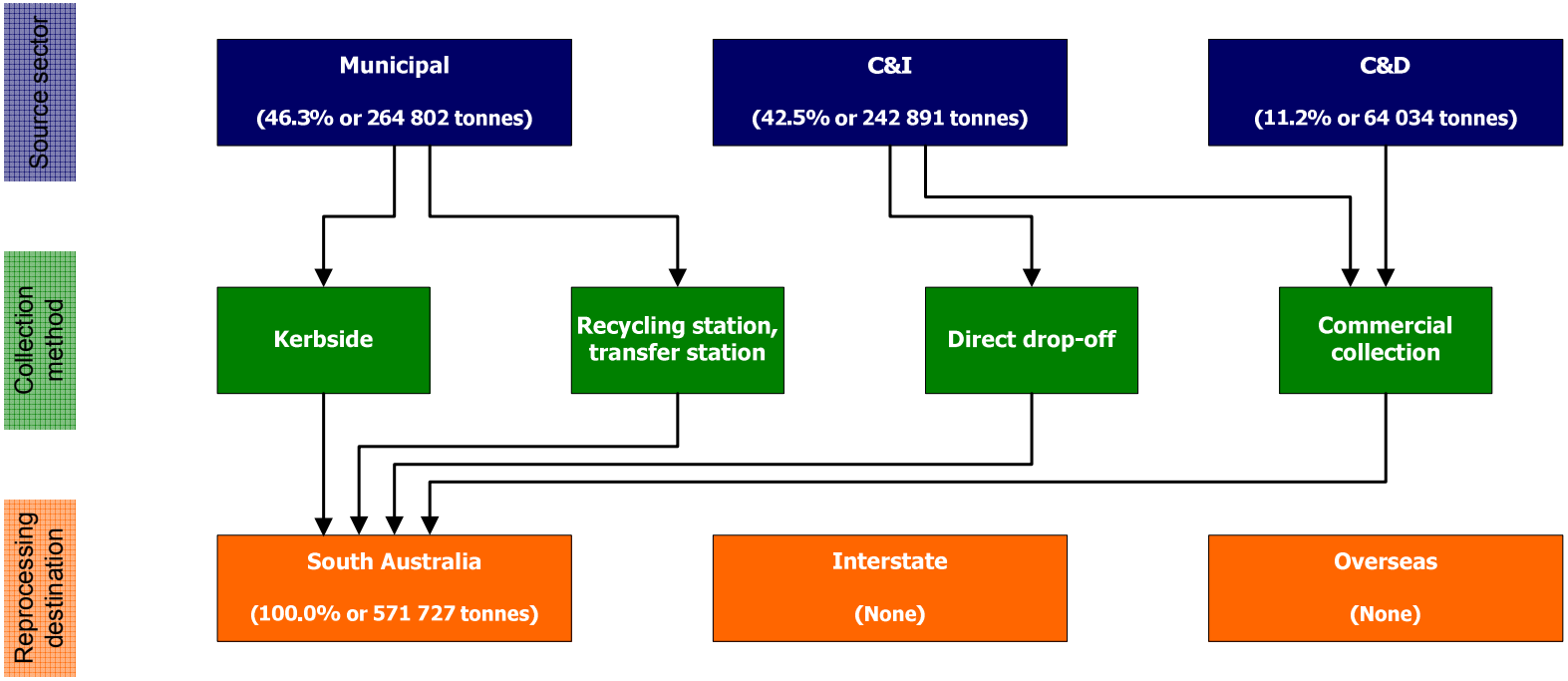

Figure 3-13 Flow of organics recovered for reprocessing, SA 2006-07

3.2 Source & end products

Table 3-17 Organics source products, SA 2006-07

Material	Source products
Food organics	Commercial food wastes
Garden organics	Municipal garden organics
Timber	Barks, sawdust, wood/timber packaging, general wood/timber
Organics – other	Paper pulp/sludge, misc. agricultural organics, animal bedding, paunch, animal mortalities, other - misc.

Table 3-18 Organics end products, SA 2006-07

Material	End products
Food organics	Primarily composted soil conditioners, potting mixes and mulches
Garden organics	Primarily composted soil conditioners, potting mixes and mulches
Timber	Composted soil conditioners, potting mixes and mulches (approximately 75%)
	Fuel for cement manufacture – energy recovery (approximately 25%)
Organics – other	Primarily composted soil conditioners, potting mixes and mulches

3.3 Recycling activity trends and reuse

3.3.1 Trends

Presented in Figure 3-14 and Table 3-19 is annual organics recycling data for SA for the period of 2003–04 through to 2006–07. Due to significant changes in the data collection methodology from 2004–05 caution should be taken in comparing 2003–04 data with that of later years. For example, in 2004–05 more categories of organics reprocessing were defined to be more consistent with interstate and national definitions. In addition, the use of timber as a fuel in cement manufacture began in 2004–05, utilising significant quantities of timber that were previously disposed to landfill.

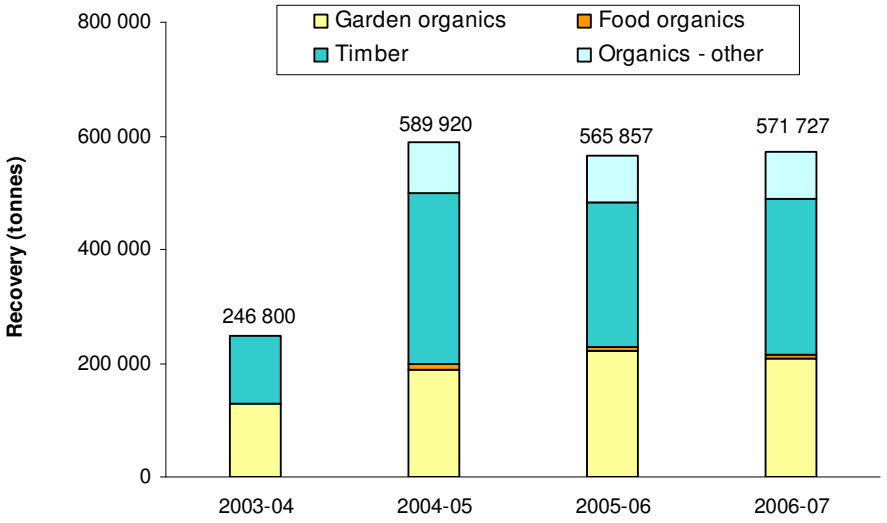

Figure 3-14 Annual organics recovery, SA 2003–04 to 2006-07

Table 3-19 Annual organics recovery, SA 2003–04 to 2006-07

Material	2003–04 recovery (tonnes)	2004–05 recovery (tonnes)	2005–06 recovery (tonnes)	2006-07 recovery (tonnes)
Food organics	0	10 540	6 005	3 981
Garden organics	130 100	188 610	222 499	209 725
Timber	116 700	300 980	255 728	275 385
Organics – other	0	89 790	81 625	82 636
Total	**246 800**	**589 920**	**565 857**	**571 727**

Assessing the exact impact the drought has had on organic recycling activity is not possible. Consultation with key stakeholders in the organics industry has revealed that the drought has caused a reduction in the amount of gardening activity, and hence has had a negative impact on the

volume of organics reprocessed. This is the most likely explanation for the downturn in garden organics recycling.

3.3.2 Reuse

The primary sources of timber waste are the timber industry and the demolition industry. All identified waste from the timber industry underwent some kind of reprocessing step, usually into a composted product. No direct reuse was counted in the data presented.

Some timber waste from the demolition industry is likely to be recovered for reuse by the recycled timber industry, or directly by other groups (e.g. builders and other trades people), however the scale of this reuse activity, and the destination of the reused timber, is not known.

3.4 Market summary

3.4.1 Current market situation

The Recycled Organics Unit report (2007) for Compost Australia *Organics Recycling in Australia: Industry Statistics 2007 (draft)* is the primary source of information in this section, except where otherwise indicated.

In 2006–07 most of the small increase in organic material reported as recycled in SA was recovered through organics recycling facilities, with the remainder (timber) used for energy production (Hyder survey 2007).

The number of organics recycling facilities involved in the Compost Australia survey decreased from 33 facilities in 2005–06 to 32 facilities in 2006–07, aerobic windrow composting (hot composting) remained the dominant method for compost reprocessing.

3.4.2 Market size and strength

Reported sale of mulch products increased significantly from 704 552 m^3 in 2005–06 to 860 557 m^3 in 2006–07. In 2006–07 there was a 24% increase in the quantity of lower price raw mulch sold, and a 33% increase in the sales of higher quality, higher price composted mulch sold.

Reported sale of soil conditioner products decreased significantly from 233 159 m^3 in 2005–06 to 144 021 m^3 in 2006–07. There is a reported shift away from soil conditioners to mulches, this is explained as follows in the Recycled Organics Unit report (2007) for Compost Australia:

mulches which are effective in retaining limited soil moisture and increasing water use efficiency may be a market response to prolonged water shortages for both urban parks and gardens and for commercial horticulture; and to further significant reduction in water allocations for intensive horticulture (ROU 2007).

3.4.3 Market barriers

The key issues and barriers impacting upon the market were identified as (ROU 2007):

1. Site regulation and planning consent – inconsistent, unnecessarily costly, requirements don't support policy
2. Raw materials contamination
3. Gate fees too low (metro areas) / tender appraisal is price driven
4. Impact of urban water restrictions
5. Development of new products/markets (particularly agriculture).

4 Paper and cardboard

4.1 Quantity recovered and reprocessing location

The paper and cardboard recovery data presented in this report has been provided by a range of industry sources, including manufacturers, industry groups and reprocessors.

The quantity of paper and cardboard recovered in SA and the location of reprocessing during 2006–07, is presented in Table 4-20. Paper and cardboard recovery totalled 175 705 tonnes, with over 50% of this being cardboard and waxed cardboard (Figure 4-15). This material was recovered through both commercial and household recycling collections.

Table 4-20 Paper & cardboard recovery, SA 2006–07

Material	Net recovery[1]	Reprocessing location		
	(tonnes)	SA	Interstate	Export
Cardboard & waxed cardboard[2]	96 436	0.0%	56.0%	44.0%
Liquid paperboard[2]	1 373	0.0%	0.0%	100.0%
Magazines[3]	4 680	0.0%	42.7%	57.3%
Newsprint	40 000	12.8%	21.3%	66.0%
Phonebooks	2 042	0.0%	0.0%	100.0%
Printing & writing papers	30 574	0.0%	16.2%	83.8%
Total	**175 105**	**2.9%**	**39.7%**	**57.4%**

1. Net recovery excludes reprocessing losses
2. 100% cardboard & LPB packaging – refer to Section 8 (Packaging Summary) for more details
3. Exported magazine material is unknown, any magazine export is captured in newsprint export

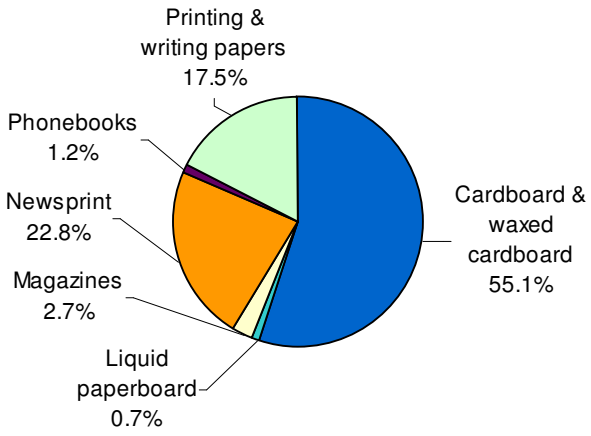

Figure 4-15 Composition of recovered paper & cardboard (by weight), SA 2006–07

The breakdown of paper and cardboard recovery by source sector and material type is presented in Figure 4-16 and Table 4-21. The commercial and industrial waste sector was the main source sector.

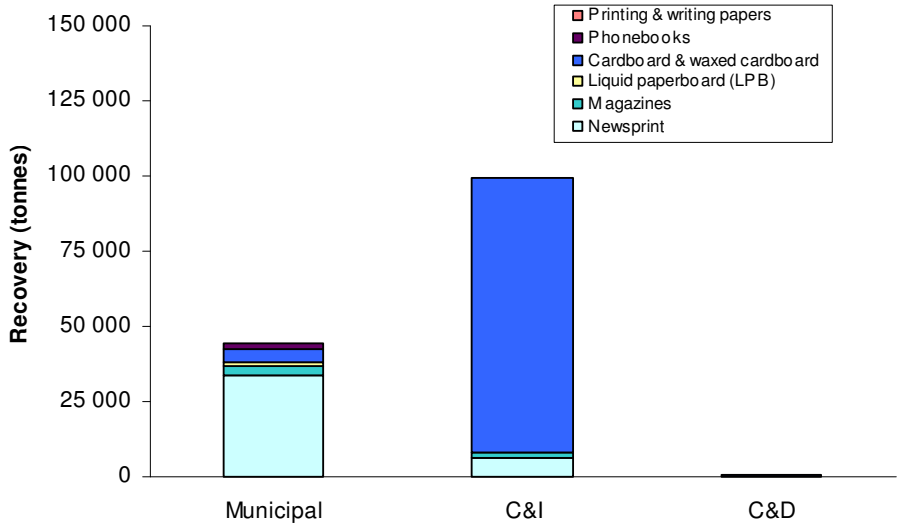

Figure 4-16 Paper & cardboard recovery – by source sector, SA 2006–07

Table 4-21 Paper & cardboard recovery – by source sector, SA 2006–07

Material	Source sector (tonnes)			
	Municipal	C&I	C&D	Total
Cardboard & waxed card.	4 357	91 169	910	96 436
Liquid paperboard	1 373	0	0	1 373
Magazines	3 080	1 600	0	4 680
Newsprint	33 677	6 323	0	40 000
Phonebooks	1 838	204	0	2 042
Printing & writing papers	0	30 574	0	30 574
Total	**44 325**	**129 870**	**910**	**175 105**

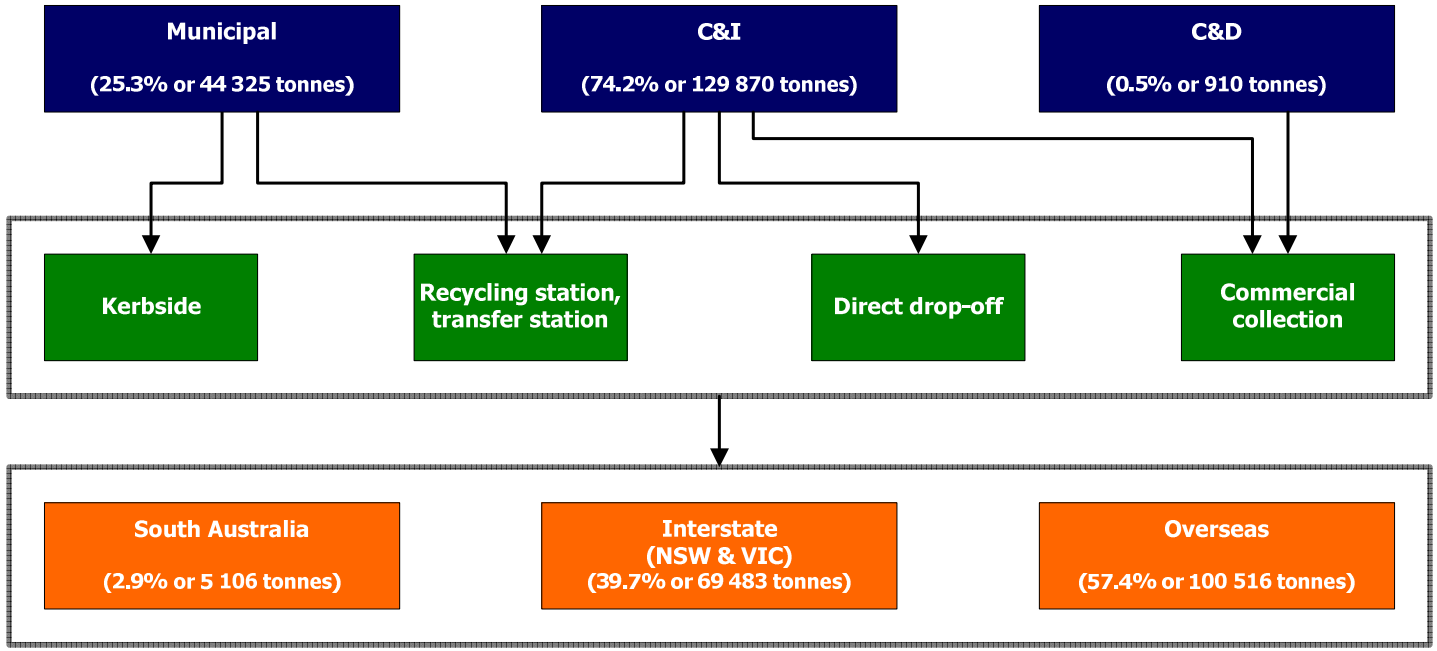

Figure 4-17 Flow of paper & cardboard reprocessing, SA 2006–07

4.2 Source and end products

Table 4-22 Paper & cardboard source products, SA 2006-07

Material	Source products
Cardboard & waxed cardboard	Mostly corrugated cardboard used for the packaging of industrial and consumer goods
Liquid paperboard	LPB packaging, both CD and non-CD. CD LPB packaging includes flavoured milk beverages and fruit juice flavoured beverages. non-CD packaging includes milk and fruit juice packaging
Magazines	Pre-consumer waste and post-consumer magazine material in mixed paper to export
Newsprint	Both pre and post-consumer newsprint, and some magazine material. Also includes some magazines & TV guides which are printed on newsprint or improved newsprint
Phonebooks	Phone books
Printing & writing papers	Office paper and a small amount of packaging paper from office sources

Table 4-23 Paper & cardboard end products, SA 2006-07

Material	End products
Cardboard & waxed cardboard	Packaging
Liquid paperboard	Printing and writing paper
Magazines	Newsprint and packaging
Newsprint	Multiple end products including: packaging, cat litter, newsprint, insulation, building products and dust suppression. Reuse is also widespread.
Phonebooks	Packaging and newsprint
Printing & writing papers	Packaging, writing paper

4.3 Recycling activity trends, barriers and reuse

4.3.1 Trends

Presented in Figure 4-18 and Table 4-24 is annual paper and cardboard recycling data for SA for the period of 2003–04 through to 2006–07.

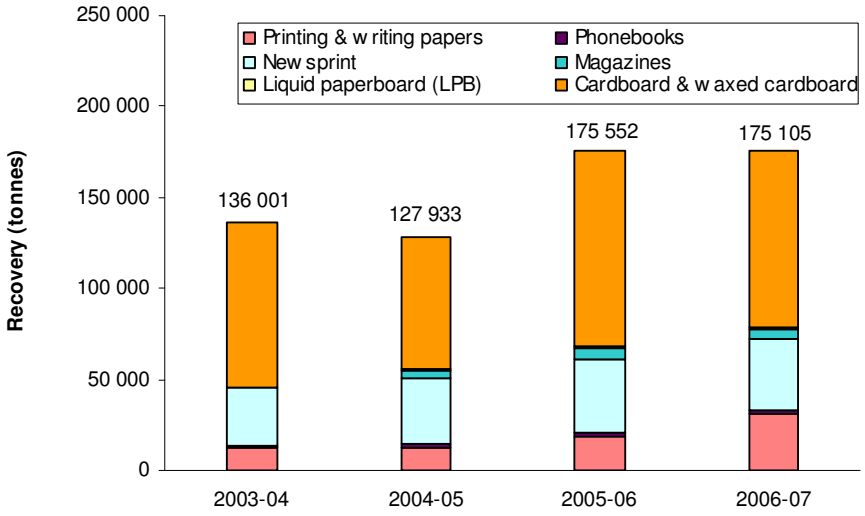

Figure 4-18 Annual paper & cardboard recovery, SA 2003–04 to 2006-07

Newspaper recycling rates in SA have risen significantly over the past five years, reaching 71.5% in the 2005 calendar year. PNEB data for the 2006 calendar year indicates that the newspaper recycling rate is higher again, just over 74%. This continual increase has resulted in increases in export quantities, particularly in printing and writing papers and cardboard grade paper.

Table 4-24 Annual paper & cardboard recovery, SA 2003–04 to 2006-07

Material	2003–04 recovery (tonnes)	2004–05 recovery (tonnes)	2005–06 recovery (tonnes)	2006-07 recovery (tonnes)
Cardboard & waxed cardboard	91 000	72 117	106 943	96 436
Liquid paperboard (LPB)	0	971	1 239	1 373
Magazines	0	4 650	5 918	4 680
Newsprint	31 398	35 917	40 607	40 000
Phonebooks	1 303	1 685	2 042	2 042[1]
Printing & writing papers	12 300	12 593	18 803	30 574
Total	**136 001**	**127 933**	**175 552**	**175 105**

1. The 2006-07 phonebook figure is based on the 2005-06 survey data. At the time of the audit and production of this report the 2006-07 phonebook data was not available.

4.3.2 Barriers

The efficient collection of printing and writing paper outside households and Adelaide's CBD remains a challenge.

In general, local recycling activity is consistent, except for increasingly strong competition from exporters and the boxboard industry.

The paper mill in Shoalhaven (NSW) that received most liquid paperboard in Australia closed in March 2006, resulting in the export of most liquid paperboard.

4.3.3 Reuse

Newspaper and phonebook reuse activities include; fire-lighting, use as drop-sheets and animal bedding.

4.4 Market summary

4.4.1 Market size

With no significant SA market outlets for waste paper, almost all (97%) goes into interstate or export markets.

For cardboard the price and demand remained strong, with a little over 50% being shipped to Victoria and NSW mills. Of the remainder, much of the material exported is handled by the major recyclers Amcor and VISY and shows Adelaide's role nationally as a buffer market where interstate transit is regulated to match mill demand with the remainder exported.

For newsprint a similar case situation exists with Norske Skog capturing a sizable share of old newspapers and the remainder going to export.

Other grade of paper – printing and writing, liquid paperboard and phonebooks are largely sent to export.

The price of all sorted grades remained buoyant through 2006/2007.

4.4.2 Market strength

Demand for liquid paperboard in Australia ceased in 2006/2007 due to the closure of the Shoalhaven Mill. There remains strong demand overseas in the Middle East. While the market for unsorted mixed grade paper continues to contract, the strength of the market for high purity, high density baled grade specific paper is very strong.

5 Plastics

5.1 Quantity recovered and reprocessing location

The plastics recovery data presented in this report has been sourced from the annual Plastics and Chemicals Industries Association (PACIA) survey of plastics reprocessors. The PACIA exercise is undertaken on a calendar year basis and the data published here is for the 2006 calendar year.

The quantity of plastics recovered in SA and the location of reprocessing, during 2006, is presented in Table 5-24. Plastics recovery was 17 634 tonnes, with LDPE and PET the largest contributors at around 30% each (Figure 5-19). Recovery was through commercial and industrial collections and municipal recycling collections.

Table 5-25 Plastics recovery, SA 2006

Material	Net recovery[1]	Reprocessing location		
	(tonnes)	SA	Interstate	Export
Polyethylene terephthalate (PET)	5704	11.9%	79.3%	8.8%
High density polyethylene (HDPE)	2779	79.0%	0.0%	21.0%
Polyvinyl chloride (PVC)	363	33.0%	60.1%	6.9%
Low density polyethylene (LDPE)	5403	62.4%	29.6%	8.0%
Polypropylene (PP)	1542	81.7%	5.3%	13.0%
Polystyrene (PS)	167	24.0%	46.0%	30.0%
Other plastics	922	51.0%	49.0%	0.0%
Total	**16 881**	**48.2%**	**41.2%**	**10.6%**

1. Net recovery excludes reprocessing losses, but includes plastic packaging – refer to Section 8 (Packaging Summary) for more details

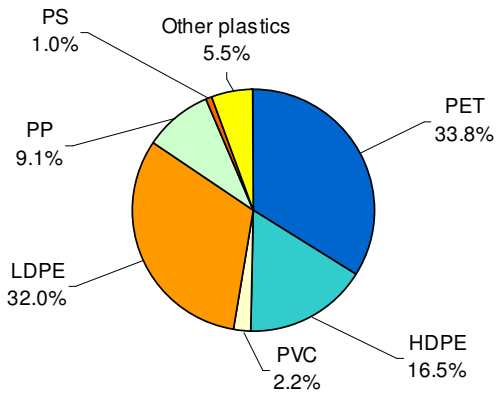

Figure 5-19 Composition of recovered plastics (by weight), SA 2006

The breakdown of plastics recovery by source sector and material type is presented in Figure 5-20 and Table 5-26.

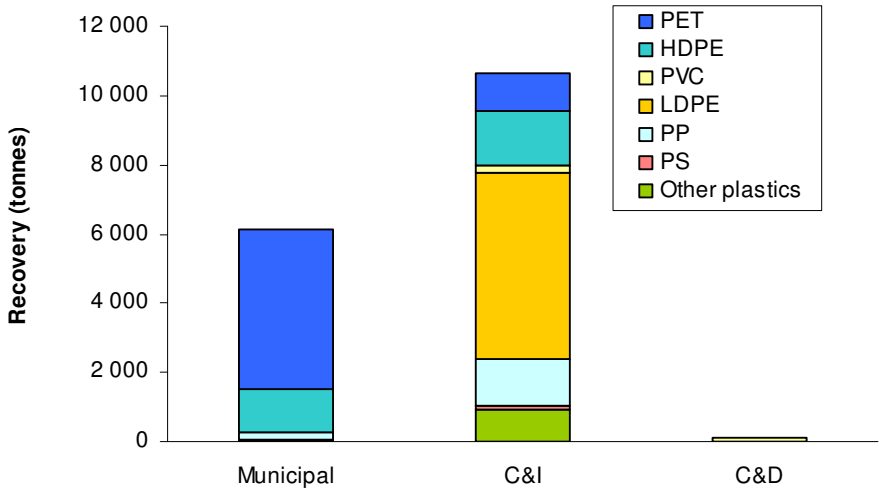

Figure 5-20 Plastics recovery – by source sector, SA 2006

Both Figure 5-20 and Table 5-26 show that the main source sector is commercial and industrial, with the majority of PET coming from the municipal source sector.

Table 5-26 Plastics recovery – by source sector, SA 2006

Material	Source sector (tonnes)			
	Municipal	C&I	C&D	Total
Polyethylene terephthalate (PET)	4 624	1 080	0	5 704
High density polyethylene (HDPE)	1 233	1 546	0	2 779
Polyvinyl chloride (PVC)	25	206	132	363
Low density polyethylene (LDPE)	0	5 403	0	5 403
Polypropylene (PP)	200	1 342	0	1 542
Polystyrene (PS)	50	117	0	167
Other plastics	0	922	0	922
Total	**6 132**	**10 617**	**132**	**16 881**

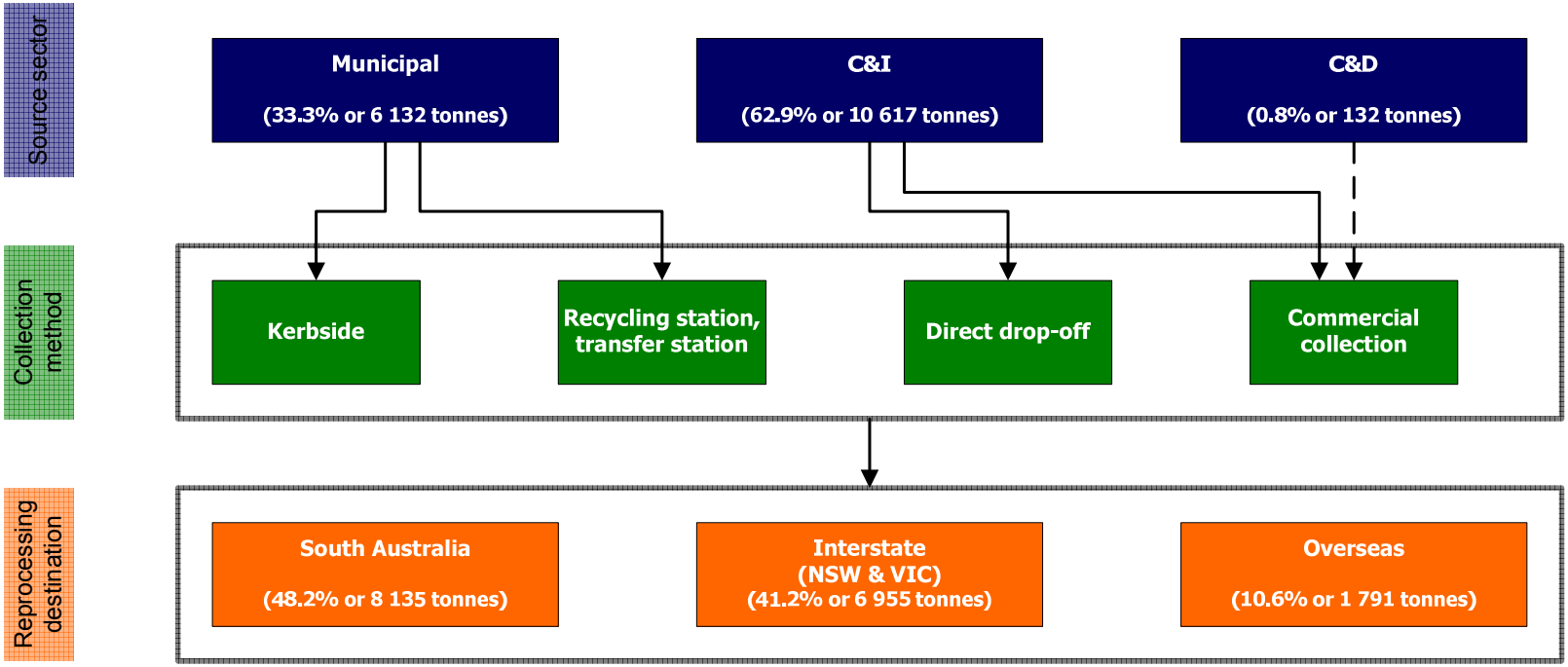

Figure 5-21 Flow of plastics reprocessing, SA 2006

5.2 Source and end products

Table 5-27 Plastics source products, SA 2006

Material	Source products
Polyethylene terephthalate (PET)	Soft drink bottles, fruit juice bottles
High density polyethylene (HDPE)	Milk bottles, manufacturing scrap, other packaging bottles, mobile garbage bins, drums, pipes, crates and pallets
Polyvinyl chloride (PVC)	Manufacturing scrap
Low density polyethylene (LDPE)	Flexible film used as distribution packaging, packaging bottles, manufacturing scrap
Polypropylene (PP)	Manufacturing scrap, rigid packaging applications, pallet strapping, automotive parts
Polystyrene (PS)	Manufacturing scrap, pipe supports, EPS freight packaging, rigid food packaging
Other plastics	Manufacturing scrap, domestic durables

Table 5-28 Plastics end products, SA 2006

Material	End products
Polyethylene terephthalate (PET)	Soft drink bottles and other packaging applications, fibre applications such as geotextiles, mixed polymer timber replacement products
High density polyethylene (HDPE)	Pallets, agricultural pipe, bins and crates, mixed polymer timber replacement products
Polyvinyl chloride (PVC)	Floor coverings, pipe and hoses fitting, garden hoses
Low density polyethylene (LDPE)	Builders film and damp-course linings, garbage bags, retail carry bags, mixed polymer timber replacement products, irrigation piping, garden furniture
Polypropylene (PP)	Crates and boxes, plant pots, building materials, mixed polymer timber replacement products
Polystyrene (PS)	Waffle pods, produce boxes, building materials, concrete reinforcement stools, mixed polymer timber replacement products
Other plastics	Various

5.3 Recycling activity trends, market conditions and reuse

5.3.1 Trends

Presented in Figure 5-22 and Table 5-29 is annual plastics recycling data for SA for the period of 2003 to 2006. As can be seen, significant growth occurred in plastics recycling across SA during 2006, with PET and LDPE the main growth plastics. No data is available for reprocessing by polymer type during 2003.

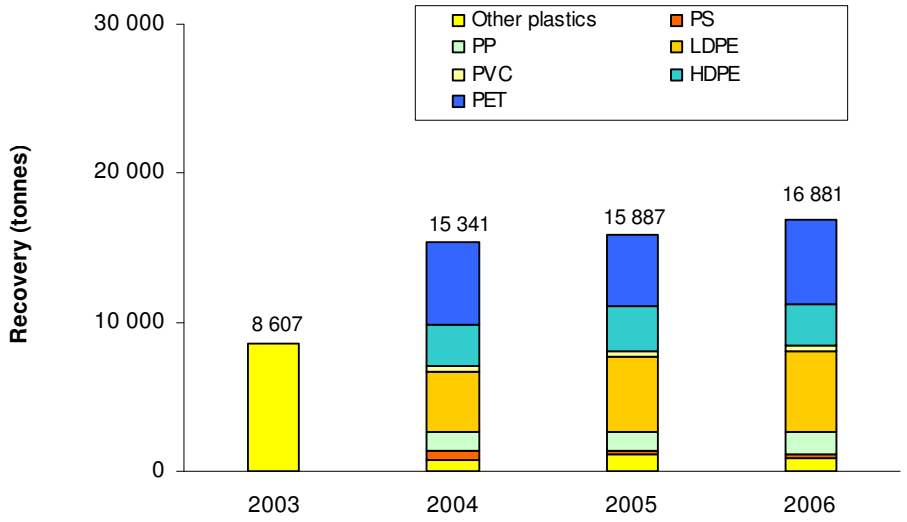

Figure 5-22 Annual plastics recovery, SA 2003 to 2006

Table 5-29 Annual plastics recovery, SA 2003 to 2006

Material	2003 recovery (tonnes)	2004 recovery (tonnes)	2005 recovery (tonnes)	2006 recovery (tonnes)
Polyethylene terephthalate (PET)	0	5 544	4 753	5 704
High density polyethylene (HDPE)	0	2 728	3 036	2 779
Polyvinyl chloride (PVC)	0	329	365	363
Low density polyethylene (LDPE)	0	4 063	5 043	5 403
Polypropylene (PP)	0	1 272	1 252	1 542
Polystyrene (PS)	0	613	332	167
Other plastics	8 607	792	1 107	922
Total	**8 607**	**15 341**	**15 887**	**16 881**

5.3.2 Market conditions

Table 5-30 Recycling market conditions, SA 2006

Material	Industry comments
Polyethylene terephthalate (PET)	Market is highly competitive, especially with regards to overseas competition for Australian recyclate. Continuing issues with cross contamination with other polymers.
High density polyethylene (HDPE)	Export of post-consumer material continues to drive Australian prices up. Continuing issues with cross contamination with other polymers.
Polyvinyl chloride (PVC)	Strong export demand and competition continues. Continuing issues with cross contamination with other polymers. Shrinking manufacturing base in Australia is reducing availability of high quality pre-consumer scrap.
Low density polyethylene (LDPE)	Strong export demand and competition continues. Continuing issues with contamination, primarily from non-polymer sources such as product residues and labels.
Polypropylene (PP)	Tightening supply of right grades and good quality recyclate. Continuing issues with cross contamination with other polymers. Bumper bars and poly pipe in reasonable supply.
Polystyrene (PS)	Recyclate is difficult to come by and exports are driving the domestic price up. Continuing issues with contamination, the source of which is unclear.

5.3.3 Reuse

There is a high level of reuse of plastic freight packaging in the forms of crates, drums and pallets. Beyond this there was no significant reuse of waste plastics identified as taking place in SA during 2006.

5.4 Market summary

5.4.1 Market size

The worldwide size of the plastics recycling sector continues to grow, however, the Chinese market is now much more exacting in their requirements. The volume of waste plastic exported climbed again in 2006/2007 as it has done in previous years. There is also a wider range of interstate market outlets for most plastics.

In addition, the local Adelaide plastics recycling sector remains strong and accordingly the proportion of material collected and processed within the State is amongst the highest nationally.

Prices for waste plastics increased in 2006/2007 in part influenced by rising virgin plastic prices due to the increased price of oil.

5.4.2 Market strength

The plastics recycling market is strong due to its local industry sector and the mix of local, interstate and export sales of waste plastics.

6 Glass

6.1 Quantity recovered and reprocessing location

The quantity of glass recovered in SA and the location of reprocessing, during 2006–07, is presented in Table 6-30. Total glass recovery was 50 110 tonnes, with over 99% reprocessed within SA.

Table 6-31 Glass recovery, SA 2006–07

Material	Net recovery[1]	Reprocessing location		
	(tonnes)	SA	Interstate	Export
Glass	50 110	99.3%	0.4%	0.3%

1. Net recovery excludes reprocessing losses – refer to Section 8 (Packaging Summary) for more details

The breakdown of glass recovery by source sector is presented in Figure 6-23. Almost all glass reprocessed was sourced from the municipal sector.

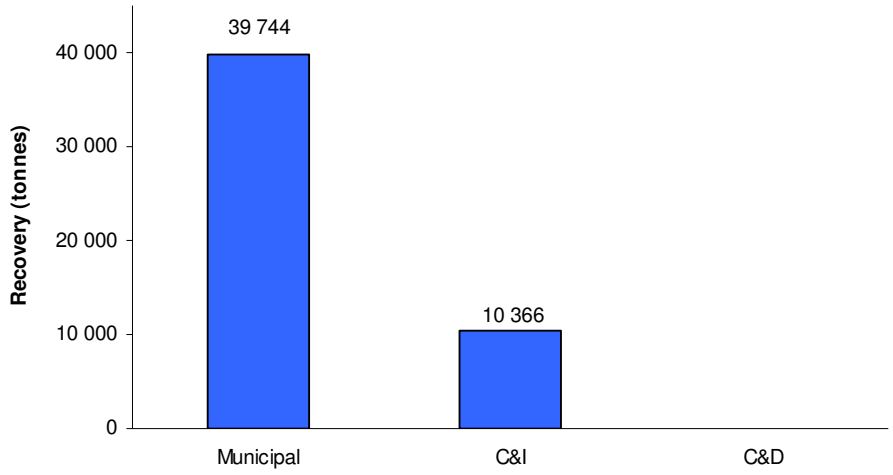

Figure 6-23 Glass recovery – by source sector, SA 2006–07

A significant quantity (18,000 tonnes) of bottle glass is imported into SA from WA for reprocessing. This material is not included in the quantity of glass recovered due to its interstate source.

6.2 Source & end products

Table 6-32 presents the glass source products. This is consistent with the municipal source sector contributing 83% of all glass reprocessed in SA.

Table 6-32 Glass source products, SA 2006–07

Material	Source products
Glass	Packaging – beer/wine/food Building glass

Table 6-33 Glass end products, SA 2006–07

Material	End products
Glass	Bottle manufacture, and some into reflective beads for road marking

6.3 Recycling activity trends and reuse

6.3.1 Trends

Presented in Figure 6-24 is the annual glass recycling data for SA for the period of 2003–04 to 2006–07.

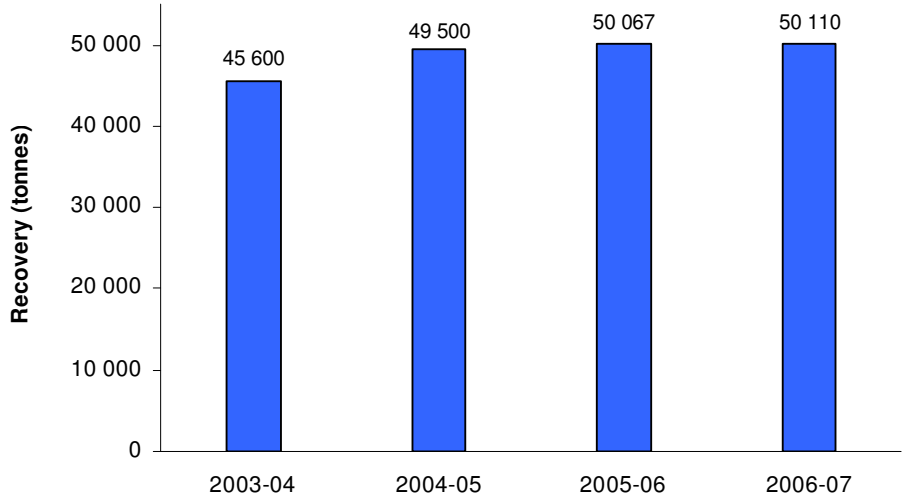

Figure 6-24 Annual glass recovery, SA 2003–04 to 2006–07

6.3.2 Reuse

There was no direct large scale reuse of glass identified as taking place in SA during 2006–07.

6.4 Market trends

The South Australian market is unique in having two glass manufacturing plants within the Adelaide area. These are operated by Owen's Illinois and Amcor. The strength of the wine and beer industries in SA has led to this outcome.

It compares to WA where no glass manufacturing occurs and this results in the need to transfer 18 000 tonnes of glass recyclate to Adelaide for use in bottle manufacture. The high level of export of bottled wine means that the market need for recyclate is likely to exceed the supply from the local recycling stream. While the production of glass containers in SA is slanted towards the clear and green glass used in wine packaging, the need for both amber and clear in beer and food packaging ensures there are adequate market outlets for all material.

The price paid for glass cullet in glass manufacture has reduced overtime and as a result the price paid for recyclate has also dropped in real terms. This reduces the financial drive for expansion of glass recovery, although the CD system helps to ensure a higher level of recovery from non-household sources than for other states.

The breakage of glass beyond a level at which it can be sorted is a market quality issue in all states. It is a less significant problem in SA where more of the glass is returned through routes other than kerbside collection and sorting. As a result, the level of breakage is lower and later in the handling process. Optical sorting of glass fines is being developed and used in some other states (Victoria and NSW). The degree of loss and or stockpiling of glass fines in SA is not known and therefore the need for optical sorting is not certain.

7 Other materials

7.1 Quantity recovered and reprocessing location

The 'other' materials recovery data presented in this report has been provided by a range of industry sources, including manufacturers, industry groups and reprocessors.

The quantity of 'other' materials recovered in SA and the location of reprocessing are presented in Table 7-34. Total other materials recovery was 266 747 tonnes, of which fly ash was the majority of material recovered.

Table 7-34 Other materials recovery, SA 2006–07

Material	Net recovery[1]	Reprocessing location		
	(tonnes)	SA	Interstate	Export
Fly ash[2]	260 913	100.0%	0.0%	0.0%
Foundry sands[3]	2 000	100.0%	0.0%	0.0%
Leather & textiles	2 348	0.0%	0.0%	100.0%
Tyres & other rubber	1 486	0.0%	94.7%	5.3%
Total	**266 747**	**98.6%**	**0.5%**	**0.9%**

1. Net recovery excludes reprocessing losses
2. SA fly ash data provided by the Ash Development Association of Australia (ADAA)
3. SA foundry sands data provided by the Centre for Organic & Resource Enterprises (CORE)

The breakdown of 'other' materials recovery by source sector and material type is presented in Figure 7-25 and Table 7-35.

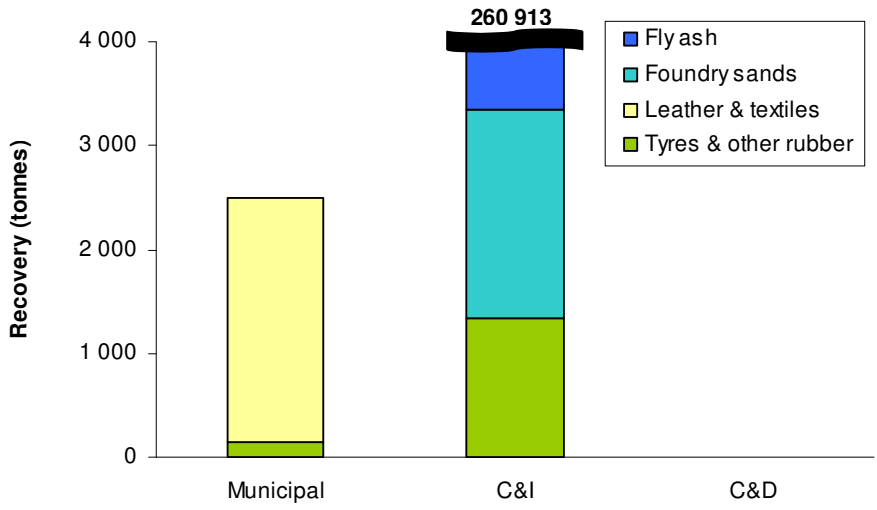

Figure 7-25 Other materials recovery – by source sector, SA 2006–07

Fly ash clearly dominates the 'other' material category, with the commercial and industrial sector the main source of fly ash.

Table 7-35 Other materials recovery – by source sector, SA 2006–07

Material	Source sector (tonnes)			
	Municipal	C&I	C&D	Total
Fly ash	0	260 913	0	260 913
Foundry sands	0	2 000	0	2 000
Leather & textiles	2 341	7	0	2 348
Tyres & other rubber	149	1 338	0	1 486
Total	**2 489**	**264 258**	**0**	**266 747**

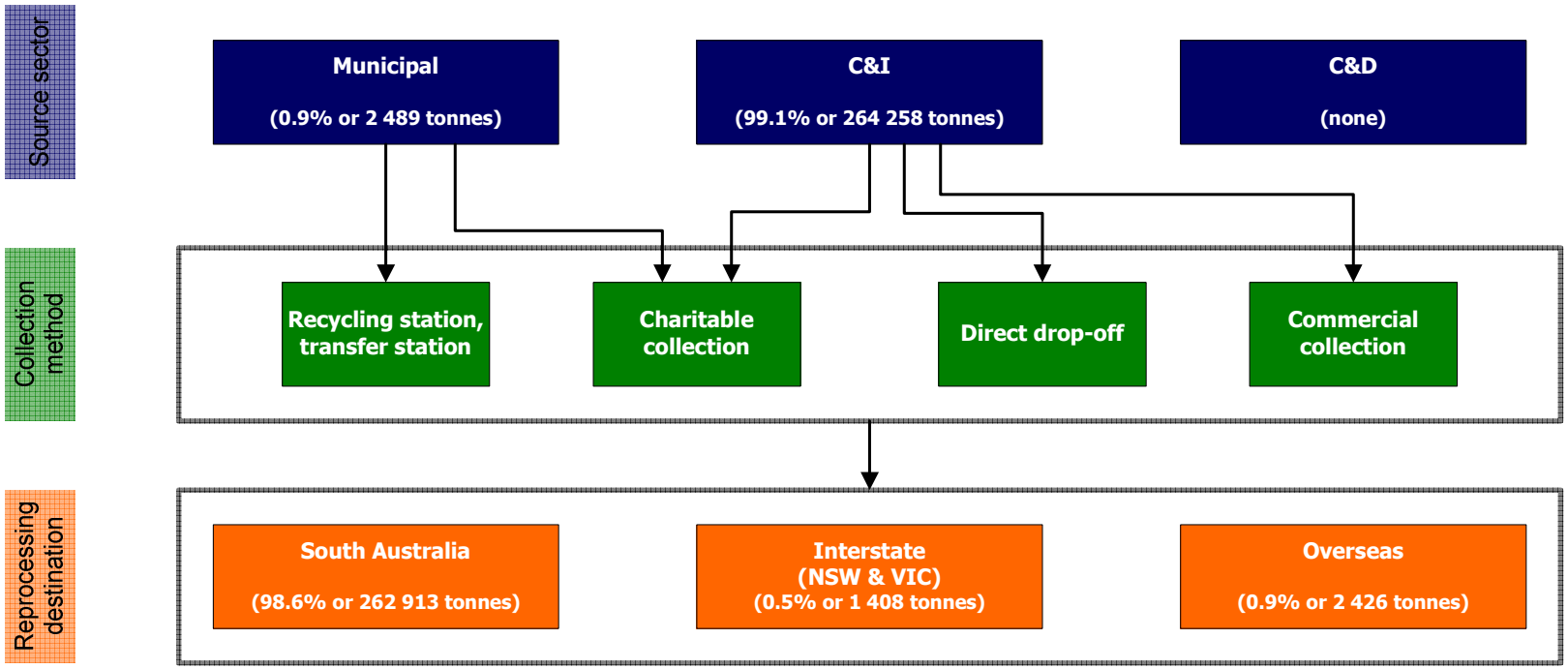

Figure 7-26 Flow of other materials reprocessing, SA 2006–07

7.2 Source & end products

Table 7-36 Other materials source products, SA 2006–07

Material	Source products
Fly ash	Power generation (coal ash)
Foundry sands	Foundry sands
Leather & textiles	Used clothing
Tyres & other rubber	Truck tyres and some passenger car tyres to export

Table 7-37 Other materials end products, SA 2006–07

Material	End products
Fly ash	The construction industry currently consumes (in concrete) most the fly ash that is recycled. As stated earlier, SA fly ash is highly desirable in cement manufacture. Recently, the Department of Environment and Climate Change NSW has authorised the use of fly ash in composts, for specified applications. A program is underway to assess the viability of fly ash as an agricultural additive to soil, one of the objectives of which is to assist carbon sequestration by agricultural soils. A program is underway to assess the use of fly ash in the manufacture of man-made aggregates for concrete, the man-made aggregates could, for example, replace crushed basalt.
Foundry sands	Commercial and domestic compost mixes during 2006–07, however there is currently no authorised reuse of foundry sands in South Australia.
Leather & textiles	Significant reuse of clothing overseas
Tyres & other rubber	New tyres, industrial adhesives and non-slip paints, road surfacing, brake pads, sporting and playground surfaces, insulation

7.3 Recycling activity trends, barriers and reuse

7.3.1 Trends

Presented in Figure 7-27 and Table 7-38 is annual 'other' materials recycling data for SA for the period of 2004–05 to 2006–07. Data for 2003–04 is excluded as no fly ash or foundry sands data was available for that period.

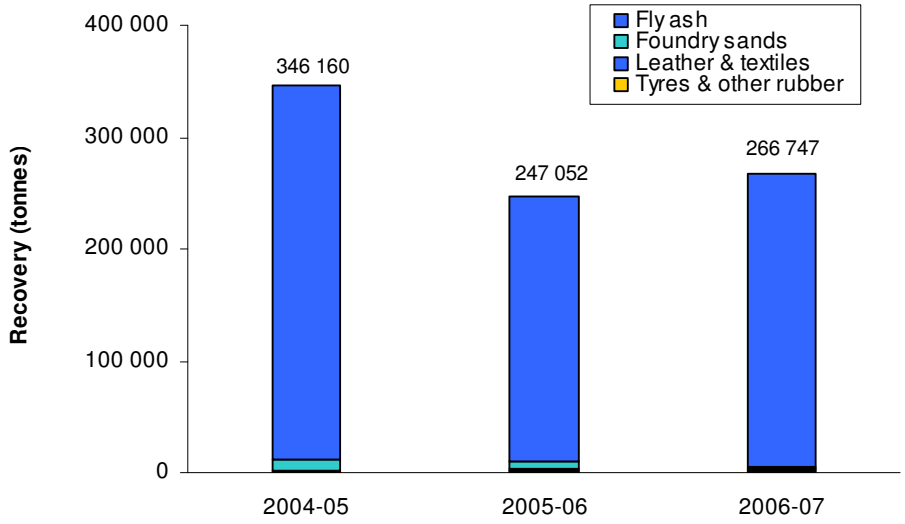

Figure 7-27 Annual other materials recovery, SA 2004–05 to 2006–07

Reprocessing of foundry sands fell sharply in 2006-07 due to difficulties in receiving the necessary approvals fro reprocessing. Compliance difficulties resulted in approximately 10 000 tonnes of foundry sands being disposed of in landfill that would otherwise have been reprocessed.

Reuse of fly ash rose slightly in 2006-07 following the sharp decline in 2005-06. The fly ash industry stated that local short-term fluctuations are typical year on year. Tyre recycling levels were largely unchanged during 2006-07.

Table 7-38 Annual other materials recovery, SA 2003–04 to 2006–07

Material	2003–04 recovery (tonnes)	2004–05 recovery (tonnes)	2005–06 recovery (tonnes)	2006-07 recovery (tonnes)
Fly ash	0	335 000	236 343	260 913
Foundry sands	0	9 006	6 755	2 000
Leather & textiles	4 080	1 564	2 419	2 348
Tyres & other rubber	88	590	1 535	1 486
Total	**4 168**	**346 160**	**247 052**	**266 747**

7.3.2 Barriers

Presented in Table 7-38 are the general barriers to other materials market development, as reported by industry.

Table 7-39 Other materials market barriers, SA 2006–07

Material	Market barriers
Fly ash	Financial: Market is inhibited by the good economic availability of alternative materials, freight costs from point of generation to point of end use and a mismatch between production and purchase requirements. Regulatory: Development of the market potential requires greater capital investment, refinement of the waste stream quality, and an improved regulatory and reporting framework. A view by industry that state regulators need to have a consistent approach, and that ideally, a nationally consistent, evidence-based approach, is required A view by industry that reporting obligations are onerous, and that legislation and policy is required that enables reuse of fly ash and addresses unscientific perception issues relating to the toxicity of fly ash. A concern by the fly ash recycling industry that fly ash may be reclassified as a hazardous waste in South Australia. There are approximately twelve standards describing the use of fly ash across a number of industries. The ash industry is closely involved with the development of Australian Standards on the wider use of fly ash.
Foundry sands	Financial: Good economic availability of alternative materials, inhibiting market. Freight costs from point of generation to point of reuse. Potentially high testing costs for foundry sands. Regulatory: As used foundry sands are an industrial waste, recycling into compost must be shown to be a beneficial reuse application.
Leather & textiles	Local manufacture of rags ceased in 2003–04, however no specific barriers to the market reported.
Tyres & other rubber	Financial: The market for tyre reprocessing is largely determined by the cost of sending waste tyres to landfill. Where the cost of landfilling is greater than the cost of export or reprocessing, tyres will be exported or reprocessed rather than disposed to landfill. The recycling rate has increased due to solid disposal enforcement and the limitation imposed on the number of times a tyre can be re-treaded. The low value of recyclate is, however, limiting the recovery. In terms of exporting tyres interstate, EPA regulations are the main market barrier. Premium prices are required in order to overcome the charges associated with exporting tyres interstate.

7.3.3 Reuse

Leather & textiles (clothing) is the only 'other' material that has significant direct reuse. An unknown quantity of the reported recovery for reprocessing (2 348 tonnes) would be directly reused overseas.

7.4 Market summary

7.4.1 Fly ash

Current market situation

In 2006–07 there was an increase of 24 570 tonnes in the reuse of fly ash from 2005–06. This increased utilisation was primarily due to growing demand from cement manufacturers.

South Australian fly ash, in particular, is generally seen as a desirable input into cement manufacturing. Significant quantities of the South Australian coals used in electricity generation, have properties loosely between lignite and bituminous coals, and the fly ash produced is highly suitable as a raw material for cement manufacture.

While no interstate transfer of fly ash took place from South Australia during 2006–07, interstate transfer is now beginning to take place, due to the increasingly strong demand. Transport costs continue to be the key factor limiting the recycling of fly ash.

Nationally, approximately 13 million tonnes of fly ash and other combustion products is produced annually, with 2 million recycled into further applications. 1.74 million tonnes of this is fly ash (85%), most of the remainder is iron and steel slag.

In NSW, coal stations are now harvesting ash dams for recycling, and in some cases, are actually reducing stockpiles of fly ash faster than they are growing. Currently, there is no known harvesting of ash dams in South Australia.

The coal and cement industries continue to strongly support the fly ash recycling industry.

Market size and trends

The national size of the direct fly ash market is currently estimated as more than $100 million/year, with it reasonable to expect substantial multiplier effects elsewhere in the economy.

The ADAA and industry partners have a target of increasing the recycling of coal combustion products from 2 million tonnes in 2007 to 4 million tonnes in 2012.

The market has seen growth of 3-4% over the past few years, however the ash recycling industry now has public targets of 15-20% per annum until 2012. This is based upon the target market for ash products of 4 million tonnes by 2012, the majority of this material would be fly ash (80-90%).

It is anticipated that carbon trading, when introduced in 2010, will have a major impact on the economics of fly ash recycling, probably for the better. According to the ADAA there is a strong greenhouse gas (GHG) benefit from the use of fly ash as an input into cement manufacture. The GHG emissions of the silica based materials, for which fly ash substitutes in cement manufacture, are 0.79 tonnes CO_{2e}/tonne, the GHG emissions of fly ash are 0.14 tonnes CO_{2e}/tonne. Fly ash generally only requires simple processing (particle size reduction) to allow direct replacement for cement manufacture. Fly ash is 85-90% silica oxide.

7.4.2 Foundry sands

Current market situation

In 2006–07 it is reported that 2 000 tonnes of foundry sands were recycled in SA. This was a significant decrease from both 2005–06 and 2004-05. It is possible that no recycling of used foundry sands has taken place, to date, during 2007–08. The decrease in reuse is due to the cessation of unregulated foundry sands reuse.

A foundry sands recycler (compost manufacturer) in South Australia is currently in discussions with the SA EPA to gain approval for the beneficial reuse of used foundry sands in compost products. The SA EPA require evidence that used foundry sands can be safely used in compost products. In the case of foundry sands the SA EPA is guided by the EPHC document *Guidance for Assessing the Beneficial Reuse of Industrial Residues to Land Management Applications – A National Approach*.

If the composter can satisfy the requirements of the EPA, requirements which are similar for the reuse of any industrial waste material, the reuse of foundry sands in compost could resume. Foundry sands can be contaminated with, for example, metals and phenols.

Elsewhere in Australia the market is generally growing well, with national recycling volumes tentatively identified as approximately 50 000 tonnes/year. National annual growth in market is not able to be estimated.

The only identified destination product continues to be compost, with the used foundry sands utilised as a replacement for quarried sands. Foundry operators are generally highly supportive of the used foundry sands recycling industry, and there are increasing numbers of re-cyclers prepared to receive foundry sands nationally.

Market size and trends

Used foundry sands are generally taken at no cost by compost companies for recycling. It is difficult is estimated the financial value of the market as the utilisation of used foundry sands represents a cost saving for foundry operators (waste disposal costs) and composters (virgin sand costs). No direct revenues are generated.

Industry sources suggest that the potential South Australian market size for foundry sands is approximately 15 000 tonnes/year, if licensing issues can be addressed.

National generation goes up and down dramatically, but has tentatively been identified as 100 000 tonnes/year.

7.4.3 Tyres

Market size and trends

Although the overall volume of waste tyres has remained steady, there has been a drastic decline in the availability of tyres for domestic reprocessing as export of waste tyres increases. The export figures for latter-2007 and early-2008 are indicating a dramatic increase in the proportion of tyres being exported rather than reprocessed in Australia.

8 Packaging summary

The packaging recovery data presented in this report has been provided by a range of sources, including super collectors, packaging manufacturers, industry groups and reprocessors. The packaging summary provided in this section identifies packaging material that has already been quantified in the earlier material based sections of this report. As such the quantities identified in this section are not in addition to Section 2 – 7, but are a sub-set of the data to provide specific information on packaging recovery.

Packaging recovery in SA is presented in Table 8-40. Total packaging recovery was 169 965 tonnes, of which 33 997 tonnes (20.0%) was recovered through the Container Deposit (CD) system, and 135 967 tonnes (80.0%) was recovered through non-CD routes, such as kerbside recycling and commercial co-mingled collections.

Table 8-40 Packaging recovery, SA 2006–07

Material	Net recovery	CD recovery		Non-CD recovery[1]
	(tonnes)	(units)	(tonnes)	(tonnes)
Steel cans	1 903	N/A	0	1 903
Aluminium cans	7 218	212 742 480	3 127	4 090
Cardboard packaging	96 436	N/A	0	96 436
Liquid paperboard cartons	1 373	27 812 392	579	793
PET packaging	5 364	99 372 374	3 750	1 614
HDPE packaging	1 783	4 923 967	109	1 674
PVC packaging	59	N/A	0	59
LL/LDPE packaging	5 333	N/A	0	5 333
Polypropylene packaging	430	N/A	0	430
Polystyrene packaging	86	N/A	0	86
Other plastics packaging	0	N/A	0	0
Glass bottles & jars	49 981	122 116 000	26 432	23 549
Total	**169 965**	**466 967 213**	**33 997**	**135 967**

1. Non-CD recovery also includes CD packaging recovered through non-CD routes
2. Glass CD recovery information, units and tonnes, are sourced from super collector data provided.

Figure 8-28 and Figure 8-29 illustrate the breakdown of packaging materials recovery by CD and non-CD. Glass bottles and jars make up the majority of the CD packaging recovery, whilst cardboard packaging is the majority material recovered through non-CD recovery.

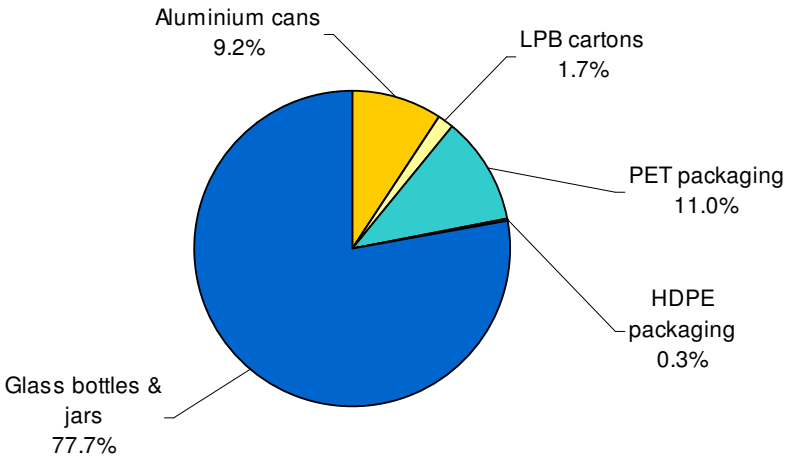

Figure 8-28 CD packaging recovery, SA 2006–07 (by weight)

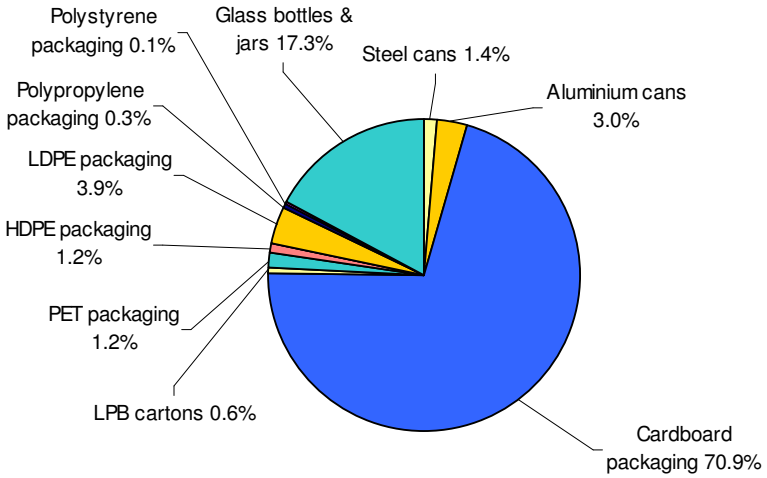

Figure 8-29 Non-CD packaging recovery, SA 2006–07 (by weight)

9 Greenhouse Gas Impacts of Recycling Activity

9.1 GHG impacts introduction

Recycling substantially improves South Australia's environment by saving energy, conserving resources and reducing emissions of greenhouse gases (GHGs) to the atmosphere.

Recycling reduces GHG emissions primarily by decreasing the amount of energy used by industry to make products, compared with feedstocks of virgin raw materials. This is because much of the energy used in industrial processes involves burning fossil fuels such as coal, diesel and petrol. Manufacturing the second time around is generally less energy intensive than the first time and consequently recycling can be seen as capturing a proportion of the energy and resources already invested in the material. Additional greenhouse gas savings are derived from reduced emissions of GHGs from landfills (e.g. methane).

9.2 GHG impacts data sources

The impact of recycling on GHG emission in SA has been estimated in this section by applying the findings of a South Australian specific study *Benefits of Recycling in South Australia (2008)* and a Victorian study *Life Cycle Impact Data for Resource Recovery from Commercial & Industrial and Construction and Demolition Waste (2005)*.

The South Australian study was based upon life cycle assessment (LCA) modelling undertaken by Hyder Consulting. The study assessed the significant environmental costs and benefits associated with the recycling, collection and reprocessing systems of the following wastes:

- Steel
- Aluminium
- Mixed paper including newsprint and cardboard
- Source separated paper – predominantly sorted office paper
- Glass
- Plastics – HDPE and PET
- Masonry materials – concrete, asphalt and bricks.

The Victorian study was based upon LCA modelling undertaken by the Centre for Design at RMIT University in Melbourne. The study assessed the environmental savings and impacts of recycling (instead of landfilling) the main C&I and C&D waste materials recovered in Victoria.

Where the material was not included in the South Australian specific study, the Victorian study results were used. Care should be taken in the application of the Victorian based results.

9.3 GHG impacts results

By substituting secondary-use materials for virgin materials in 2006–07, South Australia's recycling efforts prevented the equivalent of approximately 0.93 million tonnes of CO_2 entering the atmosphere. This is equivalent to about 18% of the annual CO_2 emissions from the entire South Australian transport sector (2005 transport sector figures), and equates to taking approximately 214 000 passenger cars off the road.

Comparisons between 2005-06 and 2006-07 GHG impacts are not possible due to a change in the methodology.

The provision of an SA specific benefits of recycling report has enabled a more accurate calculation of the GHG savings from SA recycling during 2006-07 for particular materials. However, as the report did not contain the same list of materials as the annual recycling activity audit the complete SA specific picture cannot be provided. In place of SA data, the Victorian methodology has had to be used for the following materials:

- Non-ferrous metals (excluding aluminium)
- Food organics
- Garden organics
- Timber
- Organics – other
- Polyvinyl chloride (PVC)
- Polypropylene (PP)
- Polystyrene (PS)
- Other plastics
- Fly ash
- Foundry sands
- Leather and textiles
- Tyres and other rubber

Figure 9-30 presents the recycling savings by material category, in terms of CO_2 equivalent savings, which resulted from recycling activity in SA during 2006-07.

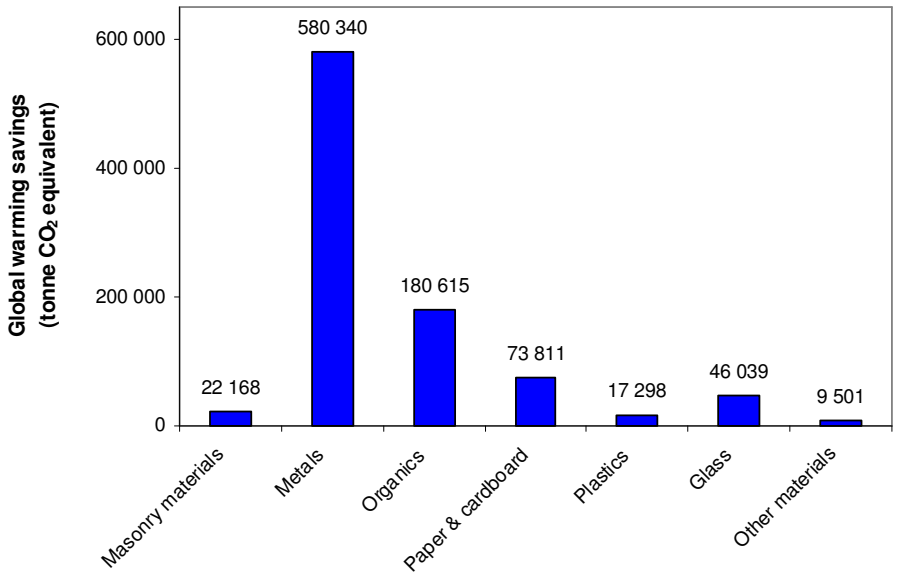

Figure 9-30 Avoided GHG emissions – by material category, SA 2006–07

The LCA modelling showed a GHG emission saving for all materials, when comparing recycling with landfill. The greatest savings in South Australia result from the recycling of steel and aluminium. The metals are also generally recycled back into a product with minimal loss, and have a high density and are therefore efficient to transport.

Table 9-41 presents the recycling savings by material, in terms of CO_2 equivalent savings, which resulted from recycling activity in SA during 2006-07.

Table 9-41 Total GHG savings and equivalencies for all materials, SA 2006–07

Material	Total benefit of recycling (tonne CO_2 eq.)	Equivalent trees planted required for carbon absorption	Equivalent cars off the road
Masonry material [1]	22,168	33,136,608	5,120
Steel	182,875	273,355,925	42,234
Aluminium	314,967	470,803,314	72,741
Non-ferrous metals (ex. Al)	82,497	123,314	19,052
Food organics	2,062	3,082	476
Garden organics	48,342	72,260	11,164
Timber	90,464	135,223	20,892
Organics - other	39,748	59,414	9,180
Mixed paper including newsprint and cardboard [2]	73,811	105,595,620	17,046
Polyethylene terephthalate (PET)	7,200	10,300,770	1,663
High density polyethylene (HDPE)	1,831	2,619,384	423
Polyvinyl chloride (PVC)	684	1,023	158
Low density polyethylene (LDPE) [3]	3,560	5,092,490	822
Polypropylene (PP)	2,536	3,791	586
Polystyrene (PS) [4]	228	340	53
Other plastics	1,259	1,882	291
Glass	46,039	65,864,178	10,633
Fly ash [5]	7,566	11,310	1,747
Foundry sands [6]	173	259	40
Leather & textiles [7]	N / A	N / A	N / A
Tyres & other rubber	1,762	2,633	407
Total	**929,773**	**967,182,819**	**214,728**

1. The masonry material data presented represents an aggregated category from the SA specific LCA and includes asphalt, bricks, concrete and clay, fines, rubble & soil.

2. The mixed paper including newsprint and cardboard data presented represents an aggregated category from the SA specific LCA and includes cardboard & waxed cardboard, liquid paperboard, magazines, newsprint, phonebooks and printing & writing papers.

3. No specific data was available on the GHG impact of recycling LDPE, it has been assumed that the impact is similar to that of HDPE.

4. No specific data was available on the GHG impact of recycling PS, it has been assumed that the impact is similar to that of 'Other plastics'.

5. No specific data was available on the GHG impact of recycling fly ash, it has been assumed that the impact is similar to that of concrete (in the Victorian report) on the basis that fly ash is used as a binder in cement and hence concrete was the most closely related category available. It is possible the CO_2 equivalent savings might be overstated, and caution should be taken in the use of this estimation.

6. No specific data was available on the GHG impact of recycling foundry sands, it has been assumed that the impact is similar to that of soil & sand (in the Victorian report) on the basis that foundry sands are used as sand for compost applications and hence soil & sand was the most closely related category available.

7. No data was available on the GHG impact of recycling leather & textiles.

10 Glossary

CD: Container deposit, sometimes referred to as container deposit legislation or CDL. A refundable charge imposed on a range of beverage containers. The deposit is included in the retail price and refunded when the container is returned to a collection point.

Clinical waste:
Waste generated by medical, nursing, dental, veterinary, pharmaceutical or other related activity which is poisonous or infectious; likely to cause injury to public health; or contains human tissue or body parts.

Commercial and industrial waste (C&I):
Comprises solid waste generated by the business sector as well as solid wastes created by state and federal government entities, schools and tertiary institutions. Unless otherwise noted, C&I waste does not include waste from the construction and demolition (C&D) sector.

Construction and demolition waste (C&D):
Includes waste from residential, civil and commercial construction and demolition activities, such as fill material (e.g. soil), asphalt, bricks and timber. C&D waste excludes construction waste from owner/occupier renovations, which are included in the municipal waste stream. Unless otherwise noted, C&D waste does not include waste from the commercial and industrial waste stream.

Garden organics:
Organics derived from garden sources e.g. grass clippings, tree prunings.

Greenhouse gases (GHGs):

For the purposes of this report GHGs are the six gases listed in the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydroflurocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6).

High density polyethylene (HDPE):
A member of the polyethylene family of plastics and is used to make products such as milk bottles, pipes and shopping bags. HDPE may be coloured or opaque.

Intractable waste:
Waste which is a management problem by virtue of its toxicity or chemical or physical characteristics which make it difficult to dispose of or treat safely, and is not suitable for disposal in Class I, II, III and IV landfill facilities.

Kerbside collection:
Collection of household recyclable materials (separated or co-mingled) that are left at the kerbside for collection by local council collection services.

Linear low density polyethylene (LLDPE):

A member of the polyolefin family of plastics. It is a strong and flexible plastic and usually used in film for packaging, bags and for industrial products such as pressure pipe.

Low density polyethylene (LDPE):
A member of the polyolefin family of plastics. It is a flexible material and usually used as film for packaging or as bags.

Municipal waste:
Solid waste generated from domestic (household) premises and council activities such as street sweeping, litter and street tree lopping. Also includes waste dropped off at recycling centres, transfer stations and construction waste from owner/occupier renovations.

Non-ferrous metals:
Those metals that contain very little or no iron, e.g. copper, brass, bronze.

Packaging:
Plastic material used for the containment, protection, marketing or handling of product.

Polyethylene terephthalate (PET):
A clear, tough, light and shatterproof type of plastic, used to make products such as soft drink bottles, film packaging and fabrics.

Polypropylene (PP):
A member of the polyolefin family of plastics. PP is light, rigid and glossy and is used to make products such as washing machine agitators, clear film packaging, carpet fibres and housewares.

Polystyrene (PS):
A member of the styrene family of plastics. PS is easy to mould and is used to make refrigerator and washing machine components. It can be foamed to make single use packaging, such as cups, meat and produce trays.

Polyvinyl chloride (PVC):
A member of the vinyl family of plastics. PVC can be clear, flexible or rigid and is used to make products such as fruit juice bottles, credit cards, pipes and hoses.

Post-consumer material
Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

Pre-consumer material:
Material diverted from the waste stream during a manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

Material diverted from the waste stream during a manufacturing processes for reprocessing at a different site. Excluded are waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e. process scrap). Examples of this include paper mill 'broke' and plastics 'regrind'.

Recovered material:
Material that would have otherwise been disposed of as waste, but has instead been collected and reclaimed as a material input, in lieu of a new primary material, for a recycling or manufacturing process.

Recycling:
Material that has been reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or into a component for incorporation into a product.

The term *recycling* is used to cover a wide range of activities, including collection, sorting, reprocessing and manufacture into new products. It also covers the processing of by-products from manufacturing processes which may otherwise be disposed to landfill, for example bark from plantation timber (for compost), and meat waste from abattoirs (for fertiliser).

Materials recovered from both pre-consumer (manufacturing losses) and post-consumer (product end-of-life) sources are defined as being able to be diverted from landfill for recycling. However, waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e. process scrap) are not defined as recycling for the purpose of this study.

Reprocessing:
Changing the physical structure and properties of a waste material that would otherwise have been sent to landfill, in order to add financial value to the processed material.

Reuse:
Reuse involves recovering value from a discarded resource in its original state without reprocessing or remanufacture.

Solid waste:
Waste materials ranging from municipal garbage to industrial waste, but excluding gaseous, liquid, hazardous, clinical and intractable wastes.

11 References

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6 Environment Protection Authority SA, 2006–07 landfill quantities data.

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8 Publishers National Environment Bureau, *ONP market report for Australia (2005).*

9 Sustainability Victoria, *Life Cycle Impact Data for Resource Recovery from Commercial & Industrial and Construction and Demolition Waste in Victoria*, prepared by the Centre for Design at RMIT University, Melbourne, 2005.

10 Zero Waste SA / Nolan-ITU, *Review of Recycling Activity in South Australia*, November 2004.

11 Zero Waste SA / Hyder Consulting, *Review of Recycling Activity in South Australia*, June 2007

12 Zero Waste SA / Hyder Consulting, *Benefits of Recycling in South Australia*, February 2008

Appendix A

Reprocessor questionnaire

Table A-1 Reprocessor questionnaire

	Questions
1	What was the reprocessed quantity of the material during 2006-07 financial year?
2	What is the estimated accuracy of the data? (+/- %)
3	What are the reprocessing losses (tonnes or %)?
4	What is the split (% or tonnes) of packaging vs. non-packaging material?
5	What was the stockpile of the material at 1 **July 2006**? (tonnes)
6	What was the stockpile of the material at 30 **June 2007**? (tonnes)
7	Was this stockpiled material (referred to in Q5 & Q6) reprocessed or un-reprocessed?
8	What source state did the material come from? (i.e. did any of the material reported in Q1 originate outside of SA?) (Identify tonnes for: South Australia, Interstate, Imported)
9	What source sector did the material come from? (Municipal, C&I and C&D tonnes and/or %)
10	If known, what are the source products?
11	What is the pre/post consumer % split?
12	What is the destination of the reprocessed material, split by SA, interstate (State) and export (Country) (tonnes or %)?
13	What is the product destination of the reprocessed material? (i.e. what products are the reprocessed material manufactured into?)
14	Please comment on any changes in the quantity of the material recycled from the 2005-06 financial year.
15	Please comment on any direct 'reuse' of the material by the market, i.e. where no reprocessing was required (this material should not contribute to the data supplied in Q1).
16	Please include comments on recycling activity trends, market access and any inhibitors to increased activity.
17	Do you know of other players in your market?
18	When would your data be available for the 2007-08 financial year?