



Circular Economy Resource Recovery Report 2021-22

Summary of Findings



Government of South Australia

Green Industries SA

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Disclaimer

This report has been prepared by Green Industries SA based on the results of a survey of the waste recovery sector by Blue Environment Pty Ltd in accordance with the terms and conditions of appointment dated 10 September 2021, and is based on the assumptions and exclusions set out in the scope of work. Information in this document is current as of 30 April 2023. While all professional care has been undertaken in preparing this report, GISA and Blue Environment Pty Ltd cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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Acknowledgement of country

We acknowledge the Traditional Custodians whose ancestral lands we live and work upon and we pay our respects to their Elders past and present.

We acknowledge and respect their deep spiritual connection and the relationship that Aboriginal and Torres Strait Islanders have to Country. We also pay our respects to the cultural authority of Aboriginal and Torres Strait Islander people and their nations in South Australia, as well as those across Australia.

Abbreviations and glossary

Alternative fuels and raw materials	Non-traditional fuels and raw materials that are co-processed in cement kilns or other thermal facilities, potentially including refuse derived fuels, solid recovered fuels, spent catalysts and others
Biosolids	Waste organic solids derived from biological wastewater treatment plants
C&D	Construction and demolition
C&I	Commercial and industrial
CDL	Container deposit legislation
CERRR	Circular Economy Resource Recovery Report
Circular economy	Looking beyond the current take-make-waste extractive industrial model, a circular economy aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources, and designing waste and pollution out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles: design out waste and pollution; keep products and materials in use [ideally at their highest and best value]; and regenerate natural systems.
CO₂-e	Carbon dioxide equivalent
Diversion	Sending waste for recycling or energy recovery instead of landfill
Energy recovery	Processes through which wastes are collected, sorted and processed to recover energy in usable form, for example process heat, steam or in electricity generation.
EPA	Environment Protection Authority
GHG	Greenhouse gas
GSP	Gross state product
kg	Kilogram
kt	Kilotonne
LDPE	Low density polyethylene
LHV	Lower heating value
MFA	Material flow analysis
ML	Megalitre
MSW	Municipal solid waste
PET	Polyethylene terephthalate
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl chloride
Recovered materials	Waste materials separated, sorted or processed for the purposes of reuse, recycling or energy recovery

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. 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. Recycling does not include waste materials that have been received at a recycling facility but have not been processed.
Reprocessing	Processing of recovered materials to make raw materials for use in making new products or direct use. May also be called 'secondary processing'
Resource recovery	Activities through which wastes are collected, sorted, processed (including through composting), and/or converted into raw materials for use in a production system. For data reporting purposes, the quantity of waste allocated to the fate 'resource recovery' is the sum of the quantities allocated to waste reuse, recycling and energy recovery.
Reuse	Reallocation of products or materials to a new owner or purpose without reprocessing or remanufacture, but potentially with some repair (for example, repair of pallets for resale, tyre retreading)
Solid waste	Waste materials ranging from municipal garbage to industrial waste, but excluding gaseous, liquid, hazardous, clinical, and intractable wastes
The survey	The Circular Economy Resource Recovery Survey 2021-22
TJ	Terajoule

Summary

Green Industries SA measures annual recycling and disposal activity in South Australia (SA) to assess how the state is performing on waste management and recycling. The findings are used to track progress against South Australia's state waste targets. This report summarises the results for the 2021-22 financial year.

Summary of 2021-22 results

An estimated
4,880,000 tonnes
 of waste material was generated in SA in 2021-22

3,990,000 tonnes
 of this material was recovered for further use

SA achieved a recovery rate of all materials
81.9%

Local government collected
684,000 tonnes
 of kerbside waste

SA local government achieved
48.8%
 recovery rate

Adelaide Metropolitan councils achieved
51.5%
 recovery rate

In SA the waste sector contributes
\$649 million
 to the state economy

Of recovered materials
92.0%
 was reprocessed locally in SA

885,000 tonnes
 was sent to landfill

Energy was recovered from
308,000 tonnes
 of waste

Environmental savings are estimated to be
1,520,000 tonnes
 Greenhouse gas equivalents

18,500 Terajoules
 Energy savings

8,400 Megalitres
 Water savings

More than
3,000 employees
 Work in the waste recovery sector



Table S1 Summary of resource recovery, landfill disposal and waste generation, SA, 2021-22

	Standard reporting materials	Separately reported materials	Total
Resource recovery (million tonnes)	3.39	0.60	3.99
Landfill disposal (million tonnes)	0.68	0.21	0.88
Waste generation (million tonnes)	4.07	0.81	4.88
Recovery rate [%]	83.4%	74.3%	81.9%

Recovery by material

Table S2 Summary of resource recovery by material type, 2021-22

Recovered material	Tonnes	Trend (compared to previous year)
Masonry (inc. clays, fines, rubble and soil)	2,029,000	▼
Metals	329,000	▼
Organics	1,351,000	▲
Cardboard and paper	164,000	▲
Plastics	33,000	▲
Glass	54,000	▼
Other materials	34,000	▲

Performance against state waste targets

In 2020, Green Industries SA released *South Australia's Waste Strategy 2020-25*. The strategy defines waste diversion¹ and reduction targets to 2025, which are guided by an overall target of zero avoidable waste to landfill by 2030. Zero avoidable waste to landfill equates to the diversion of all waste from landfill where it is technologically, environmentally and economically practicable to do so. 'Unavoidable' waste therefore refers to wastes for which no other current treatment is available including (but not limited to) asbestos, toxic and quarantine waste. A summary of progress so far based on 2021-22 data is provided in Table S3.

Table S3 Summary of state waste targets and progress on them

Topic	Target	Progress
Landfill diversion	Zero avoidable waste to landfill by 2030	SA disposed about 885,000 tonnes of waste to landfill in 2021-22, an increase from 840,000 tonnes in 2020-21
Waste generation	5% reduction in waste generation per capita from a 2020 baseline	Waste generation per capita showed 5.8% reduction in 2021-22 compared to 2020-21, the long-term trend is downwards.
Metropolitan diversion	Diversion by 2023: <ul style="list-style-type: none"> - MSW 65% - C&I 85% - C&D 90% 	Diversion rates achieved by metropolitan SA in 2021-22: <ul style="list-style-type: none"> - MSW 56% - C&I 88% - C&D 87%

Local government kerbside recovery

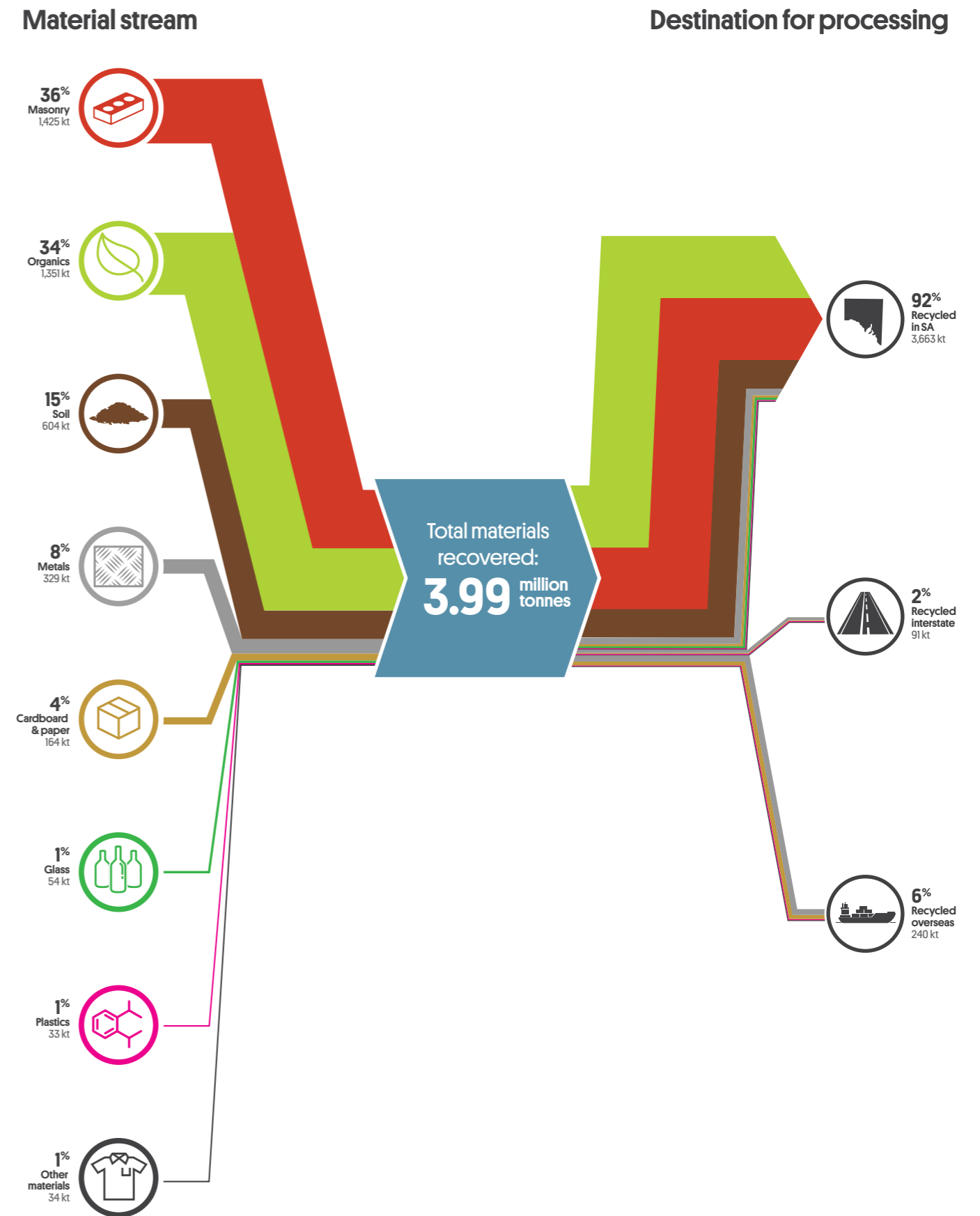
South Australia's local government councils collect waste from household kerbside bins for recovery and disposal. This material forms a part of total MSW. Total kerbside material collected is shown below.

Table S4 Total kerbside material collected by local governments, 2021-22

Kerbside waste in SA	Results
Waste materials were collected in SA	684,000 tonnes
Metropolitan councils	527,000 tonnes
Regional councils	156,000 tonnes
Recovery rate	48.8%
Metropolitan councils	51.5%
Regional councils	39.8%

¹ In this report, 'diversion' means sending waste for recycling or energy recovery instead of landfill.

Figure S1 Resource recovery, including energy recovery, SA, 2021-22, by material and destination, not including e-waste or materials reused

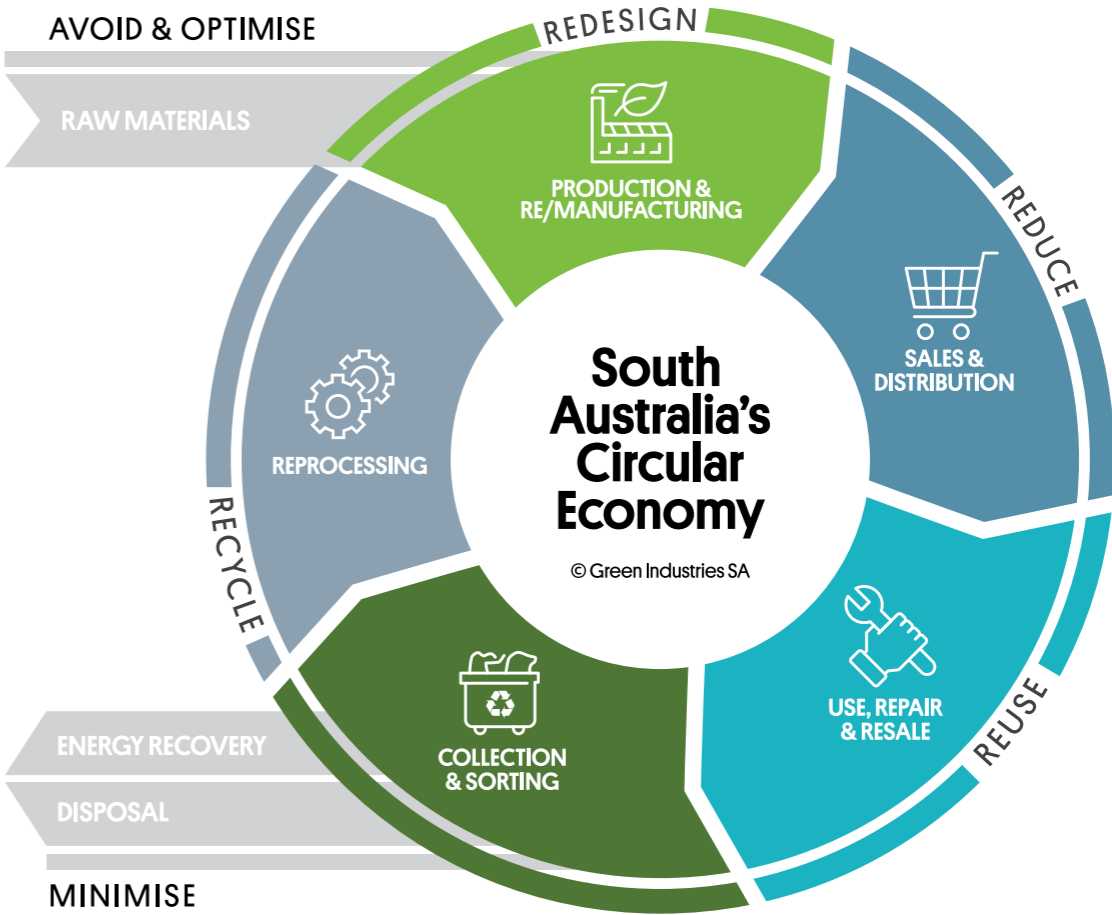




1 Introduction

A circular economy utilises resources to their fullest potential. Waste avoidance, reuse and recycling are maximised while raw material extraction and landfilling are minimised. South Australia (SA) continues to lead the way on resource recovery performance as it pushes towards a circular economy. This report provides a summary on the status of SA's resource recovery sector, including data on reuse, recycling and energy recovery, as well as the environmental, social and financial benefits that the sector provides. The findings are used to assess progress on the state waste targets set out in SA's *Waste Strategy 2020-25* (Green Industries SA 2020), which defines targets for waste reduction and waste diversion² from landfill to 2025. Table 1 (overleaf) summarises SA's waste targets.

Figure 1 South Australia's circular economy



Source: South Australia's Waste Strategy 2020-2025 (Green Industries SA 2020)

² In this report, 'diversion' means sending waste for recycling or energy recovery instead of landfill.

The *Circular Economy Resource Recovery Survey 2021-22* (the Survey) asked recyclers, reprocessors, the reuse sector and the energy recovery industry in SA about their operations in 2021-22. Data were sought on tonnes of materials recovered, including information on:

- source stream – municipal solid waste (MSW), commercial and industrial (C&I) waste, or construction and demolition (C&D) waste
- geographical origin – metropolitan or regional SA
- final reprocessing location – in SA, interstate or overseas
- value of recovered materials
- proportion of material derived from post-consumer packaging
- the type of productive use made of the recovered material.

Table 1 Summary of SA's waste targets

Overall targets				
2025	Per capita waste generation 5% reduction from a 2020 baseline			
2030	Zero avoidable waste to landfill by 2030			
Metropolitan waste targets				
	% diversion household bin system	% diversion all MSW ³	% diversion C&I	% diversion C&D
2023	60%	65%	85%	90%
2025	70%	75%	90%	95%
Non-metropolitan waste targets (all source streams)				
2020	Maximise diversion to the extent practically and economically achievable			
2023	Regional Waste Management Plans are in place for all South Australian regional local government areas and/or regional city clusters and set regionally appropriate and progressive waste diversion targets			

³ Quantities arising from total MSW material comprising household bin systems, hard waste services, street sweepings, council-operated parks and gardens, public place locations, waste collected at drop-off facilities, and council-operated commercial services.



2 Circular economy resource recovery statistics

2.1 Resource recovery and landfill disposal

Overall waste generation in 2021-22 was 4.88 million tonnes [5.04 million tonnes in the previous year] and SA recovered about 3.99 million tonnes of material. Disposal to landfill was 885,000 tonne resulting in a recovery rate of 81.9% for the state [83.3% in 2020-21].



Table 2 Annual SA resource recovery and landfill disposal quantities diversion performance for 2021-22 and previous years

Parameter	2003-04	2021-22	Change
			03-04 to 21-22
Resource recovery ('000 tonnes)			
Standard reporting materials	1,880	3,389	80%
Separately reported materials	162	604	273%
Total	2,042	3,994	96%
Landfill disposal ('000 tonnes)			
Standard reporting materials	1,258	676	-46%
Separately reported materials	20	209	947%
Total	1,278	885	-31%
Waste generation ('000 tonnes)			
Standard reporting materials	3,138	4,065	30%
Separately reported materials	182	813	347%
Total	3,320	4,878	47%
Recovery rate (%)			
Standard reporting materials	59.9%	83.4%	24%
Total	61.5%	81.9%	20%
SA population (persons)			
	1,534,000	1,821,000	19%
Per capita recovery (kg/person/yr)			
Standard reporting materials	1,230	1,861	51%
Total	1,330	2,193	65%
Per capita disposal (kg/person/yr)			
Standard reporting materials	820	371	-55%
Total	830	486	-41%
Per capita waste generation (kg/person/yr)			
Standard reporting materials	2,050	2,232	9%
Total	2,160	2,679	24%
SA Gross State Product (GSP) (\$ millions)			
	\$108,396	\$124,252	15%
Performance metrics per GSP (tonnes/\$ million GSP)			
Total recovery	36.2	32.1	-11%
Total disposal	11.8	7.1	-40%
Total waste generation	30.6	39.3	28%

Progress since the first survey year (2003-04)

Waste generation has increased with population. The recovery rate has dropped slightly to 81.9% after consistently being around 83% for the past five years.

Figure 2 Trend in resource recovery and landfill disposal in SA since 2003-04

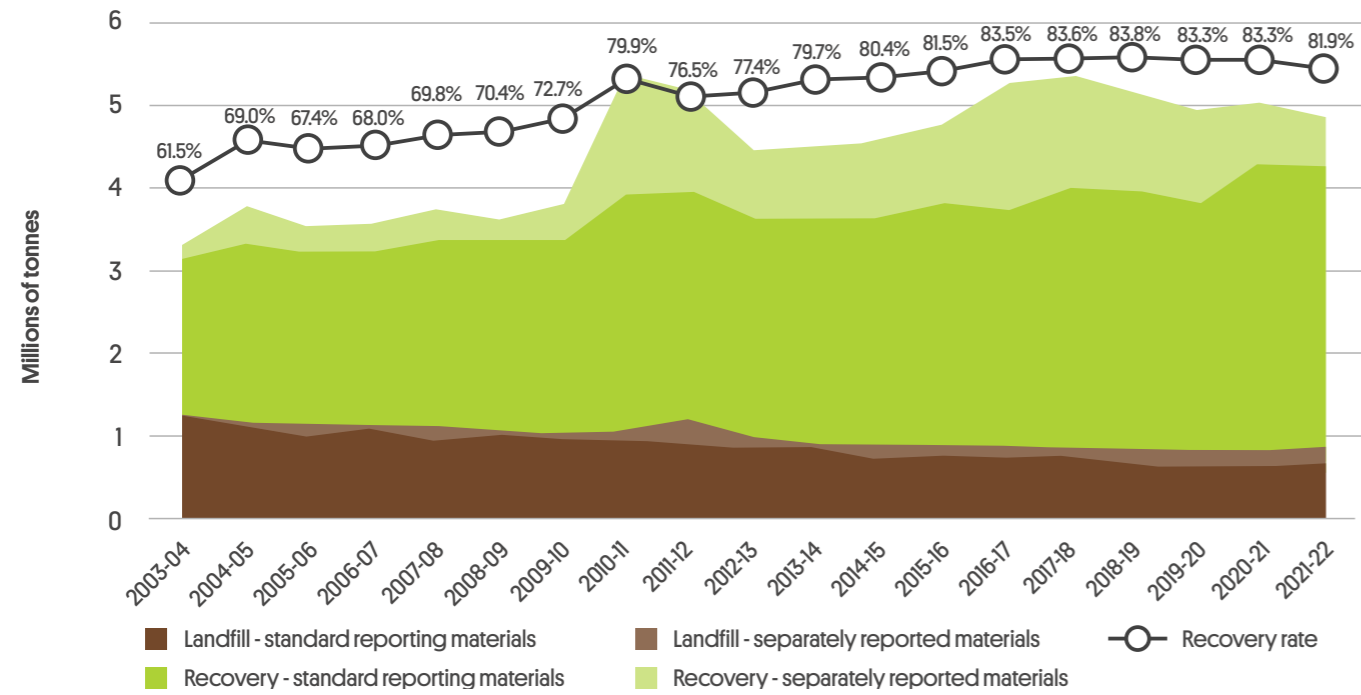


Figure 3 Trend in resource recovery in SA since 2003-04 by material category, including tonnes per million dollars of gross state product (GSP)

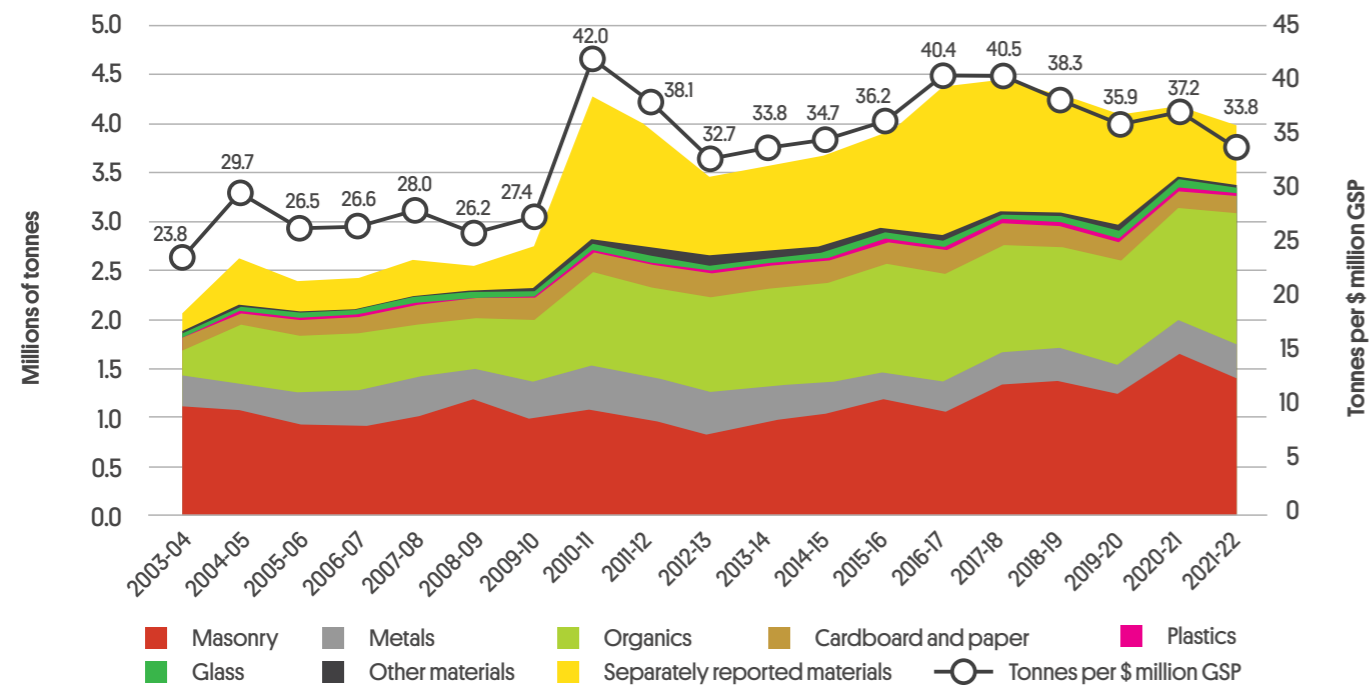
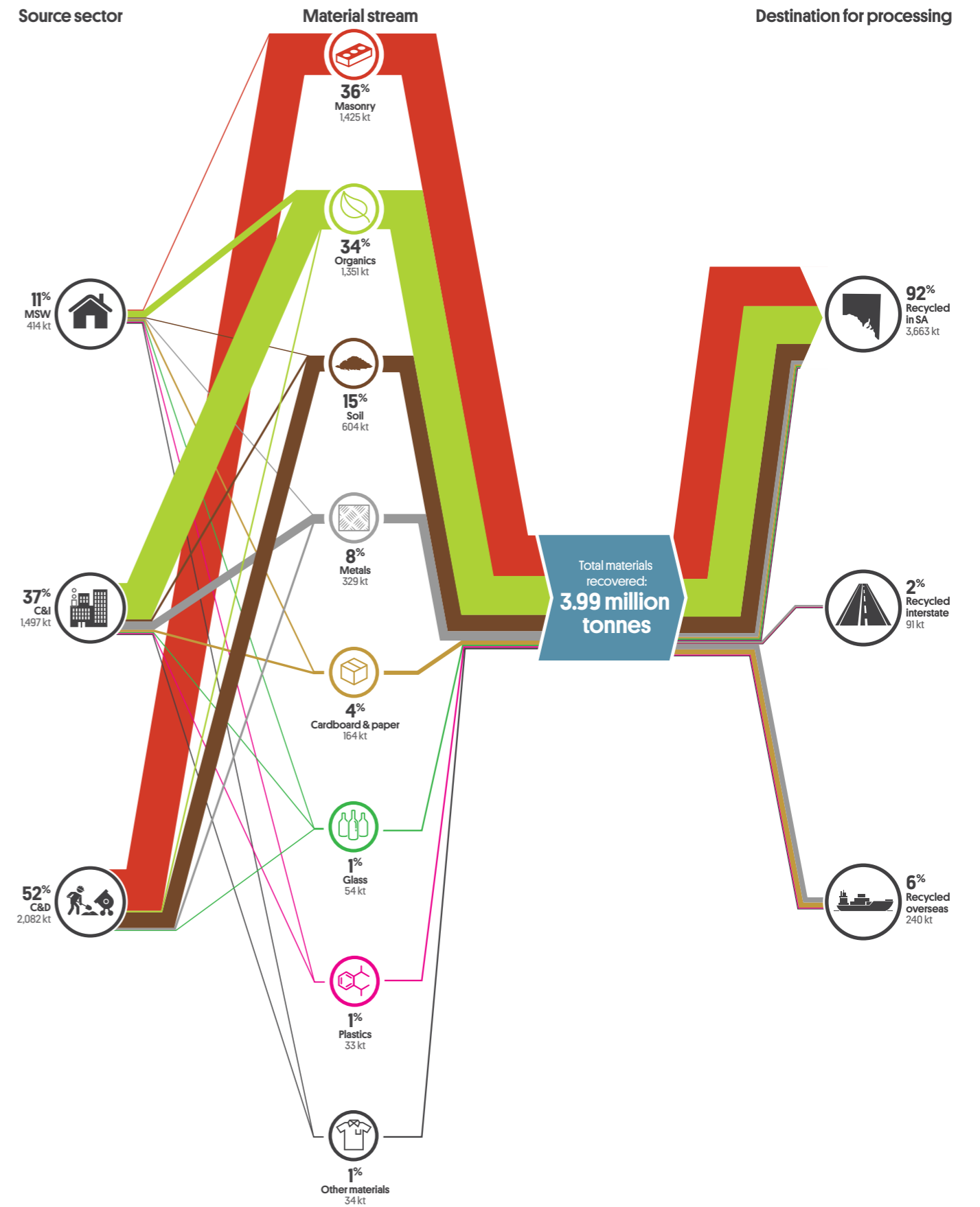


Figure 4 Resource recovery, including energy recovery, SA, 2021-22, by material, source stream and destination, not including e-waste or material reused



Landfill disposal

SA disposed about 885,000 tonnes of waste to landfill in 2021-22, an increase from the 840,000 tonnes landfilled in 2020-21. Figure 5 displays trends for disposal by source stream, and shows that most landfill waste is from the municipal stream.

Figure 5 Landfill disposal in SA since 2007-08 by source stream

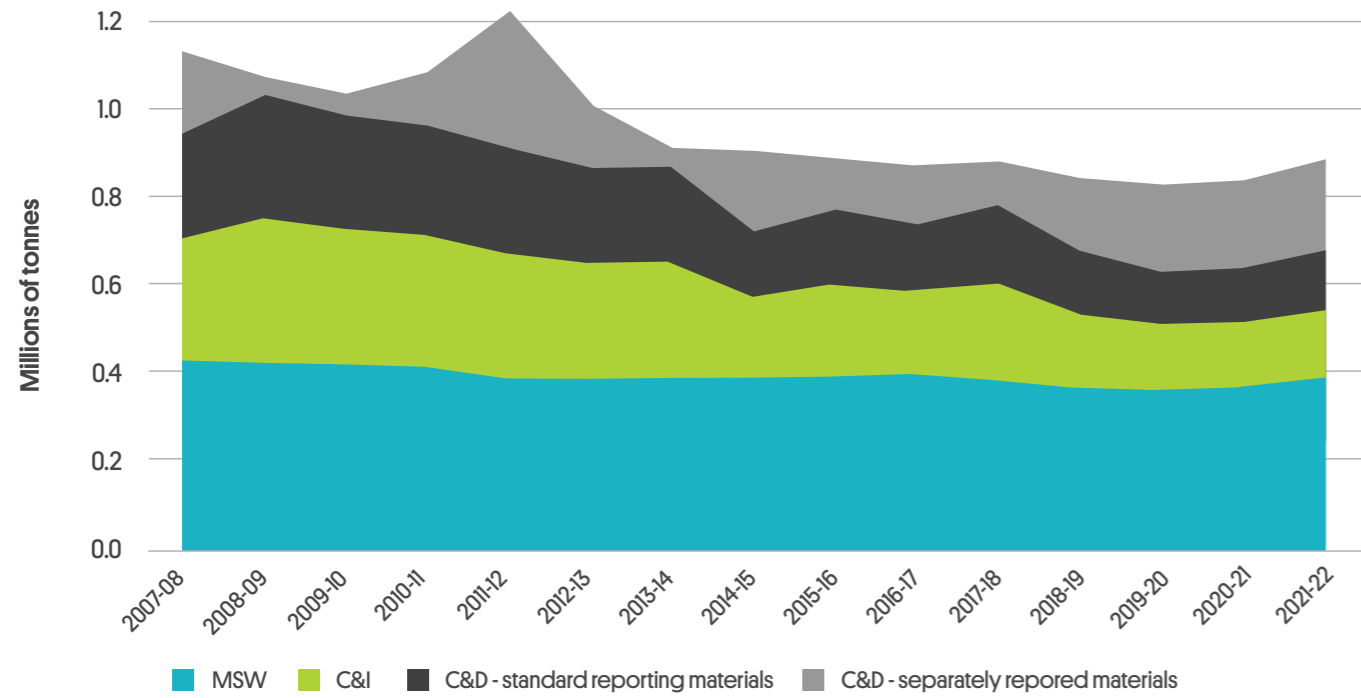
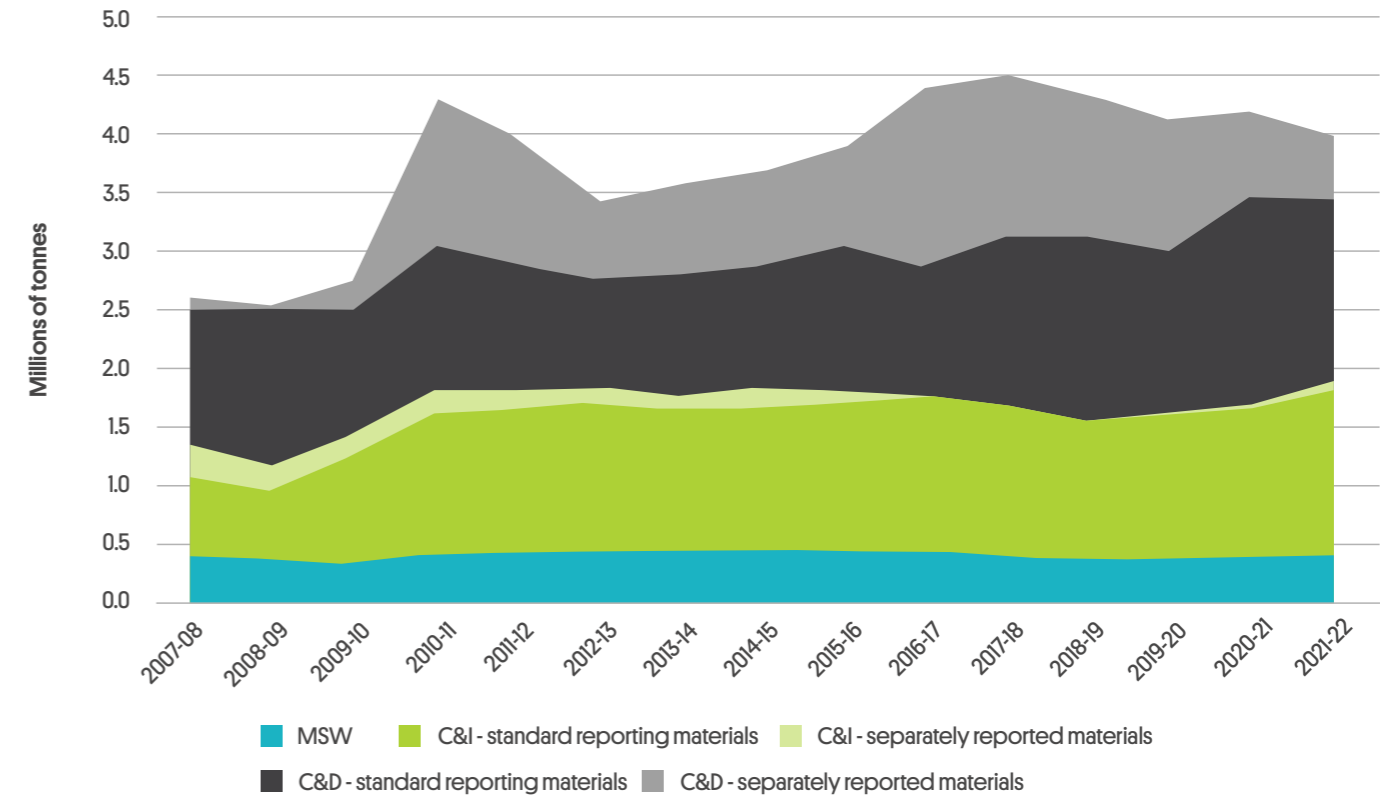


Figure 6 Resource recovery in SA since 2007-08 by source stream



Source stream

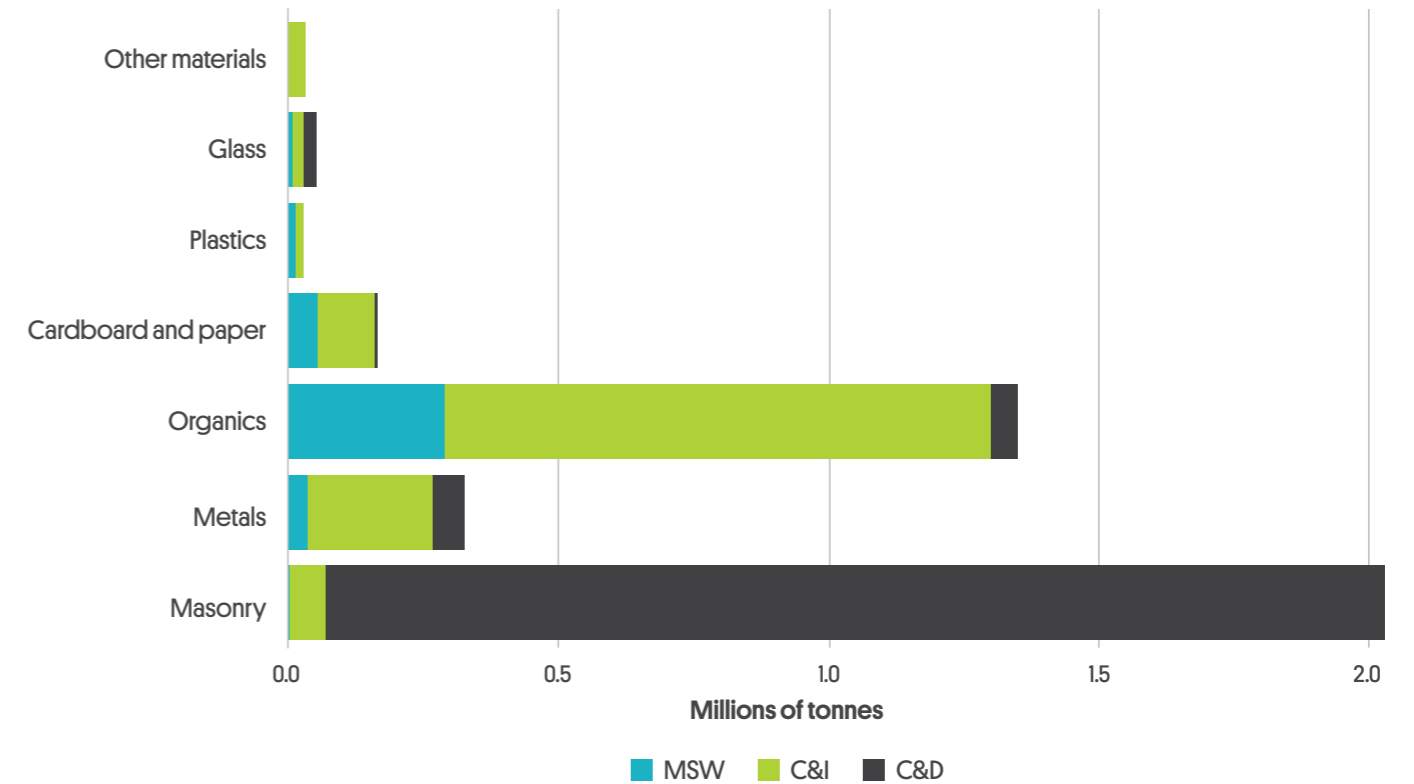
The source stream origin for SA waste and recovered materials in 2021-22 is shown in Table 3, Figure 6 and Figure 7. Like previous years, recovered materials mostly comprised C&D waste [52%], followed by C&I [37%] and MSW [11%].

The estimated recovery rate for C&I was the highest in 2021-22 at 91%, followed by C&D at 86% then MSW at 52%. The MSW rate is slightly lower than last year and holds the most opportunity for improvement.

Table 3 South Australia recovery and landfill disposal by source stream in 2021-22

Sector	Recovery		Landfill disposal		Recovery rate
	'000 tonnes	% of total	'000 tonnes	% of total	
MSW	414	11%	386	44%	52%
C&I	1,497	37%	158	18%	91%
C&D	2,082	52%	341	39%	86%
Total	3,994	100%	885	100%	82%

Figure 7 Source stream of recovered materials by material category, SA, 2021-22



Geographical origin

Metropolitan Adelaide contributed about 2,868,000 tonnes of the total recovered materials in 2021-22, and 641,000 tonnes of total disposed waste, achieving a 81.7% recovery rate.

Regional SA contributed 1,126,000 tonnes (28%) of total recovered materials, an increase partly due to improved data visibility on meat rendering in regional SA and deposited about 244,000 tonnes (28% of all SA disposal) of waste to landfill, achieving a recovery rate of 82.2%.

Table 4 SA recovery and landfill disposal by geographical origin in 2021-22

Sector	Recovery		Landfill disposal		Recovery rate	
	'000 tonnes	% of total	'000 tonnes	% of total	Percentage	Trend
Metro	2,868	72%	641	72%	81.7%	▼
Regional	1,126	28%	244	28%	82.2%	▲
Total	3,994	100%	885	100%	81.9%	▼

Destination for recovered materials

In 2021-22, of 3,994,000 tonnes of recovered materials 92% were reprocessed in SA. About 2% of materials were reportedly reprocessed interstate and 6% overseas.

Figure 8 Destination of SA sourced materials in 2021-22



All masonry, separately reported materials (clay, fines, rubble and soil), organics and glass were reprocessed locally.

Most plastics (60%) and 'other' materials (64%) were reprocessed in SA in 2021-22 whereas the majority of cardboard and paper materials (62%) were sent overseas for reprocessing.

Energy recovery

During energy recovery wastes are collected, sorted and processed to recover energy in usable form, for example process heat, steam or in electricity generation.

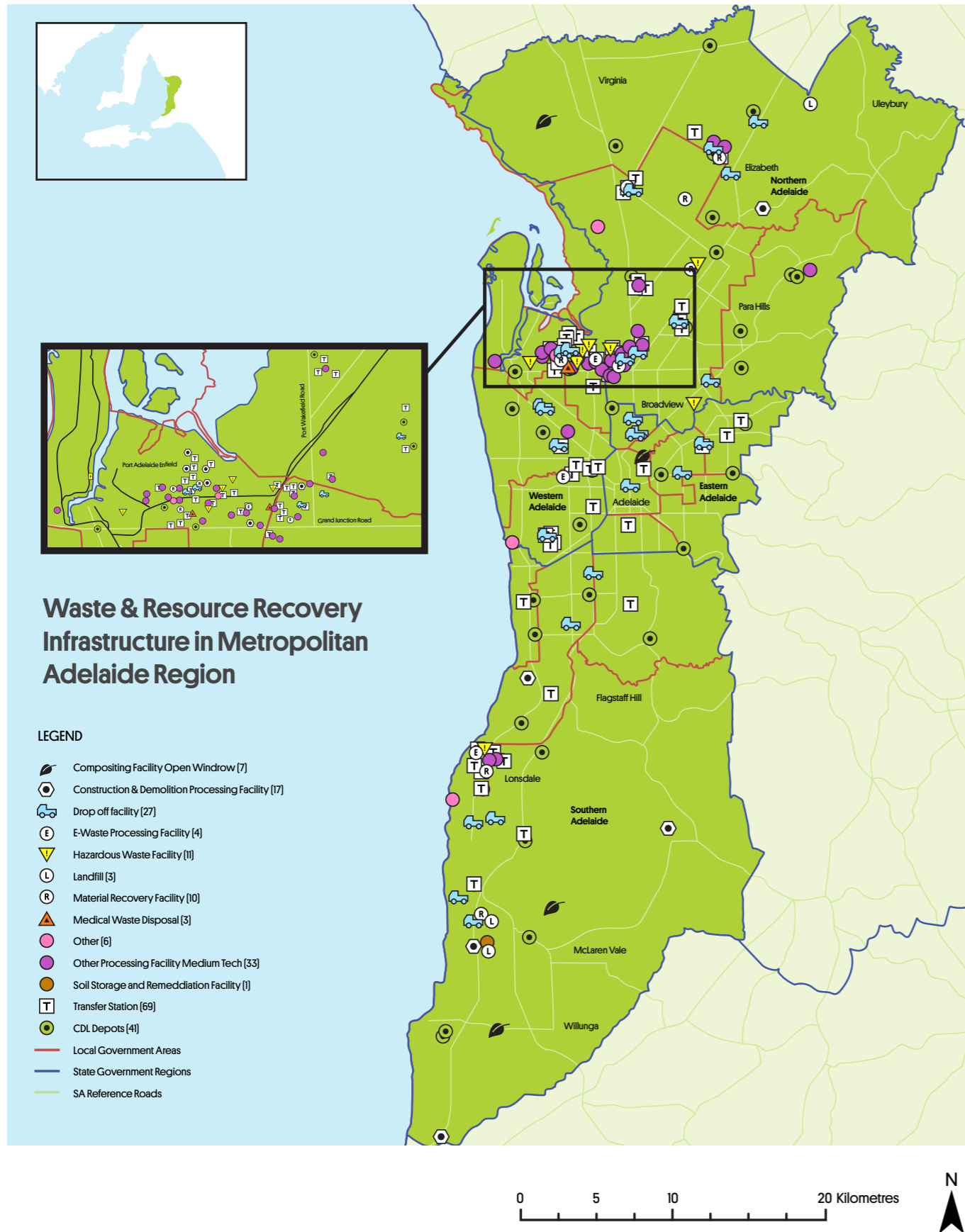
About 308,000 tonnes of SA materials were estimated as recovered for energy in 2021-22 (about 8% of recovered volumes). This has substantially increased from 137,000 tonnes in the previous year, but is due to improved data visibility on products from meat rendering used in biodiesel production.

Table 5 Material and energy recovery, SA, 2021-22

Recovery type	Tonnes	Contribution to recovery rate (%)
Material recovery	3,686,000	92%
Energy recovery	308,000	8%
Total (resource recovery)	3,994,000	100%



Figure 9 The locations of main sites of recyclers and reprocessors in Adelaide



Waste & Resource Recovery Infrastructure in Metropolitan Adelaide Region

- LEGEND**
- Composting Facility Open Windrow [7]
 - Construction & Demolition Processing Facility [17]
 - Drop off facility [27]
 - E-Waste Processing Facility [4]
 - Hazardous Waste Facility [1]
 - Landfill [3]
 - Material Recovery Facility [10]
 - Medical Waste Disposal [3]
 - Other [6]
 - Other Processing Facility Medium Tech [33]
 - Soil Storage and Remediation Facility [1]
 - Transfer Station [69]
 - CDL Depots [41]
 - Local Government Areas
 - State Government Regions
 - SA Reference Roads

Imports

Industry also imports waste materials from interstate or overseas, however these do not count towards SA's recycling performance. Already reprocessed materials imported into SA for manufacturing are also not included.

Table 6 Materials reported as imported to SA for resource recovery in 2021-22, tonnes

Material category	Imported tonnes								Total
	ACT	NSW	NT	Qld	Tas	Vic	WA	O'seas	
Masonry	0	0	0	0	0	0	0	0	0
Metals	0	5,330	19,980	0	0	5,000	0	0	30,310
Organics	0	3,500	0	0	0	70,000	0	0	73,500
Cardboard and paper	0	0	20	0	0	0	0	0	20
Plastics	0	100	200	10	0	10	0	160	480
Glass	0	0	0	0	0	0	0	230	230
Other materials	0	0	0	0	0	0	0	0	0
Total	0	8,900	20,200	0	0	75,000	0	400	104,500

Market value of resource recovery

The total value of recovery in SA in 2021-22 is estimated at about \$649 million, higher than previously due to increases in quantities of meat rendering to 125,000 tonnes which has a high dollar value per tonne.

Organics was the greatest contributor to total value in 2021-22 [\$379 million] due to 'Other organics' being included for the first time this year in the resource recovery value.

Scrap metals are a high-value commodity and represented the next largest share of market value. Recovered metals were estimated at a total value of \$170 million in 2021-22 [a decrease from \$223 million in 2020-21].

Scrap cardboard and paper overall was valued at \$44 million. Printing and writing paper had the highest reported value of between \$275 and \$300 per tonne compared to newsprint and magazines valued at \$100 per tonne.

Recovered masonry materials contributed about \$15 million in 2021-22.

Disaster waste

SA recorded 4,290 tonnes of bushfire waste sent to landfill in 2021-22.

2.2 Performance against state targets

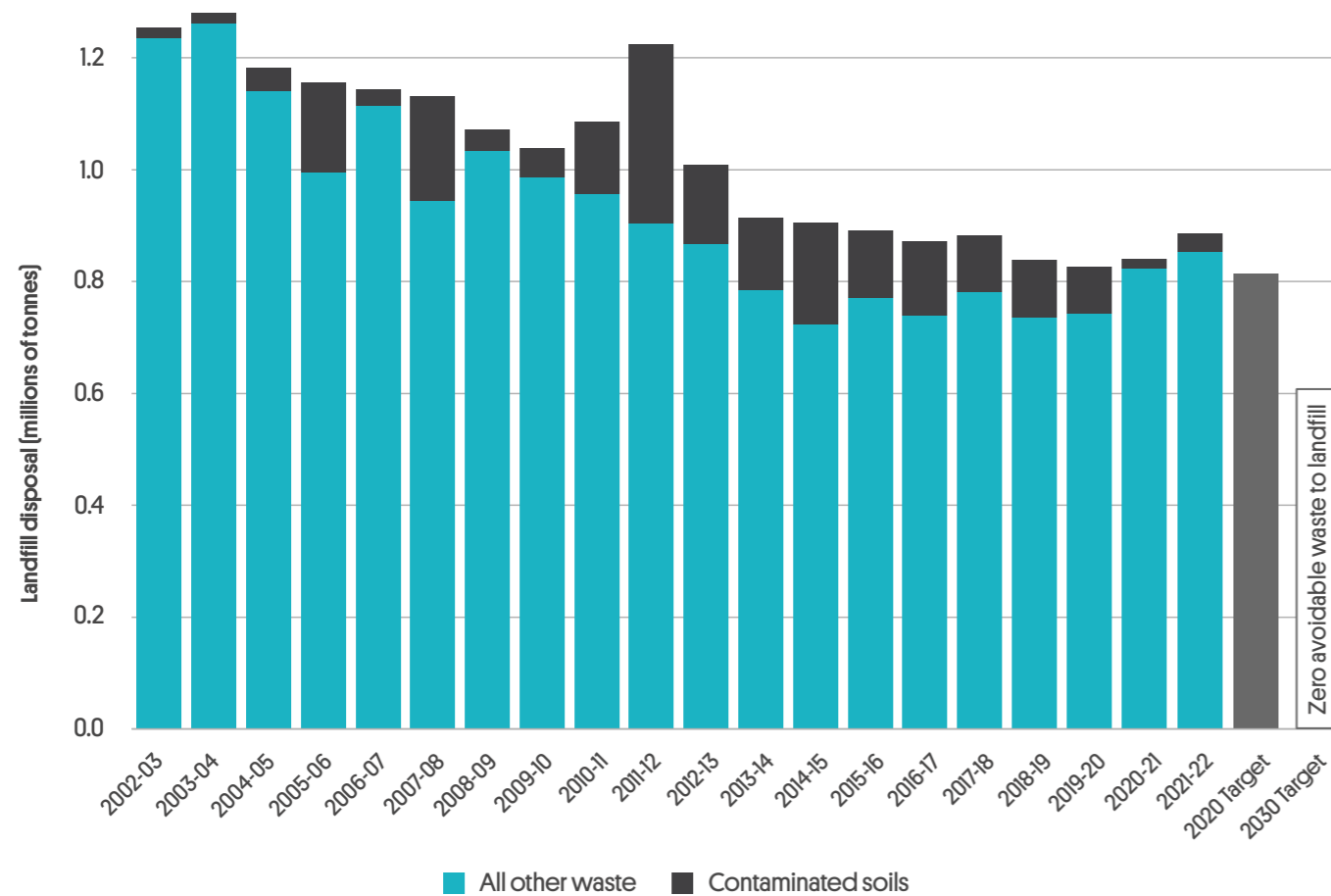
In 2020, Green Industries SA released *South Australia's Waste Strategy 2020-25*. The strategy defines waste diversion and reduction targets to 2025, which are guided by an overall target of zero avoidable waste to landfill by 2030. This section details SA's progress in achieving these targets.

Landfill diversion target

South Australia's Waste Strategy 2020-25 sets out a goal for zero avoidable waste to landfill by 2030. The State disposed about 885,000 tonnes of waste to landfill in 2021-22, an increase from 840,000 tonnes in 2020-21. A range of actions will need to be implemented to achieve SA's ambitious landfill target for 2030.

SA came close to meeting the 2020 target for reducing waste to landfill by 35% from a 2002-03 baseline, but increases in landfill in 2021-22 resulted in a lower reduction of 27% against the 2002-03 levels.

Figure 10 Landfill disposal trend since 2002-03, including state targets for 2020 and 2030



Waste generation target

South Australia's Waste Strategy 2020-25 sets a target of 5% reduction in waste generation per capita from a 2020 baseline. Table 7 summarises a five-year trend in waste generation per capita for all reported materials. Waste generation per capita decreased by 165 kilograms [5.8%] in 2021-22 compared to the previous year, and an overall reduction of 4.3% since the period 2019-20.

Table 7 Waste generation per capita since 2017-18, including the state target for 2025

Recovery type	2017-18	2018-19	2019-20	2020-21	2021-22	Change [%]	Target
						20-21 to 21-22	2025
Waste generation per capita [kg/person/yr]	3,090	2,960	2,800	2,844	2,679	-5.8%	5% reduction from 2020 baseline

Metropolitan diversion target

The State is moving towards its 2023 goals of 65% diversion for MSW, 85% diversion for C&I, and 90% diversion for C&D. Table 8 presents the diversion rate achieved in metropolitan SA in 2021-22, together with State targets for 2023 and 2025.

In 2021-22, the C&I recovery rate was 88.2%, above the 2023 target of 85% and close to the diversion target of 90% by 2025. The C&D source stream recovery rate was 87.2%, just shy of the target of 90% for 2023. The MSW recovery rate was 55.9%, slightly lower than the previously held recovery rate of 56.1% in 2020-21. There is significant room for improvement for municipal stream to achieve state targets.

Table 8 Metropolitan diversion rate for SA in 2021-22, including state targets to 2025

Source sector	2021-22 diversion rate	Metropolitan diversion target	
		2023	2025
MSW	55.9%	65%	75%
C&I	88.2%	85%	90%
C&D	87.2%	90%	95%



2.3 Local government recovery

Local governments capture data on materials collected in household bins at kerbside for disposal or recycling. These data are presented and discussed in this section. The data represent a subset of the MSW tonnes discussed elsewhere in this report, which also includes non-kerbside municipal waste such as hard waste, street sweepings and domestic materials dropped off at transfer stations.

Overall kerbside collections

Table 9 shows data on materials collected in household residual, recycling and organics bins at kerbside in SA in 2021-22. About 684,000 tonnes of kerbside materials were collected in SA, of which 527,000 tonnes were from the metro region and 156,000 tonnes were from regional areas. This was very similar to last year. Most kerbside waste was collected in residual bins (350,000 tonnes), followed by organics bins (202,000 tonnes), and recycling bins (132,000 tonnes).

SA's recovery rate for kerbside waste in 2021-22 was an estimated 49%, slightly higher than the previous year's rate of 48%. Recovery was higher for metropolitan councils (51%) than regional councils (40%). Compared to the previous year, performance in 2021-22 was slightly improved for both metropolitan and regional SA.

Table 9 Materials collected from households at kerbside in SA in 2021-22

Region	Collected at kerbside (tonnes)				Recovery rate [%]
	Residual	Recycling	Organics	Total	
Metro	256,000	103,000	169,000	527,000	51.5%
Regional	94,000	29,000	33,000	156,000	39.8%
SA	350,000	132,000	202,000	684,000	48.8%

Recovery by region

Table 10 shows population and kerbside data for 2021-22 at the sub-region level, including kilograms of kerbside waste per capita.

Table 10 Population and kerbside data statistics by region

Region or sub-region	Population	Kerbside waste collected (t)	Kerbside waste per capita (kg/capita)	Recovery rate
Metro	1,349,929	527,000	391	51%
Central Eastern	276,240	105,000	381	54%
Northern	375,546	142,000	379	47%
Southern	340,458	140,000	411	53%
Western	357,685	140,000	391	52%
Regional	470,601	156,000	332	40%
All SA	1,820,530	684,000	376	49%

Coverage

Nearly all households in SA are provided a kerbside service. About 99% of households live in a council area providing a residual waste service, 97% have a recycling service and 91% have an organics service.

Table 11 Kerbside service coverage for SA households

Stream	Number of services in SA	Coverage
Residual	716,000	98.7%
Recycling	700,000	96.5%
Organics	660,600	91.1%
Total households in SA	726,000 ⁴	100%

⁴ ABS [2019] 3236.0 Household and Family Projections, Australia, 2016 to 2041 [Series II], online at: www.abs.gov.au/statistics/people/population/household-and-family-projections-australia/2016-2041

2.4 Comparative performance with other jurisdictions

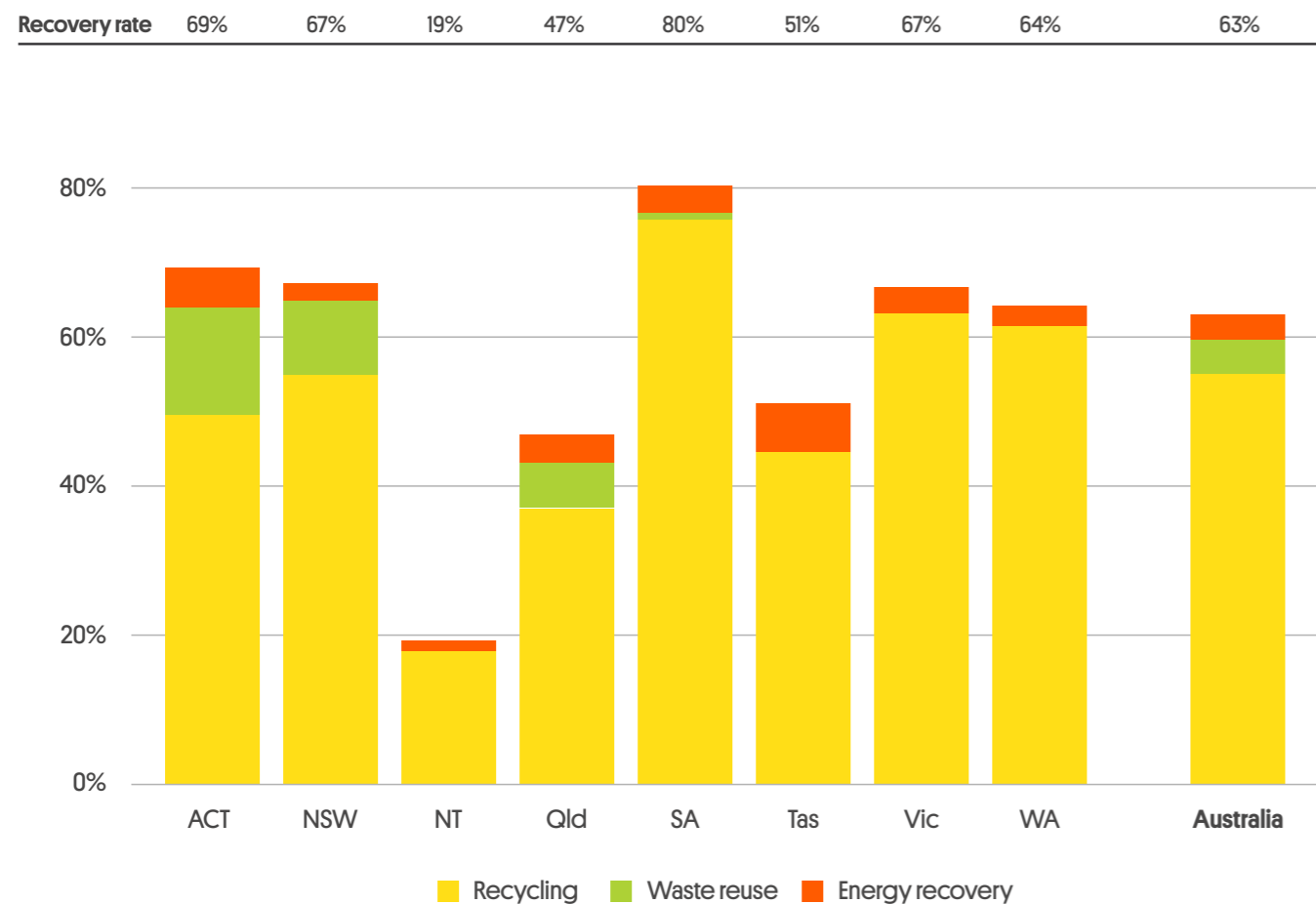
SA has led recycling and resource recovery performance in Australia for many years.

The methods used by states and territories to measure and report waste vary. The *National Waste Report 2022* [Blue Environment 2022], released by the Department of Climate Change, Energy, the Environment and Water in 2022, adjusts these methods to present a consistent as possible comparison of recovery rates across states and territories. These data are discussed in this section.

Figure 11 is taken from the *National Waste Report 2022* and shows recycling, waste reuse and energy recovery and overall recovery rates for each Australian jurisdiction in 2020-21. SA had the highest recycling rate with a recovery rate of 80%⁵. Overall, Australia achieved a recovery rate of 63% in 2020-21.

In 2021-22, SA maintained similar rates to those in Figure 11.

Figure 11 Resource recovery and recycling rates by jurisdiction, 2020-21



Source: National Waste Report 2022 [Blue Environment 2022]

⁵ This differs from the value reported in the CERRR 2020-21 due to differences in method.

2.5 Employment in the SA resource recovery sector

SA's resource recovery sector employs thousands of people across a wide range of jobs. The data represents a sub-set of total employment in SA's waste and resource recovery industry, which includes a wider range of positions [e.g. landfill operators].

Table 12 shows an increasing number of reported full-time equivalent employees in SA's resource recovery sector over the last few years. In 2021-22, 1,957 equivalent full-time employees were reported. Companies and organisations that reported employee numbers in 2021-22 made up 62% of the year's total recovered tonnes, suggesting the true number may be around 3,000.

Table 12 Reported full-time equivalent employees in SA's resource recovery sector based on survey results

Employment category	2017-18	2018-19	2019-20	2020-21	2021-22
Total full time equivalent employees	1,831	1,850	2,098	2,108	1,957

Machinery operators were the most reported employee classification, followed by drivers and administration.

Table 13 Full time equivalent employees in SA's resource recovery sector by employee type

Employment type	2021-22
Unskilled	4%
Administration	14%
Construction /design	0%
Driver	14%
Machinery operator	37%
Sorting	8%
Technical support	11%
Sales/ marketing	3%
Supervisor	5%
Other	3%
Total	100%



2.6 Reuse and the circular economy

Reuse is the reallocation of products or materials to a new owner or purpose without reprocessing or remanufacture (but potentially with some repair). The practice promotes the cycling of material without the need to consume new resources. There is a longstanding reuse network that includes its charities, non-government organisations (e.g. food rescue organisations), community groups and online trading platforms (e.g. Gumtree). Items and products commonly recirculated via the reuse economy include clothing, food, home furniture, whitegoods, vehicles and electronics.

MRA (2021) found that each year, Australians divert about 310,000 tonnes of clothing for reuse to charitable organisations nationally. Almost 10% of this is attributed to South Australians. Reusing clothes instead of landfilling them can reduce carbon emissions by 66%, water consumption by 57% and energy use by 59%. Reused clothing also generates an estimated revenue of \$1,700 per tonne.

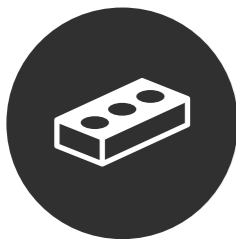
Key players in SA's charitable network reported quantities from 2021-22 which are shown in Table 14, together with estimated values for the reuse materials. Table 14 is expected to represent only a portion of reuse in SA. Some items excluded from Table 14 would contribute significant volumes to overall reuse in SA but are difficult to measure, such as items traded via community platforms (e.g. Facebook Marketplace, Gumtree, etc.). Still, the quantities and estimated values in Table 14 highlight the importance of the reuse economy from both an environmental and economic standpoint.

Table 14 Reuse in SA in 2021-22 based on survey results

Reuse material	Tonnes	Estimated value of reuse material (\$/tonne)	Estimated value of reuse materials in SA (\$/yr)
Home furnishings and goods	1,500	\$15,000	\$22,740,000
Clothes	2,000	\$1,700	\$3,426,000
Re-use food products	4,400	\$2,586	\$11,499,000
Books	400	\$1,000	\$404,000
Other donations [toys, etc.]	1,300	n/a	-



3 Material resource recovery reports



3.1 Masonry

About 2.03 million tonnes of masonry was recovered in SA in 2021-22. There were declines in quantities recovered across all material types but especially plasterboard and bricks. The masonry recovery figures are significantly affected by a small number of recycler returns with data quality issues, which may create some variation between calculated recovery and actual recovery.

Concrete contributed the greatest proportion of masonry materials [55%], followed by clay, fines, rubble and soil [30%], asphalt [14%], bricks [1%] and plasterboard [<1%]. This is consistent with last year.

Table 15 Masonry recovered, SA, 2021-22

Material type	Net recovery ('000 tonnes)	Emissions saved kt CO ₂ -e	Energy saved TJ LHV	Water saved ML
Asphalt	284	9	675	250
Bricks	27	1	8	34
Concrete	1,114	22	390	1,426
Plasterboard	0.2	0	0	0
Clay, fines, rubble and soil	604	53	858	266
Total	2,029	85	1,900	2,000

Figure 12 Masonry recovered since 2003-04 – concrete and clay, fines, rubble and soil

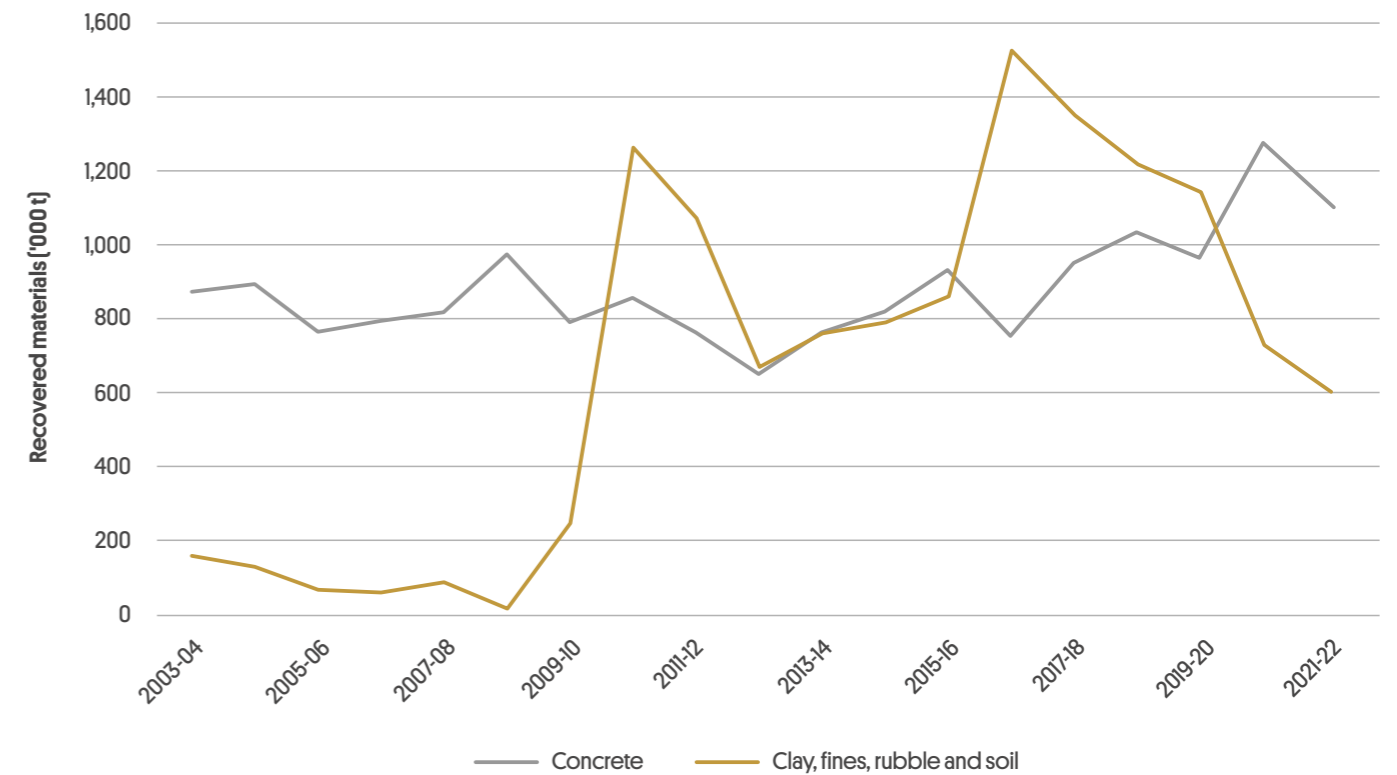
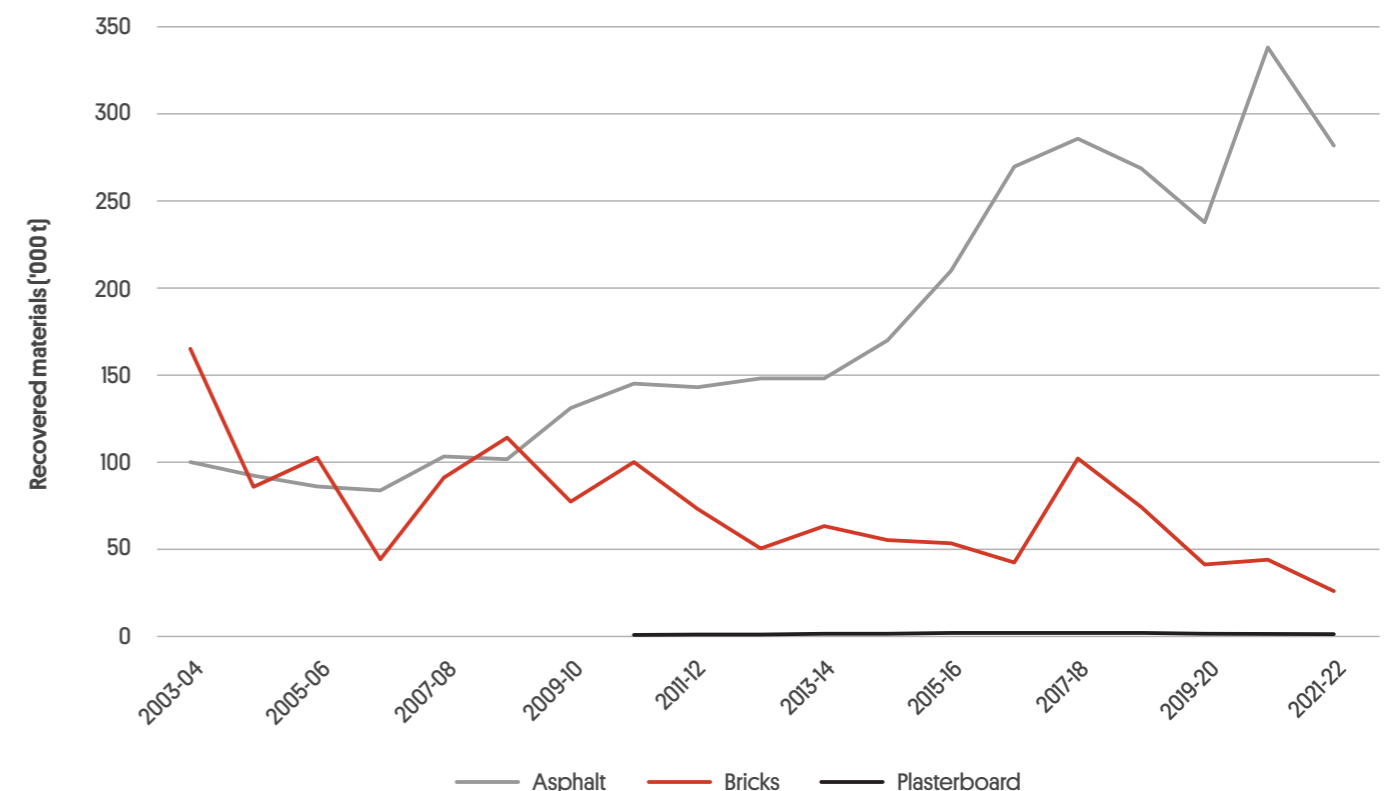


Figure 13 Masonry recovered since 2003-04 – asphalt, bricks and plasterboard





3.2 Metals

Recovery of scrap metals fell in the 2021-22 financial year to about 329,000 tonnes, compared to the previous year's 351,000 tonnes. Recovered metals were mostly iron and steel (281,000 tonnes), followed by aluminium (29,000 tonnes), copper (13,000 tonnes) and non-ferrous metals (6,000 tonnes).

Table 16 Metals recovered, SA, 2021-22

Material type	Net recovery ('000 tonnes)	Emissions saved kt CO ₂ -e	Energy saved TJ LHV	Water saved ML
Iron and steel	281	124	2,105	-663
Aluminium	29	477	5,909	839
Non-ferrous metals	19	17	703	116
Copper	13			
Non-ferrous metals (other)	6			
Total	329	617	8,700	300

Figure 14 Metals recovered since 2003-04 – iron and steel

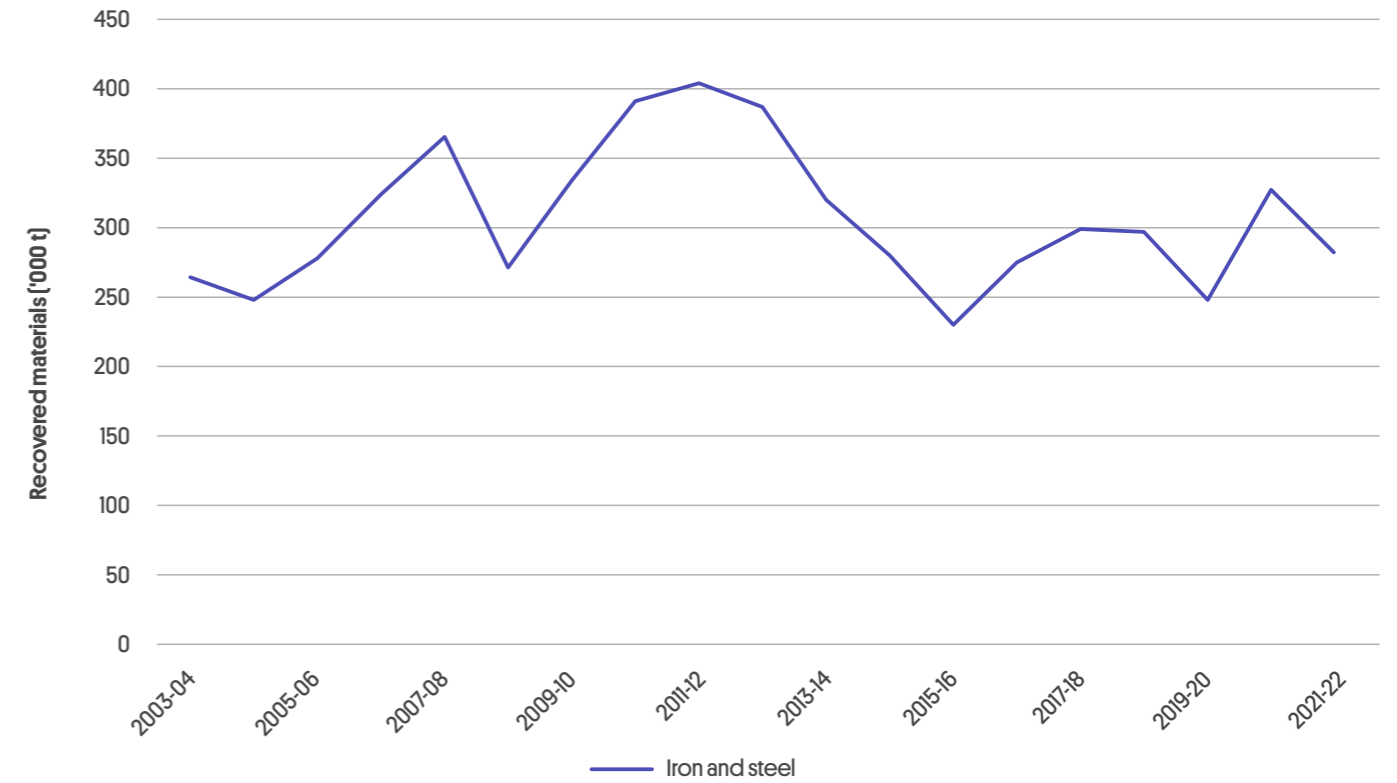
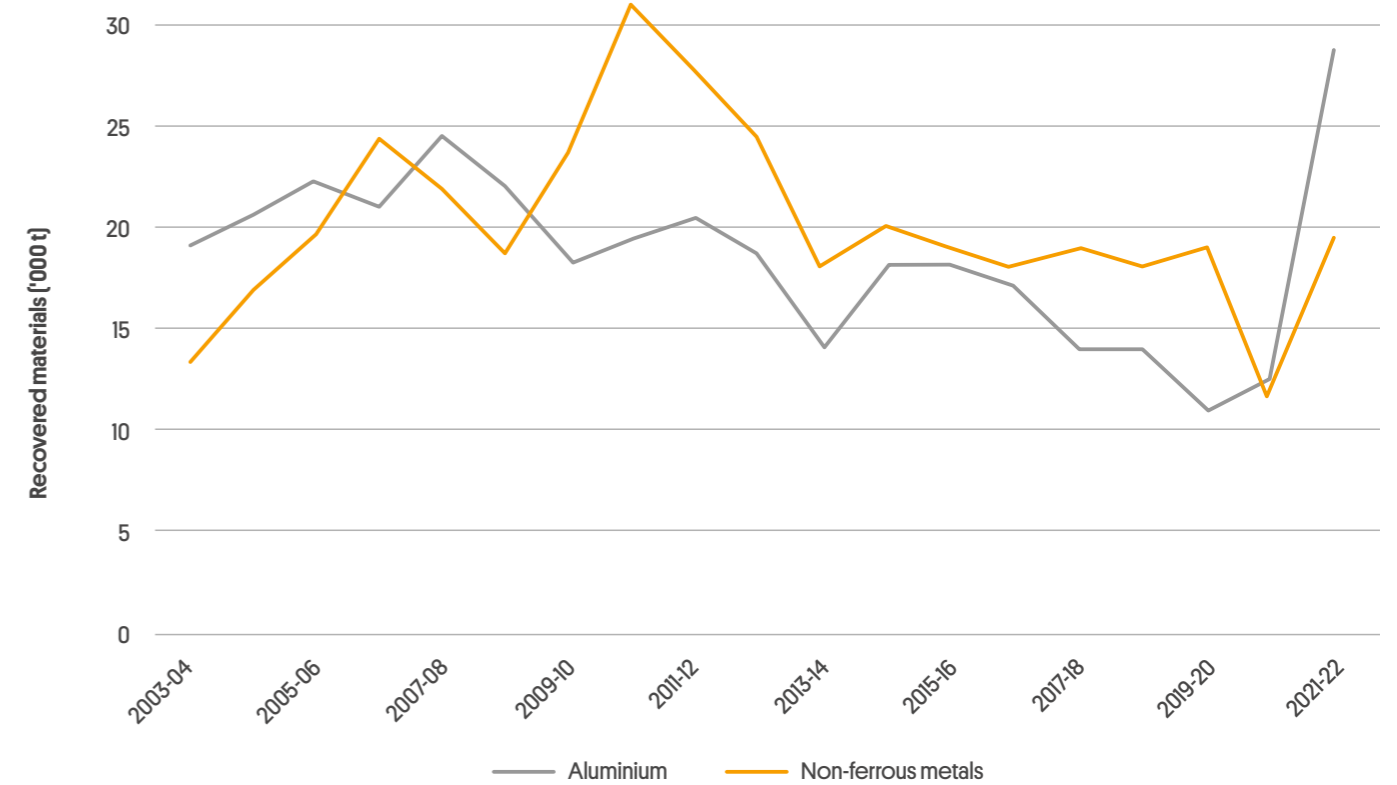


Figure 15 Metals recovered since 2003-04 – aluminium and non-ferrous metals





3.3 Organics

About 1.35 million tonnes of organic materials recovered in SA in 2021-22. 'Other organics' contributed the most to overall organics recovery, at 59%. New information sources contributed to an increase this year. About 290,000 tonnes of garden organics were recovered, contributing about 20% towards overall organics recovery.

Timber recovery increased to 238,000 tonnes and comprised 16% of total organics recovery in 2021-22. Increased visibility on food organics resulted in recovery of 30,000 tonnes [2%].

Table 17 Organics recovered, SA, 2021-22

Material type	Net recovery ('000 tonnes)	Emissions saved kt CO ₂ -e	Energy saved TJ LHV	Water saved ML
Food organics	30	29	5	13
Garden organics	290	194	90	1,620
Timber	238	43	2,550	-10
Other organics	794	383	1,718	183
Meat rendering	398			
Waste grease and fat	73			
Waste sludge and biosolids	61			
Organics - other	261			
Total	1,351	648	4,400	1,800

Figure 16 Organics recovered since 2003-04

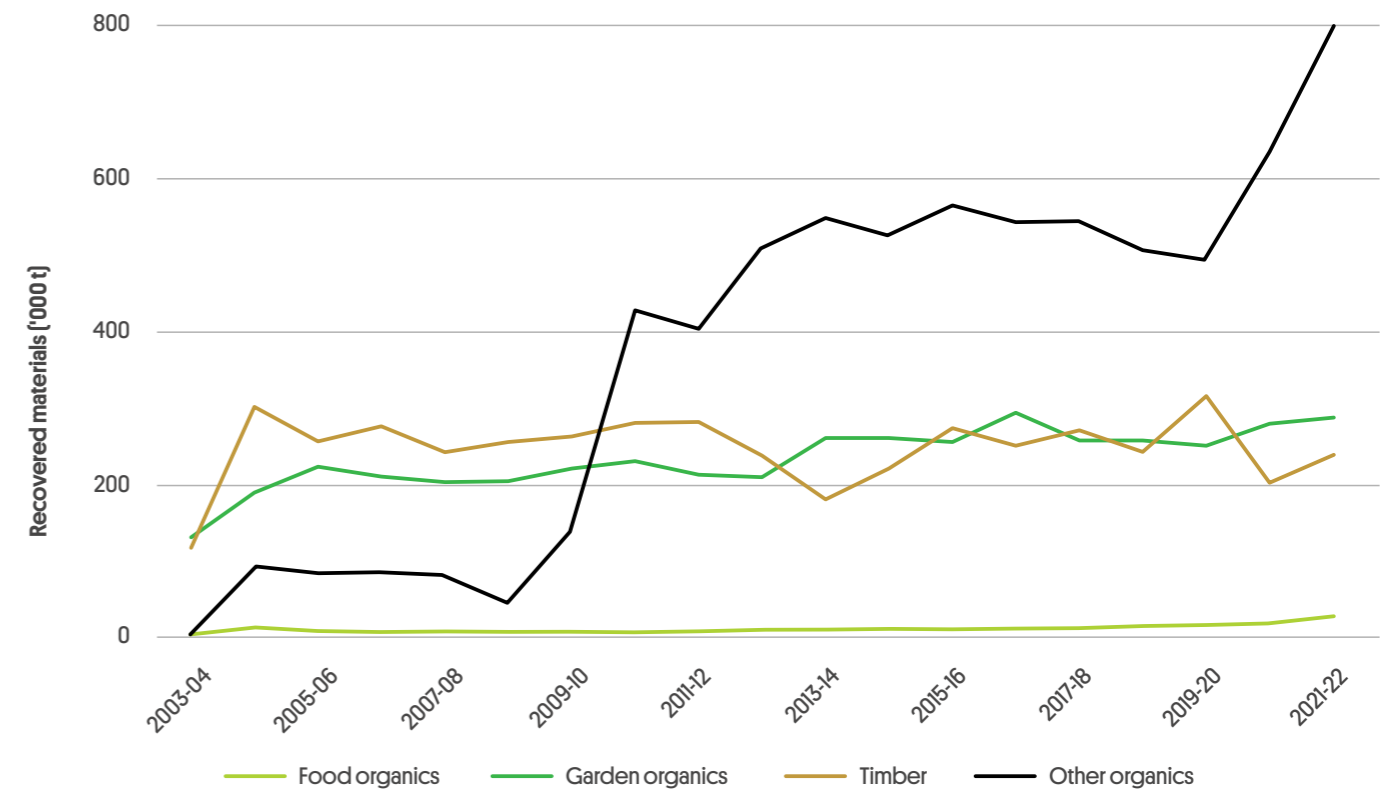
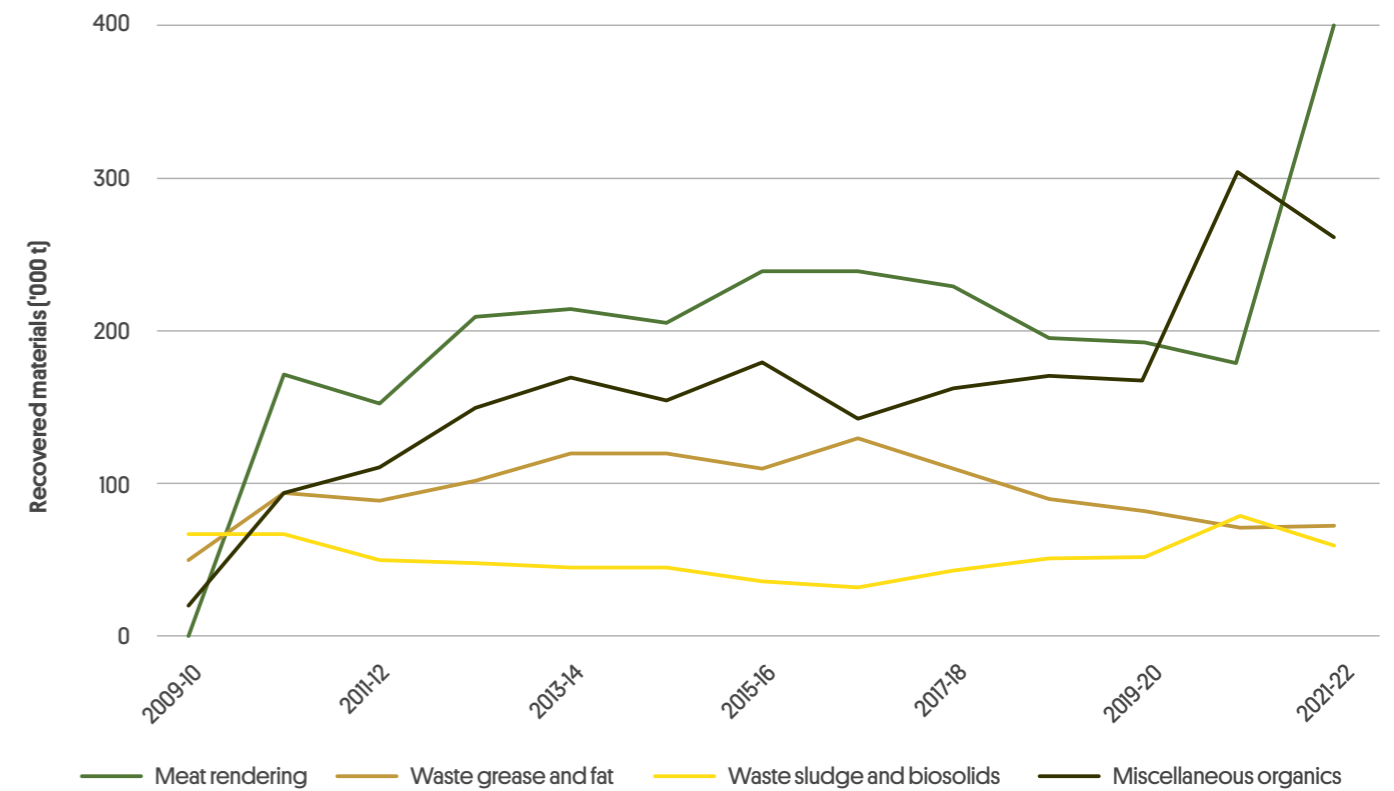


Figure 17 Other organics recovered since 2009-10





3.4 Cardboard and paper

About 164,000 tonnes of cardboard and paper were recovered in SA in 2021-22. Magazines and newsprint is the largest portion of the category with 70,000 tonnes reported as recovered in 2021-22. Cardboard and waxed cardboard accounted for 60,000 tonnes while printing and writing paper totalled 33,000 tonnes. A small amount of liquid paperboard was recovered [151 tonnes].

Table 18 Cardboard and paper recovered, SA, 2021-22

Material type	Net recovery ('000 tonnes)	Emissions saved kt CO ₂ -e	Energy saved TJ LHV	Water saved ML
Cardboard and waxed cardboard	60	10	28	669
Liquid paperboard	<1	0	0	2
Magazines and newsprint	70	32	26	768
Printing and writing paper	33	43	-22	362
Total	164	85	30	1,800

Consumption of paper and cardboard – and particularly newsprint and magazines – continue to decline due to digitisation.

Figure 18 Cardboard and paper recovered since 2003-04 – cardboard and waxed cardboard, magazines and newsprint and printing and writing paper

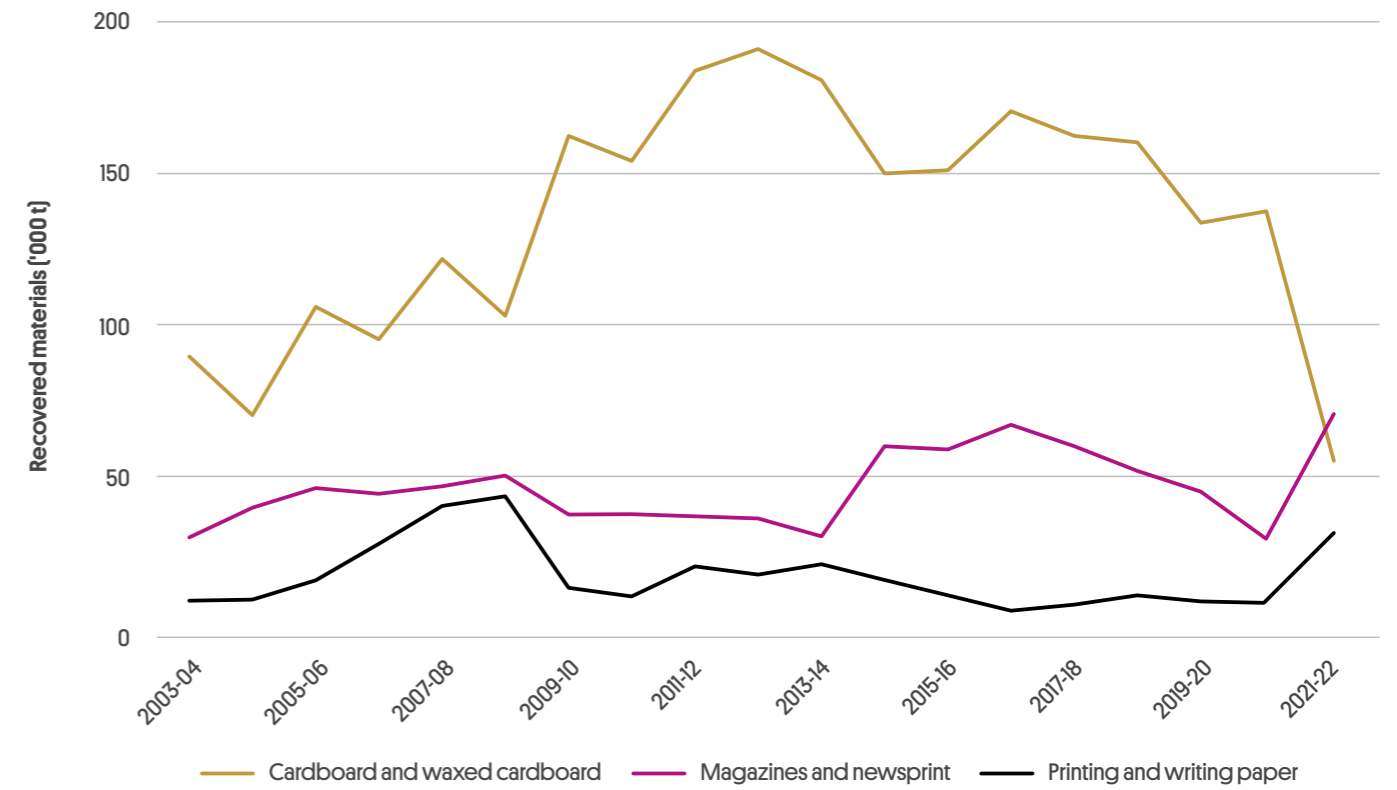
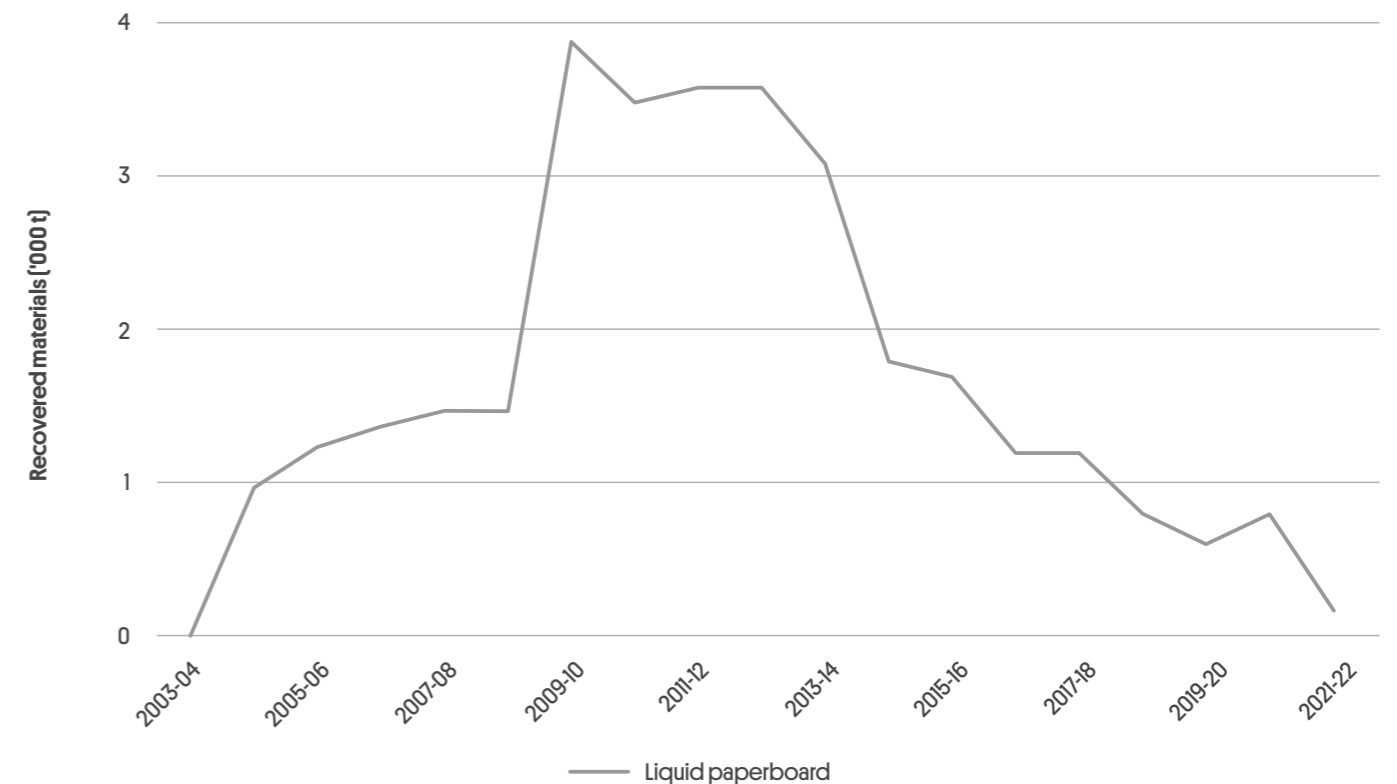


Figure 19 Cardboard and paper recovered since 2003-04 – liquid paperboard





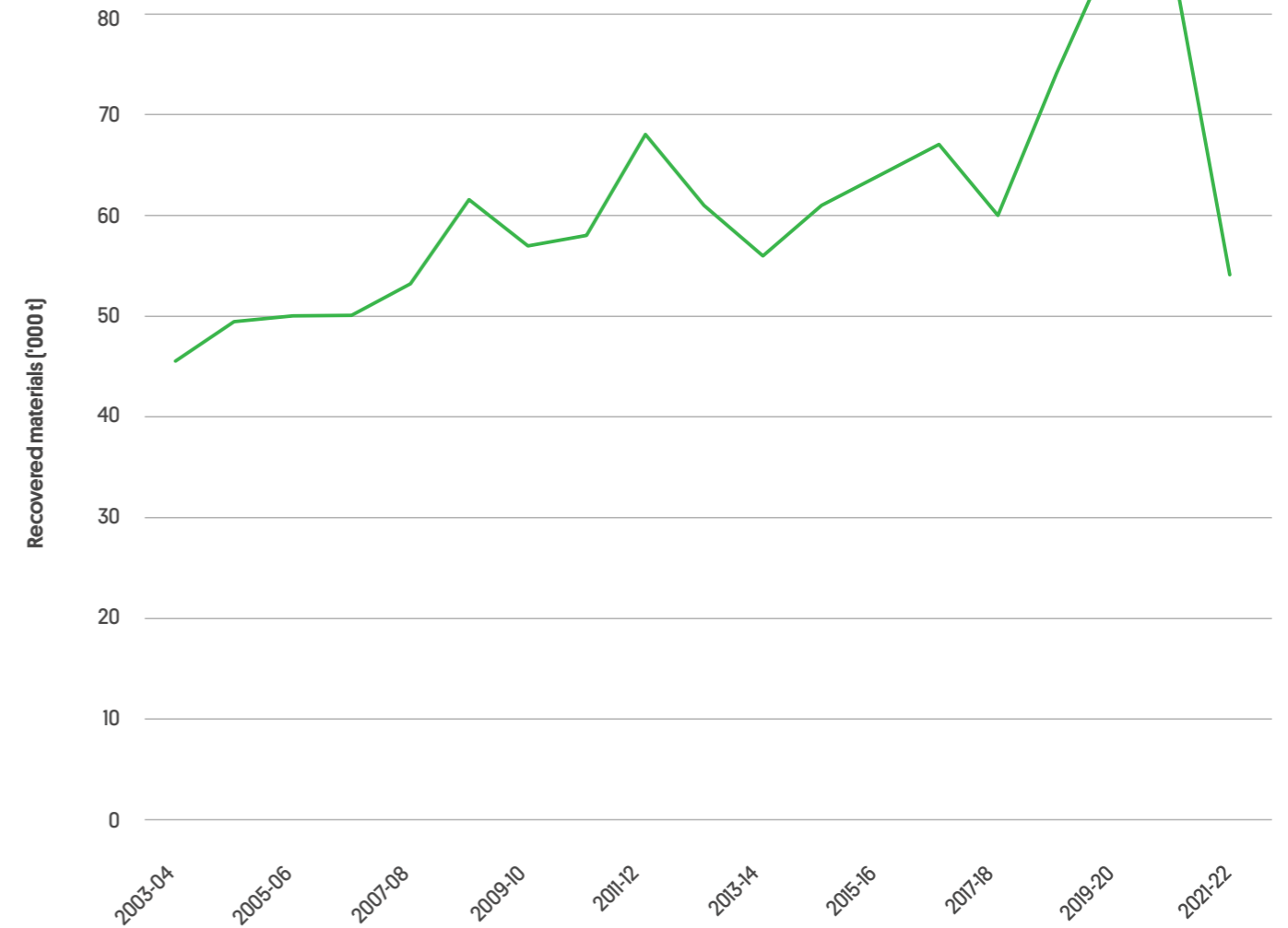
3.5 Glass

SA recovered about 54,000 tonnes of scrap glass in 2021-22. Recovered glass was mostly containers; 59% of overall volumes was glass from food and beverage containers and 41% other glass.

Table 19 Glass recovered, SA, 2021-22

Material type	Net recovery ('000 tonnes)	Emissions saved kt CO ₂ -e	Energy saved TJ LHV	Water saved ML
Glass from food and beverage containers	32			
Other glass	22			
Total	54	28	238	50

Figure 22 Glass recovered since 2003-04





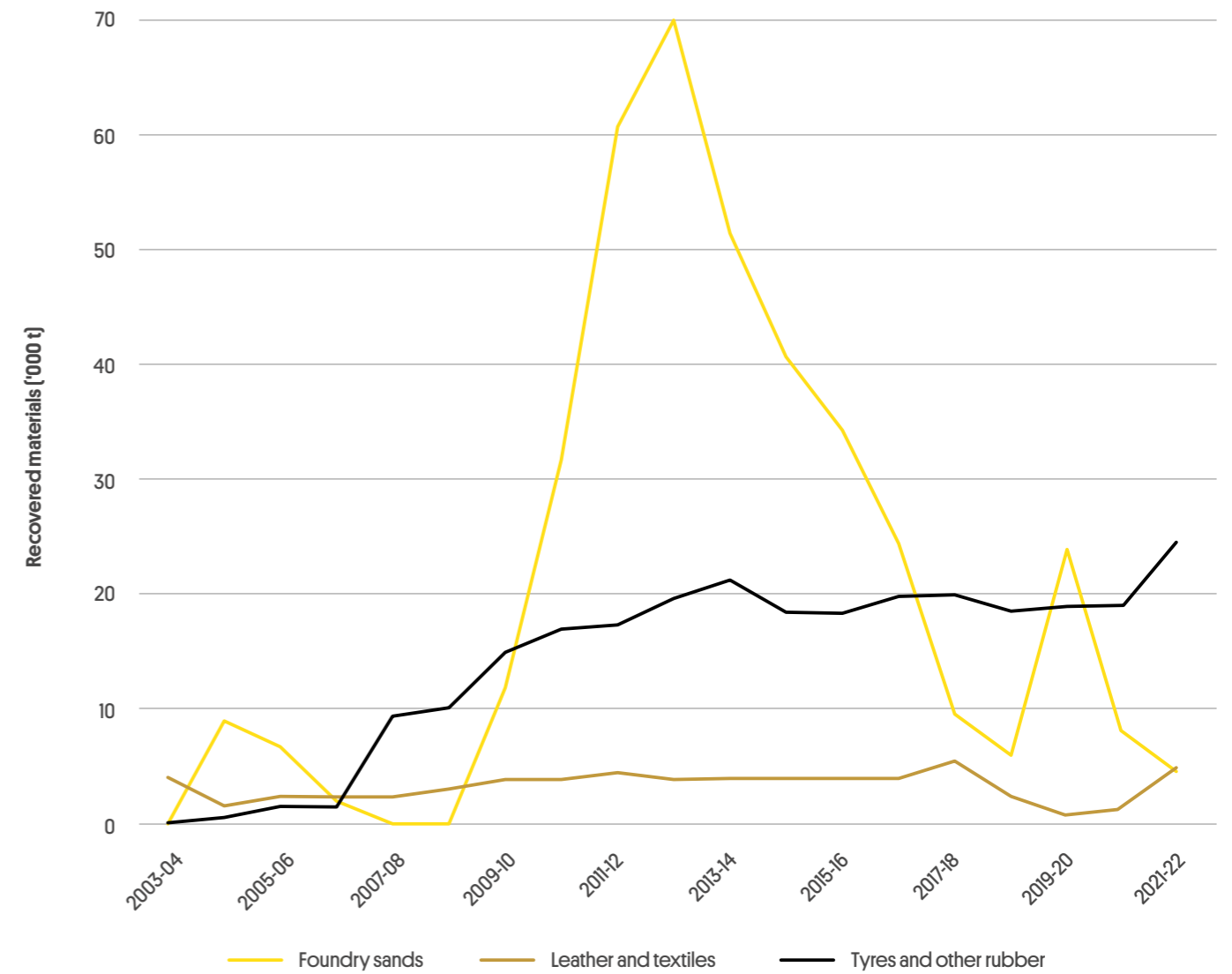
3.7 Other materials

The 'other materials' category includes fly ash, foundry sands, leather and textiles, and tyres and other rubber. The combined recovery of these materials in 2021-22 was about 34,000 tonnes. Minimal quantities of foundry sands have been recovered since 2019-20 and SA has not recovered any fly ash since the closure of the Port Augusta Power Station. Quantities of tyres and other rubber have increased since 2020-21 possibly due to the variation in reporting exported material. Tyres and other rubber contributed the most to overall recovery in this category.

Table 20 Other materials recovered, SA, 2021-22

Material type	Net recovery ('000 tonnes)	Emissions saved kt CO ₂ -e	Energy saved TJ LHV	Water saved ML
Fly ash	0	n/a	n/a	n/a
Foundry sands	4	n/a	n/a	n/a
Leather and textiles	5	n/a	n/a	n/a
Tyres and other rubber	25	26	1,583	1,291
Total	34			

Figure 21 Other materials recovered since 2003-04 – foundry sands, leather and textiles and tyres and other rubber





3.8 Plastics

SA recovered 33,000 tonnes of plastics in 2021-22, an increase from the 32,000 tonnes recovered in 2020-21. Mixed plastics recovery fell to 199 tonnes in 2021-22, while recovery of individual polymer types increased. Most recovered plastics in 2021-22 were HDPE (35%), PET (28%) and LDPE (20%).

The transition from large amounts of mixed plastics to reports by polymer type can be attributed to the Commonwealth Government’s ban on the export of mixed plastics. Previously, exported plastics were poorly sorted and contained significant contaminants which caused environmental problems in China and other receiving countries. From July 2021, exporters needed to sort plastics into single polymer streams.

Table 21 Plastics recovered, including energy recovery, SA, 2021-22

Material type	Net recovery ('000 tonnes)	Emissions saved kt CO ₂ -e	Energy saved TJ LHV	Water saved ML
Polyethylene terephthalate	9	11	498	622
High density polyethylene	12	10	596	271
Polyvinyl chloride	0	0	0	0
Low density polyethylene	7	6	336	153
Polypropylene	5	2	164	144
Polystyrene	<1	0	4	3
Mixed and/or other plastics	<1	0	6	5
Total	33	28	1,600	1,200

Figure 22 Plastics recovered since 2003-04 – PET, HDPE, LDPE, PP and mixed and/or other plastics

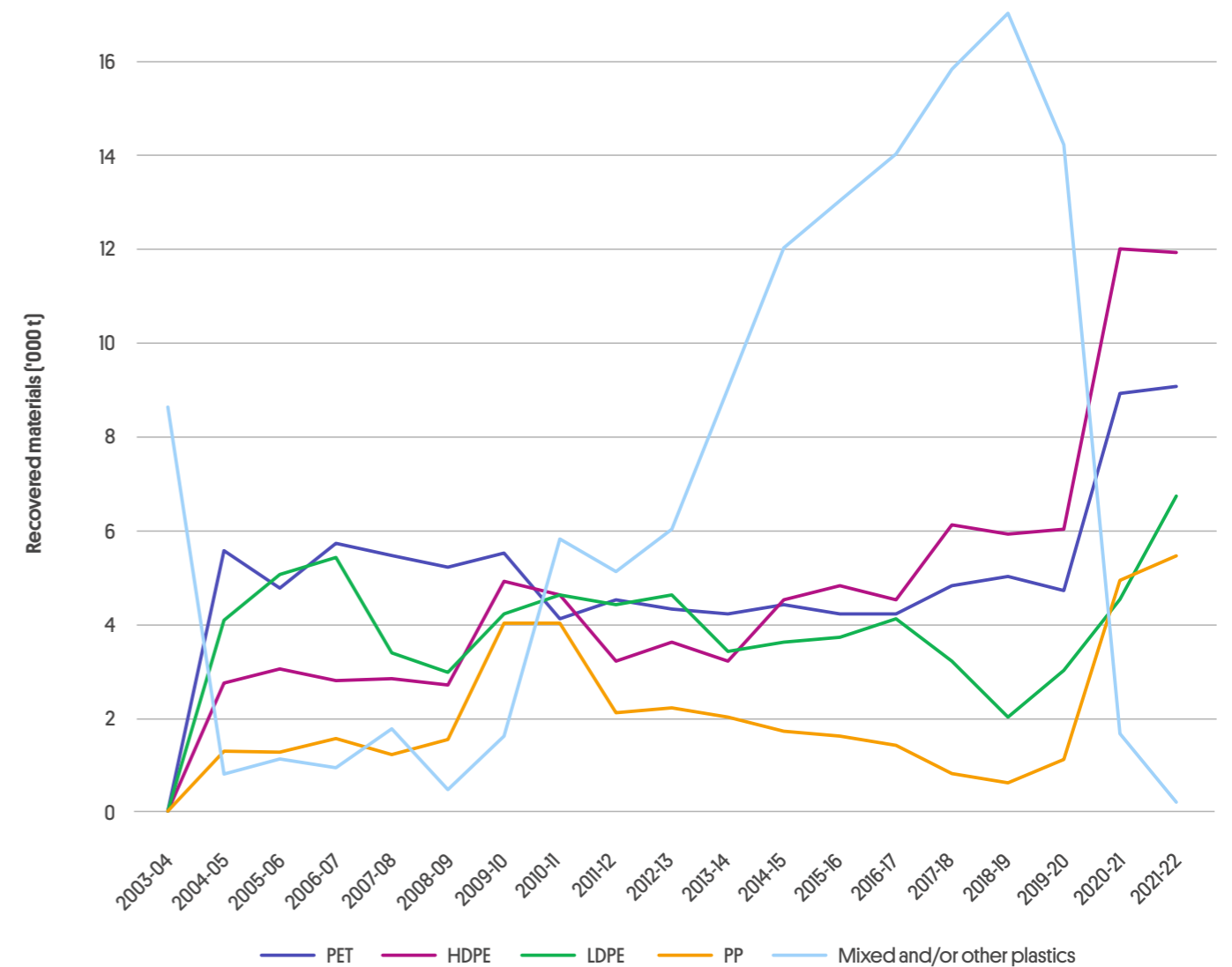
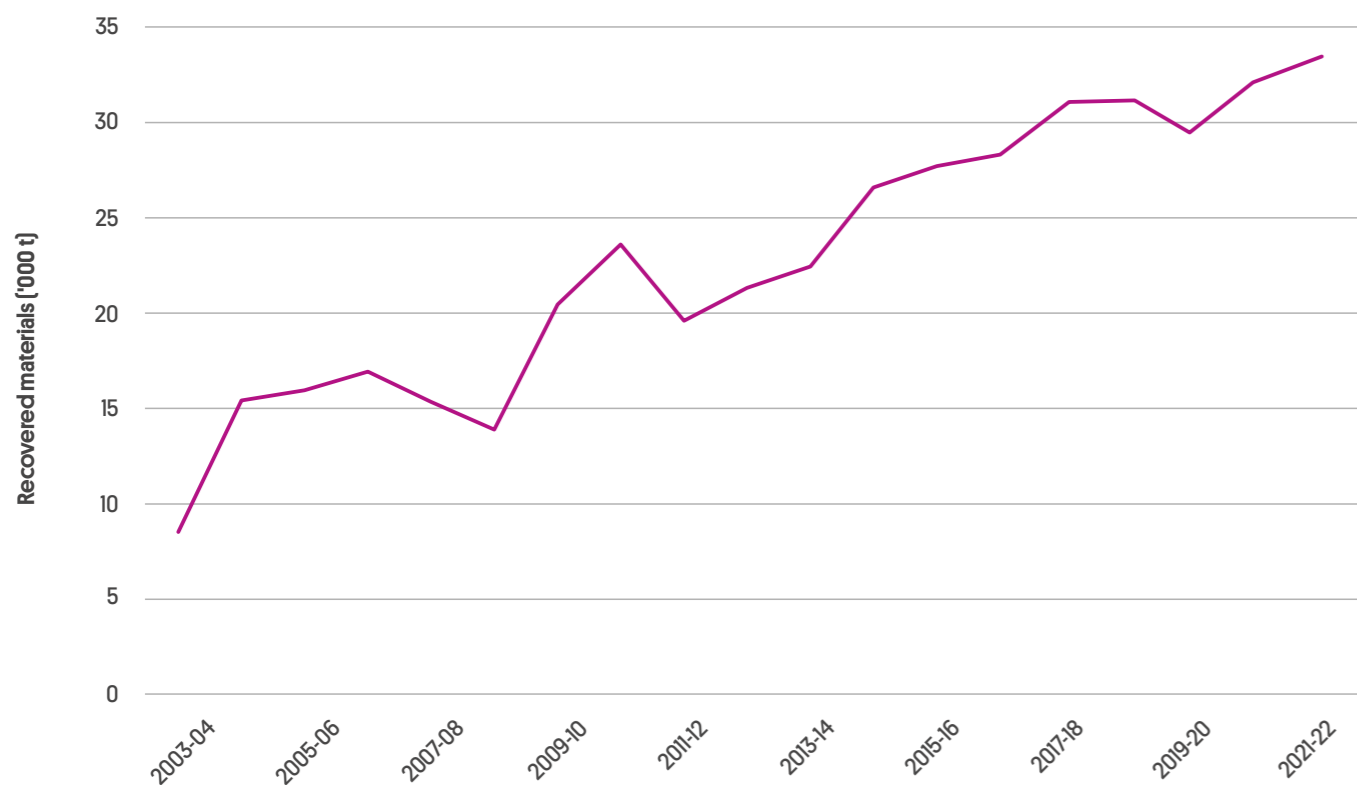


Figure 23 Plastics recovered since 2003-04 – PVC and PS



Figure 24 Plastics recovered since 2003-04 – all plastics



3.8.1 Material flow analyses for plastics

Material flow analysis (MFA) comprises a group of methods to analyse the physical flows of materials into, through and out of a given system. The following pilot traces the system of plastic flows within SA.

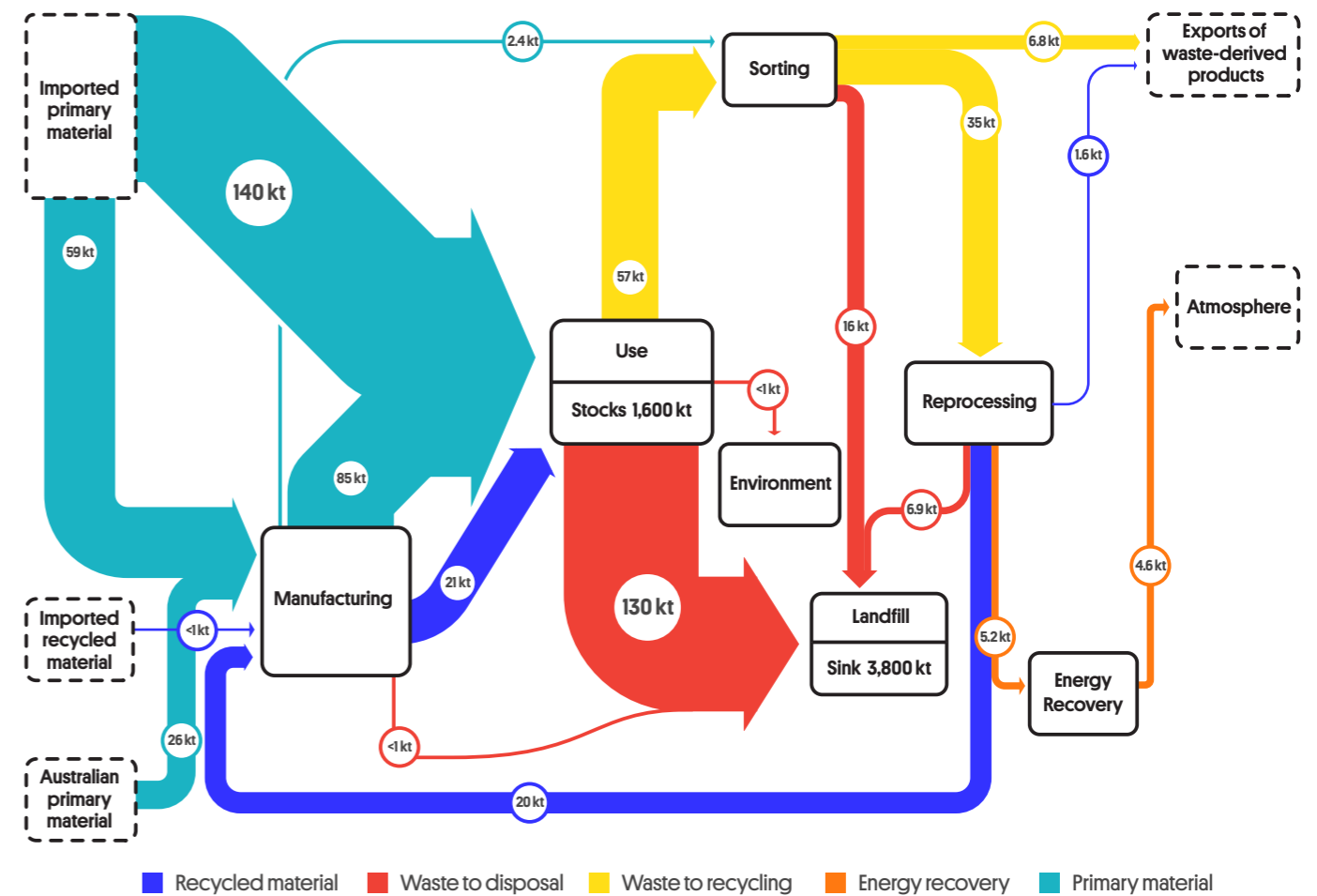
Plastics consumption in SA in 2021-22 was estimated at 239,000 tonnes. It is estimated that locally manufactured and imported plastics comprised about 9% recycled content.

Stocks of plastics in use were estimated at about 1,600,000 tonnes. Most consumed plastics arise in short lived applications like packaging, but significant quantities of plastics have accumulated over time in the built environment and in long-lasting consumer products. It is estimated that about 190,000 tonnes of plastics reached end of life in SA in 2021-22. As described in Section 3.8, about 33,000 tonnes of these were recovered. This equates to an estimated recovery rate of 18%.

It is estimated that about 82% of end-of-life plastics were sent to landfills in SA in 2021-22, which now contain at least 3.8 million tonnes of plastics.

Estimated plastics flows in SA in 2021-22 are depicted below. Estimated plastics flow diagrams for individual plastics can be found in the main report.

Figure 25 Plastic flows in SA, 2021-22



4 E-waste

Electronic waste (e-waste) can be defined as anything with a plug or battery that is no longer wanted, and includes a wide range of items such as computers, televisions and white goods.

E-waste recovery in SA dropped 10% in 2021-22 to 5,300 tonnes. The quantity of batteries reported recovered greatly increased in 2021-22. Quantities of all other e-waste materials declined.



Table 22 Reported tonnes of e-waste, SA, 2021-22

E-waste type	2021-22 (tonnes)
Printer cartridges	20
Compact fluorescent lamps	120
Batteries	2,270
Computers	860
Televisions/monitors	1,140
Mobile phones	4.8
Other e-waste	860
Total	5,270

Figure 26 Reported e-waste recovered since 2009-10 (batteries, televisions and monitors, computers and other e waste)

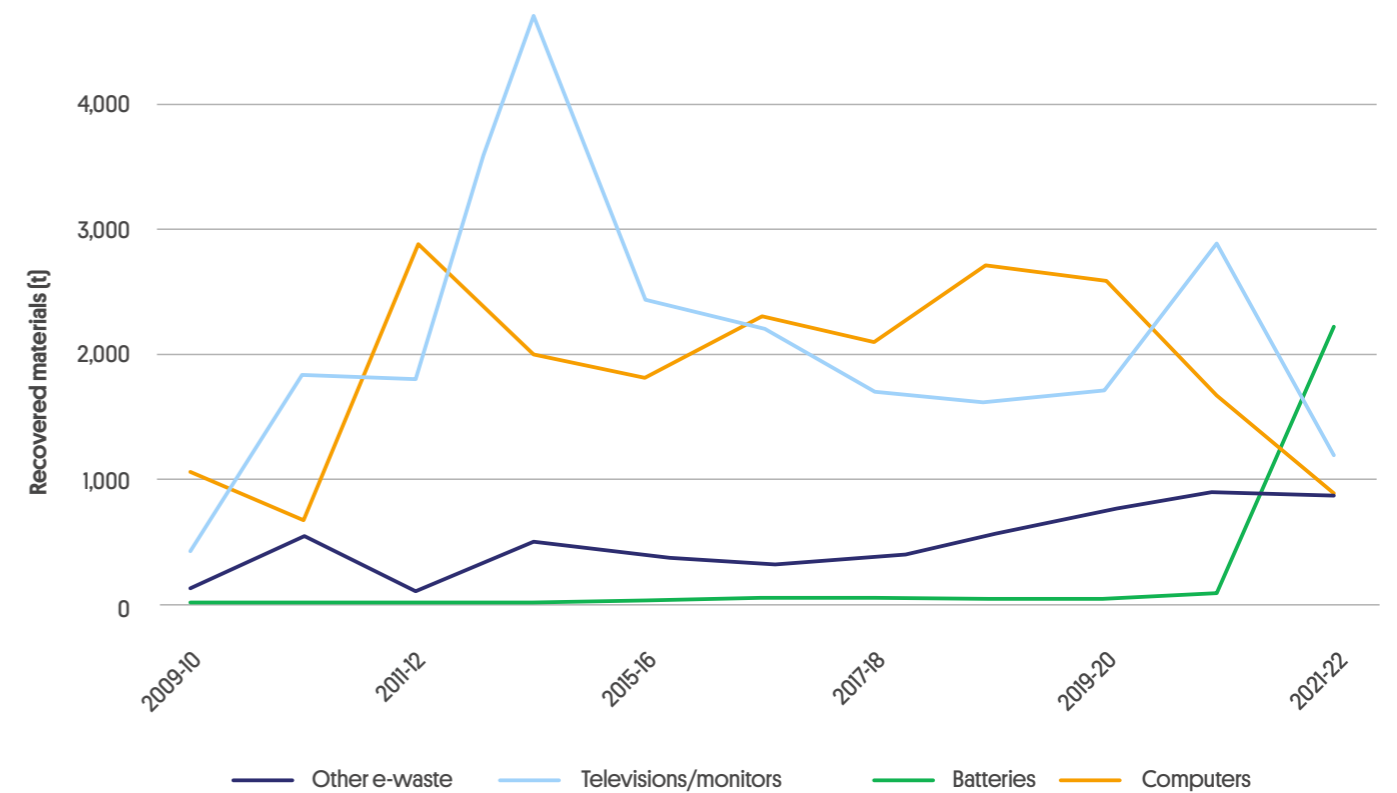
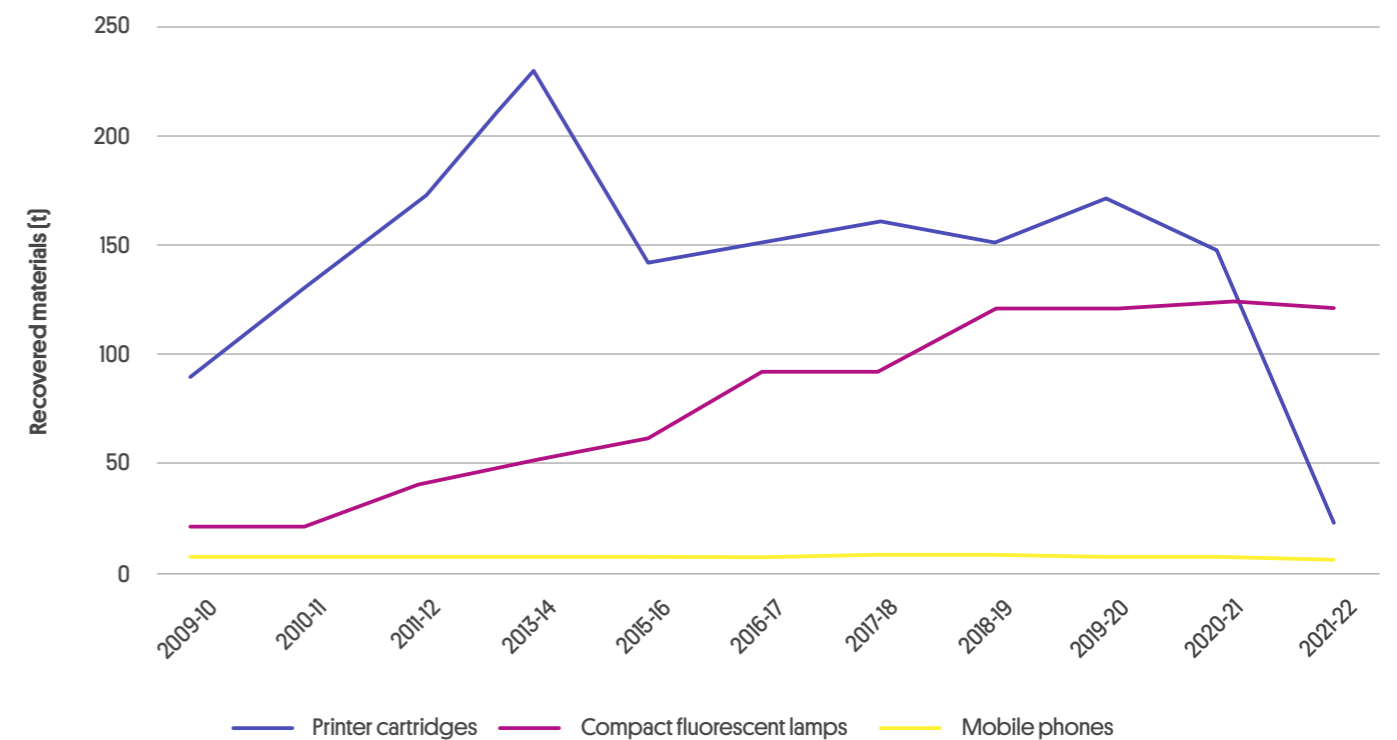


Figure 27 Reported e-waste recovered since 2009-10 (compact fluorescent lamps, printer cartridges and mobile phones)



5 Packaging

Australia has established targets for the management of packaging waste by 2025, as follows [DCCEEW 2022]:

- 100% of packaging being reusable, recyclable or compostable by 2025
- 70% of plastic packaging being recycled or composted by 2025
- 50% of average recycled content included in packaging by 2025
- the phase out of problematic and unnecessary single-use plastic packaging by 2025.

SA recovered about 204,000 tonnes of packaging materials in 2021-22, comprising about 39,000 tonnes [19%] CDL materials and 165,000 tonnes [81%] non-CDL materials.

Table 23 Estimated packaging recovered in SA in 2021-22 (tonnes)

Packaging type	Recovered (tonnes)			Packaging as a proportion of total recovery
	CDL	Other	Total	
Aluminium cans	4,400	500	4,900	42%
Cardboard packaging	0.0	109,100	109,100	90%
Glass bottles and jars	30,800	34,000	64,900	100%
HDPE packaging	300	9,900	10,200	56%
LDPE packaging	0.0	2,900	2,900	33%
Liquid paperboard cartons	500	600	1,100	100%
Other plastics packaging	0.0	500	500	48%
PET packaging	3,400	2,500	5,800	19%
Polypropylene packaging	0.0	2,400	2,400	33%
Polystyrene packaging	0.0	0.0	0.0	0%
PVC packaging	0.0	0.0	0.0	56%
Steel cans	0.0	2,300	2,300	63%
Total	39,400	164,900	204,300	-

5.1 Container deposit legislation

SA has the longest established CDL in Australia, having introduced its container deposit scheme in 1977.

South Australians returned about 39,000 tonnes of containers to CDL locations across the State in 2021-22, the bulk being glass containers [31,000 tonnes, 78%].

Figure 28 Relative proportions of returned container deposit legislation materials by weight, SA, 2021-22



The return rates were high for glass and aluminium at over 80%, while plastics packaging and liquid paperboard exhibited more moderate return rates at 70% to 53%.

Table 24 Return rates for SA's container deposit legislation materials in 2021-22

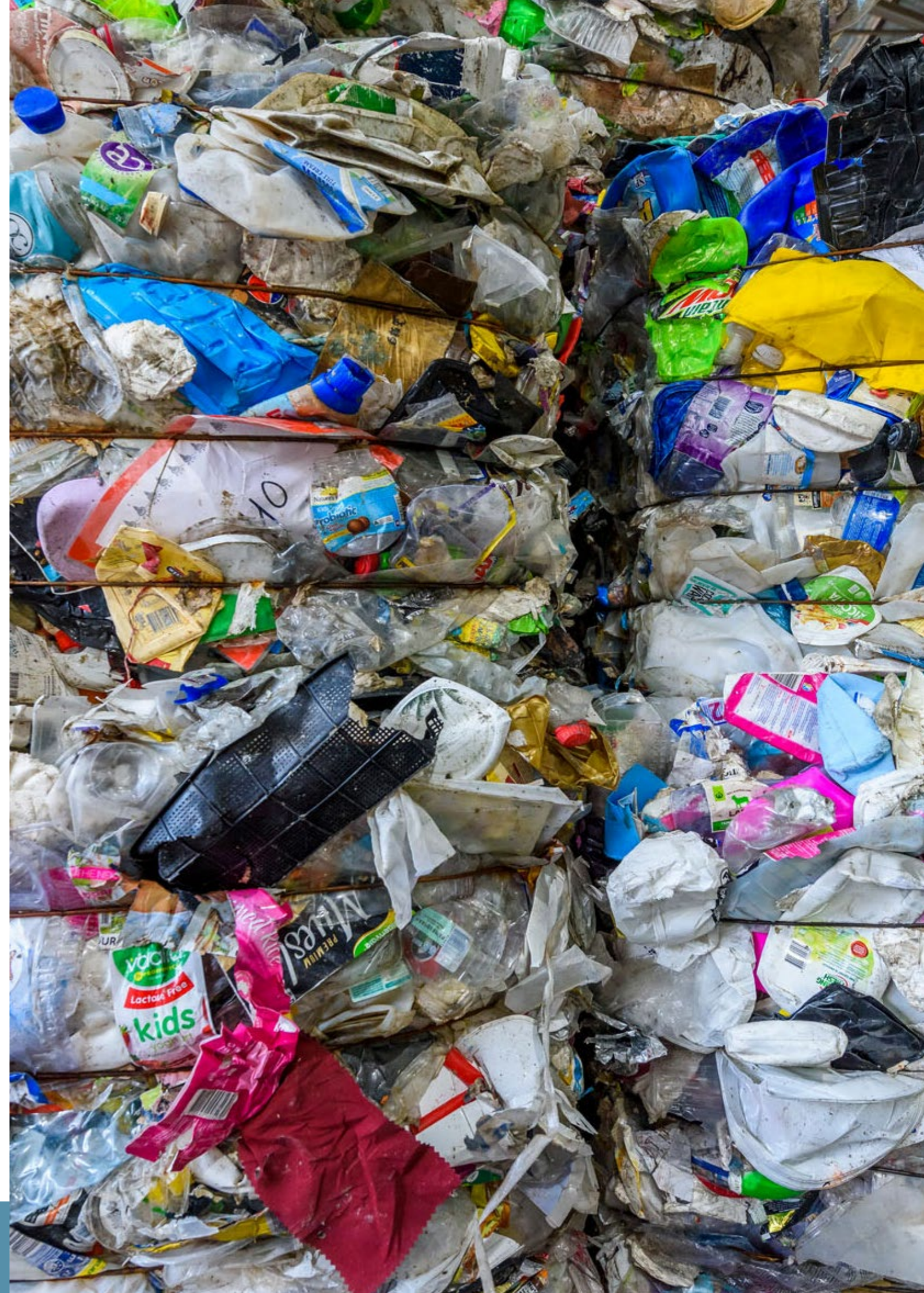
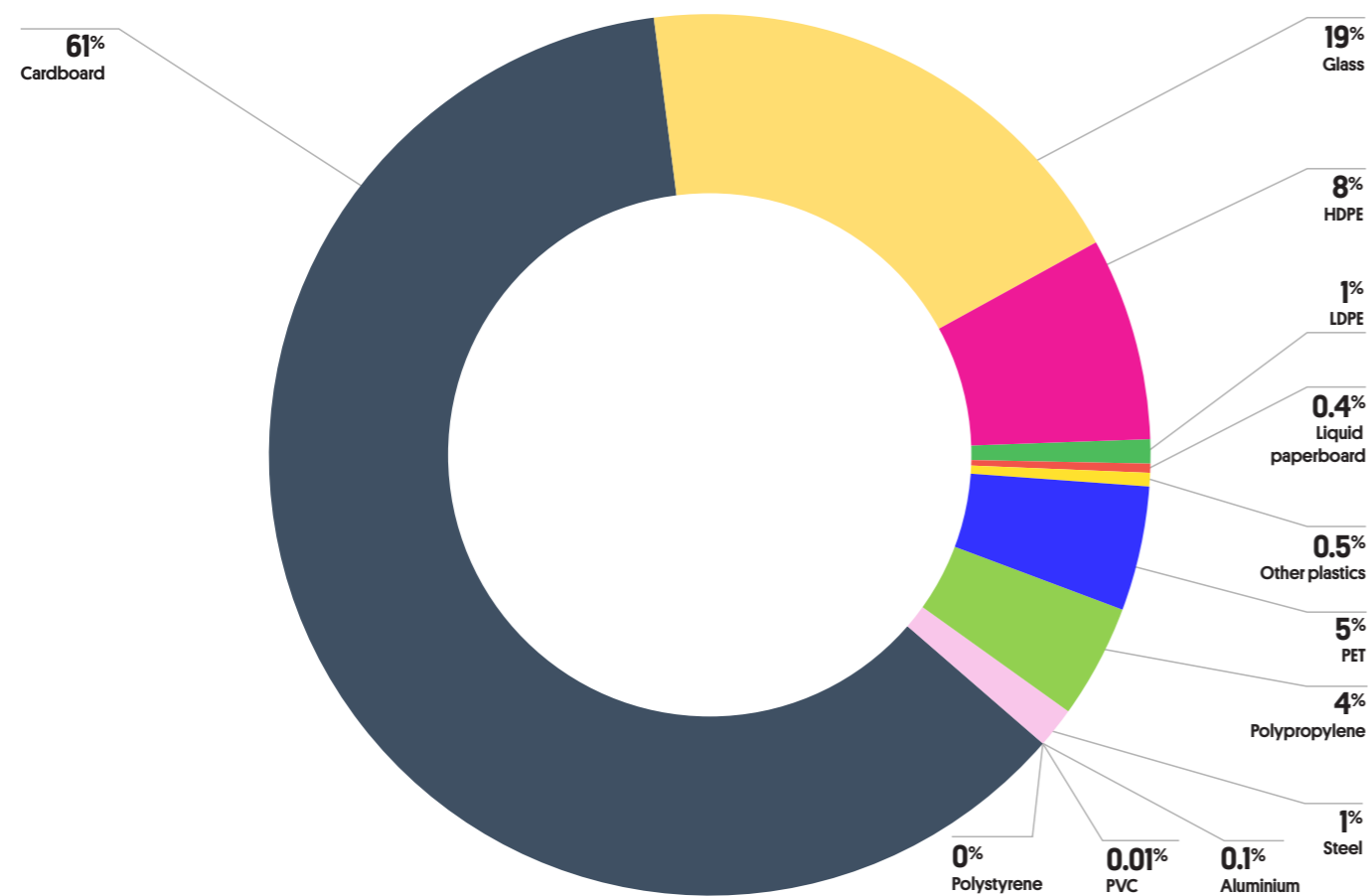
Packaging material	Recovered (tonnes)	Return rate
Glass	31,000	82%
Aluminium	4,400	84%
PET	3,400	70%
Liquid paperboard	500	53%
HDPE	300	61%



5.2 Other packaging materials

Non-CDL recovered packaging material included cardboard [61%], glass bottles and jars [19%].

Figure 29 Relative proportions of other (non-CDL) packaging materials, SA, 2021-22



6 Resource recovery value

The total value of recovery in SA in 2021-22 is estimated at about \$649 million, largely due to increases in quantities of meat rendering to 125,000 tonnes which attract a high value per tonne.

Table 25 Estimated resource value for recovered materials in SA in 2021-22

Material category or type	Recovered (tonnes)	Estimated on-sale price (\$/tonne)	Estimated value (\$ millions)
Masonry	1,425,000	\$11	\$15
Metals – iron and steel	281,000	\$390	\$110
Metals – non-ferrous including aluminium	48,000	\$1,245	\$60
Organics – meat rendering	125,000	\$2,000	\$250
Organics – garden, food and timber	557,000	NA	\$61 ⁶
Organics – other	225,000	Variable	\$67
Cardboard and paper	164,000	\$192	\$44
Plastics	33,000	\$625	\$21
Glass	54,000	\$83	\$5
Other materials (including tyres and other rubber, leather and textiles and foundry sands)	47,000	\$237	\$11
Separately reported materials and clean fill	604,000	\$7	\$4
Total			\$649



⁶ The estimated value for this grouping is calculated using dollar per unit values for products such as compost and mulch

Figure 30 Estimated market value of resource recovered materials, SA, 2021-22

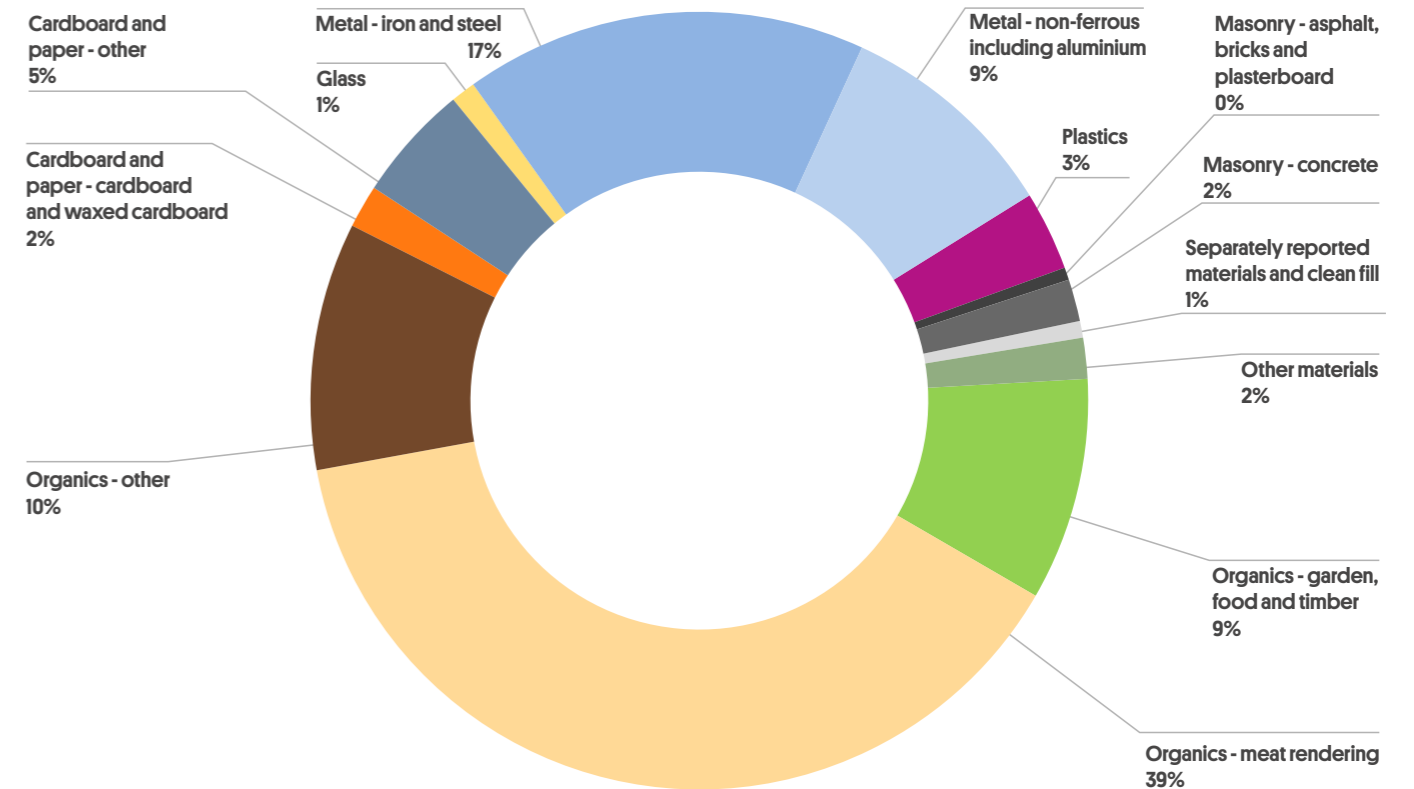
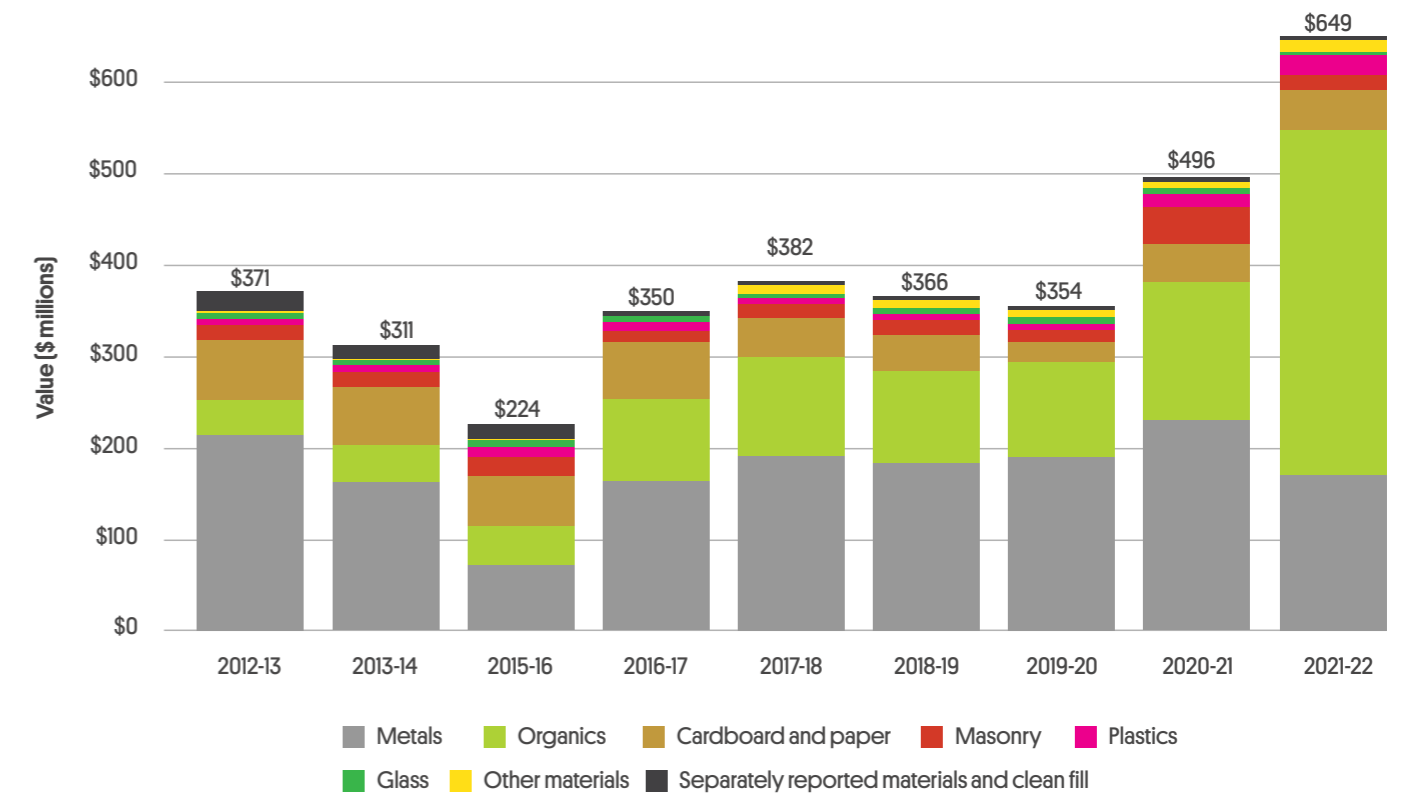


Figure 31 Estimated market value of resource recovered materials in SA, 2012-13 to 2021-22⁷



⁷ Historical values have been adjusted to account for inflation.



7

Environmental benefits of recycling

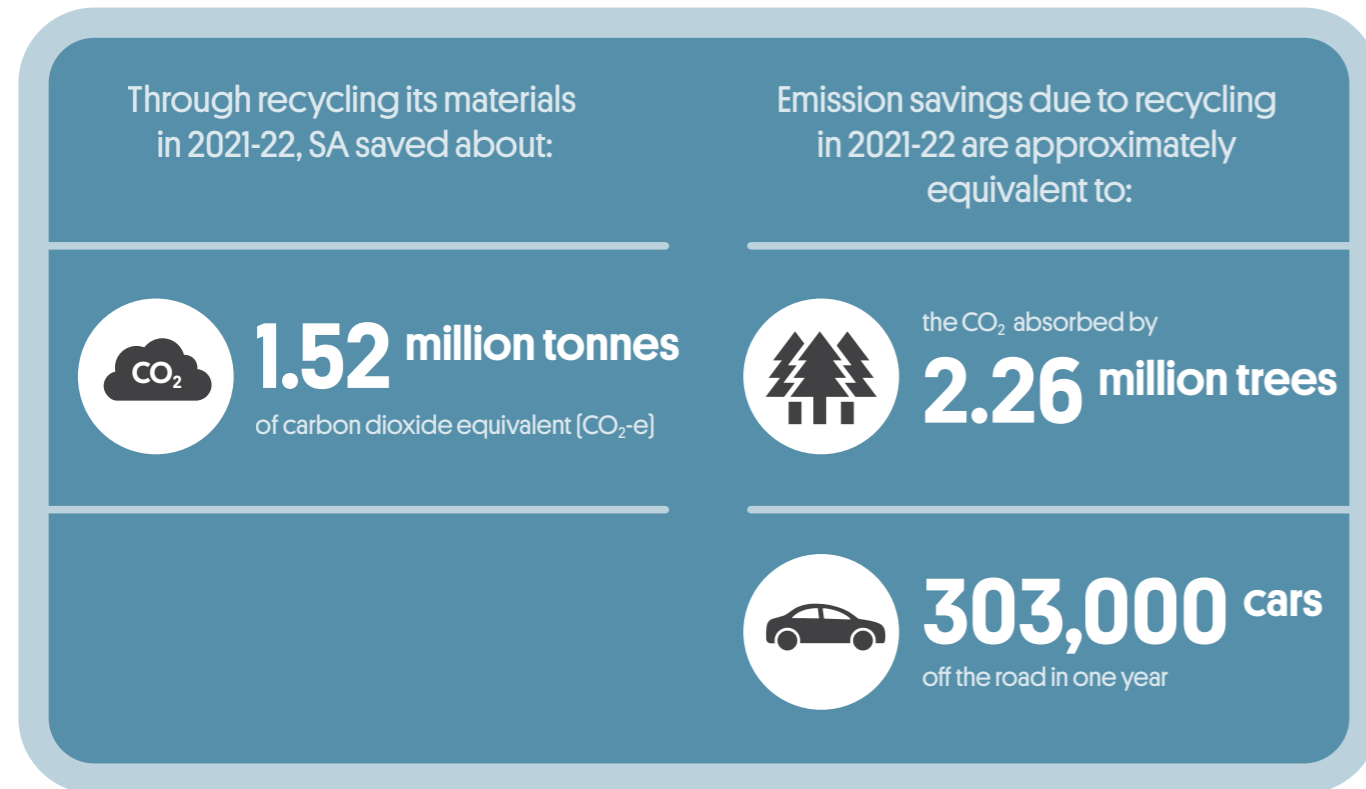
The production and consumption of materials requires the use of energy and water and emits greenhouse gases. When recoverable material is landfilled, the resource and the energy 'embodied' within it (that is, the energy used to make it) is wasted. Materials prone to biological decay (i.e. organics) generate and release the potent greenhouse gas methane when they are landfilled. Resource recovery in SA in 2021-22 achieved the following estimated environmental benefits:

Table 26 Estimated environmental benefits of recycling in SA in 2021-22

Material type	Recovered ('000 tonnes)	Emissions saved kt CO ₂ -e	Energy saved TJ LHV	Water saved ML
Total	3,994	1,520	18,500	8,400



7.1 Greenhouse gas emission savings



7.2 Energy savings

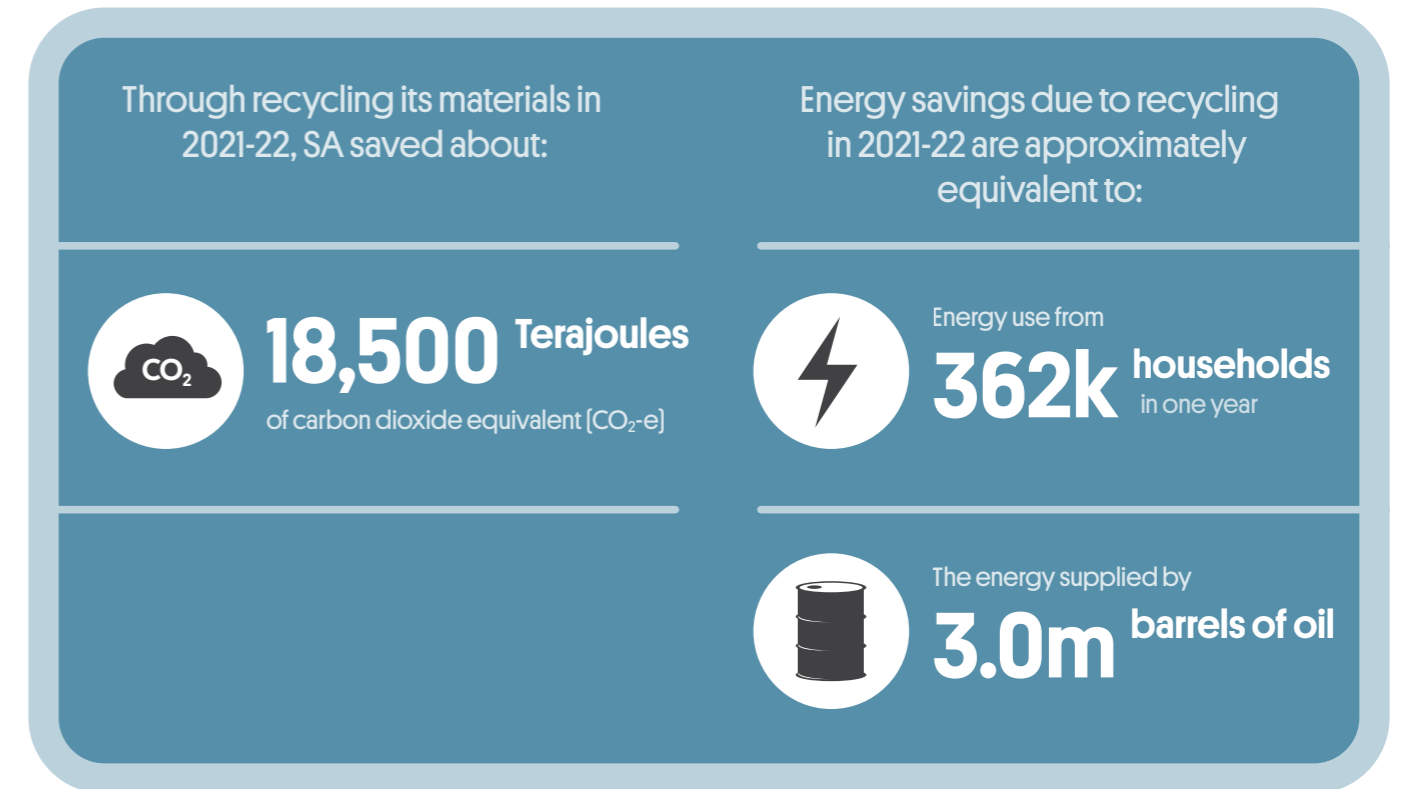


Figure 32 Estimated greenhouse gas emissions savings due to recycling, SA, 2021-22

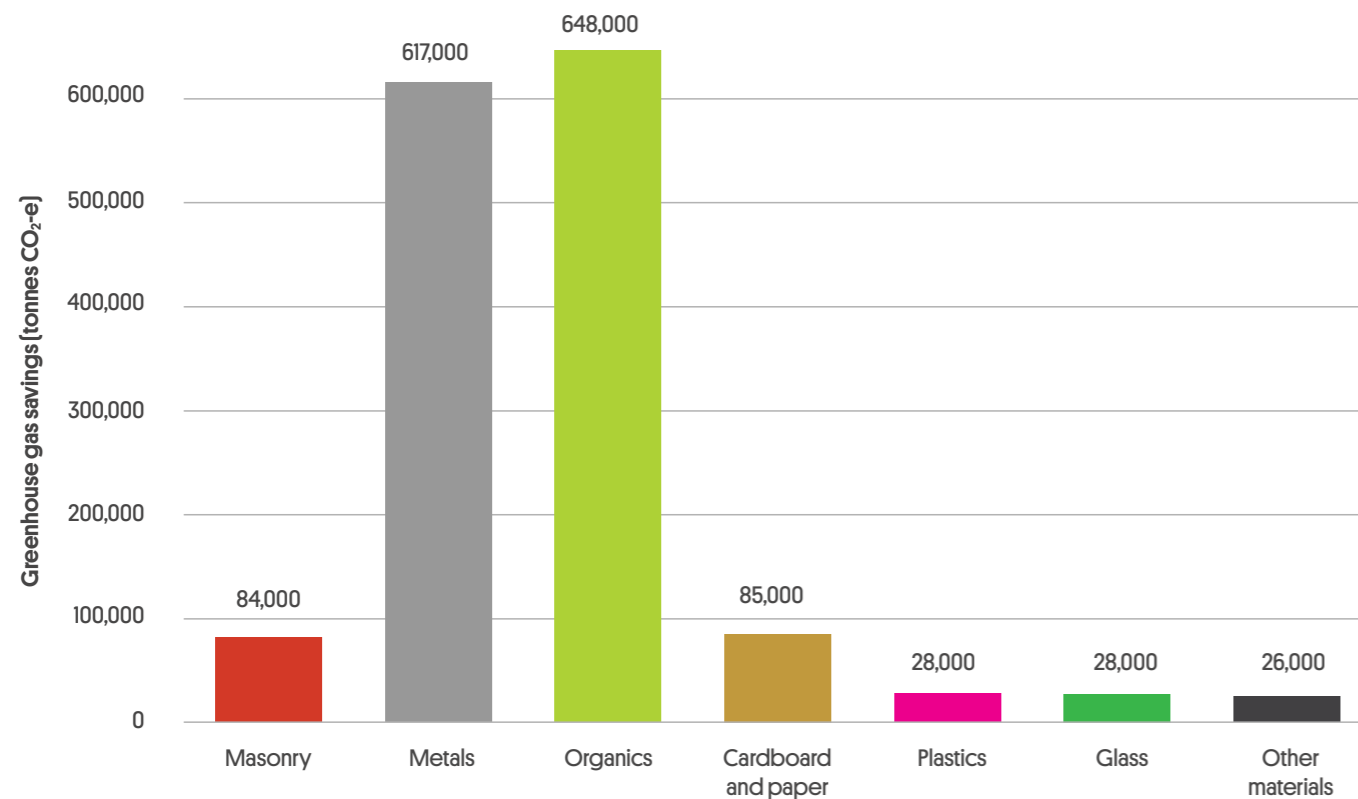
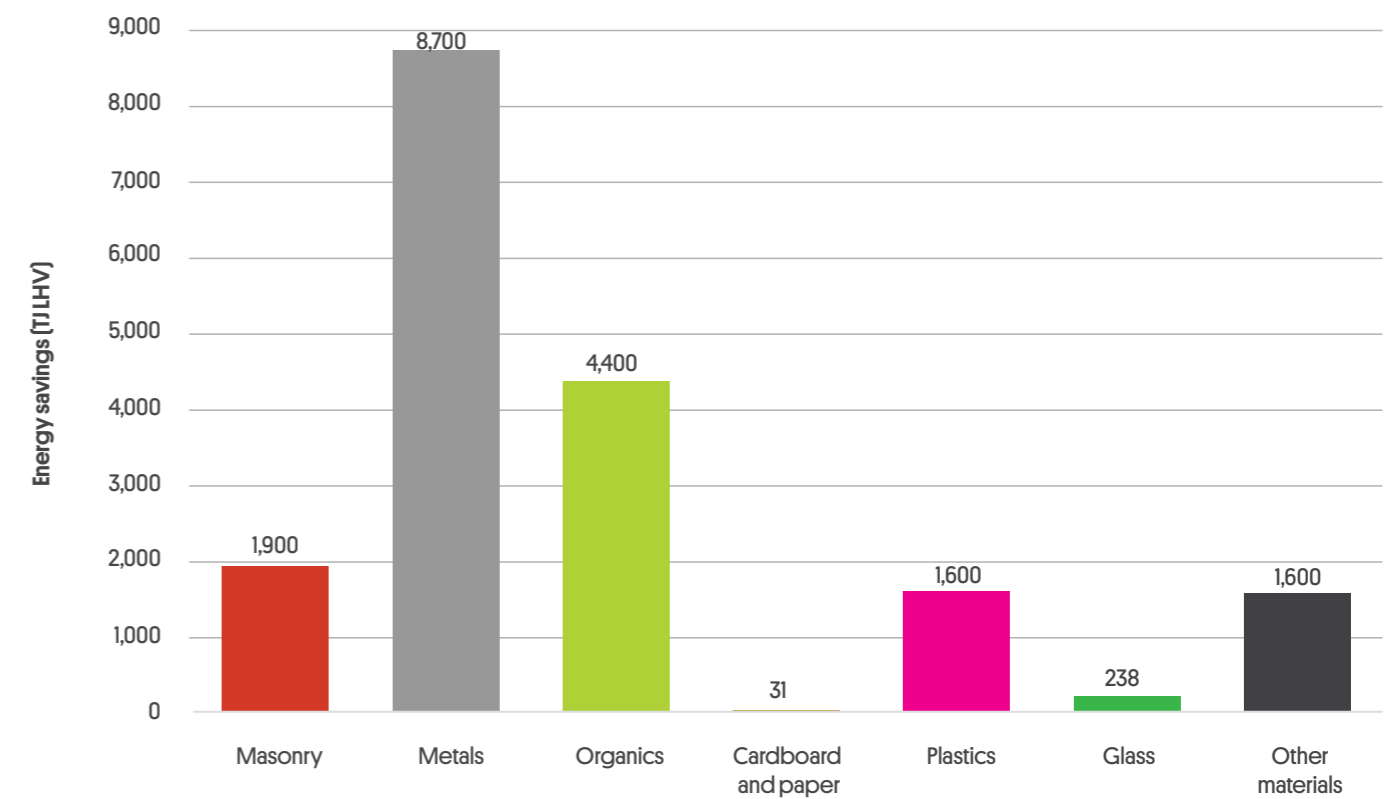


Figure 33 Estimated energy savings due to recycling, SA, 2021-22



7.3 Water savings

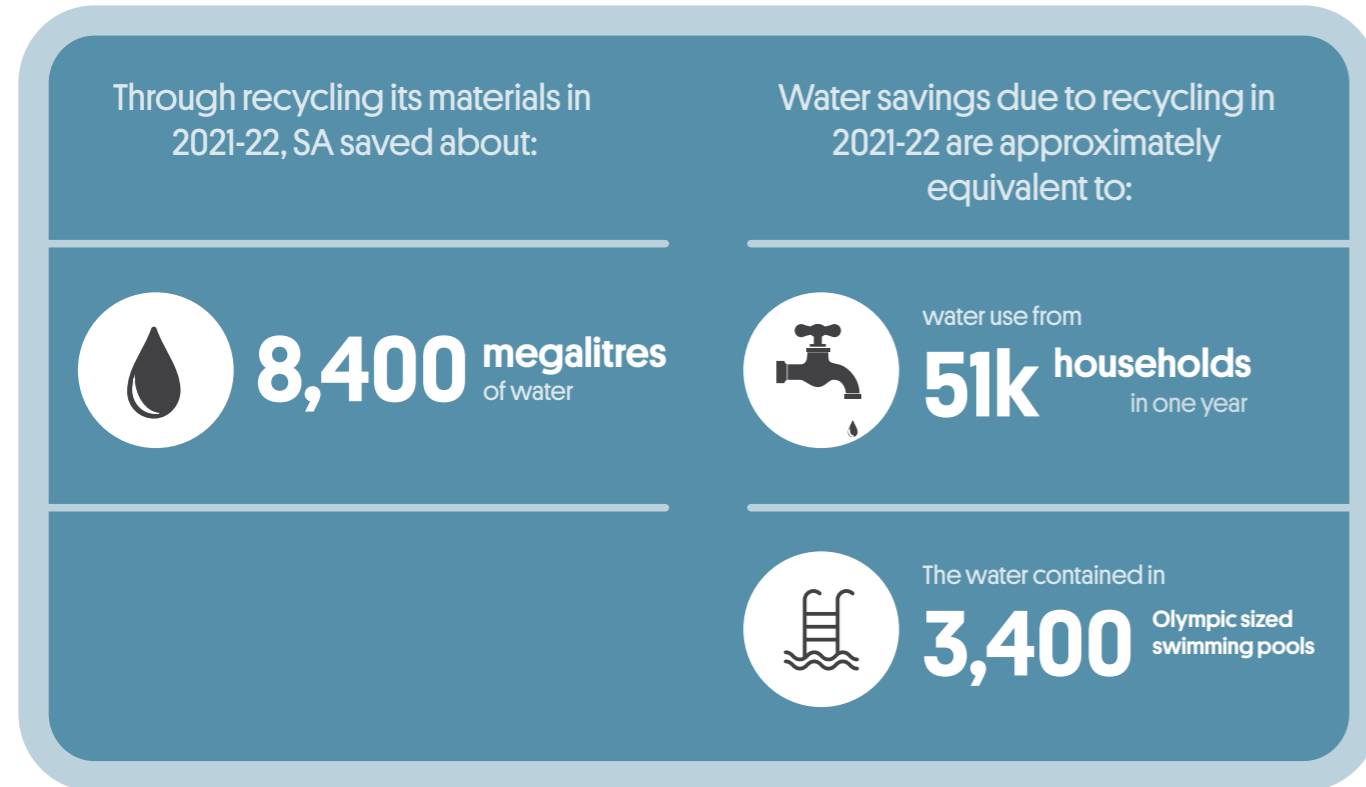
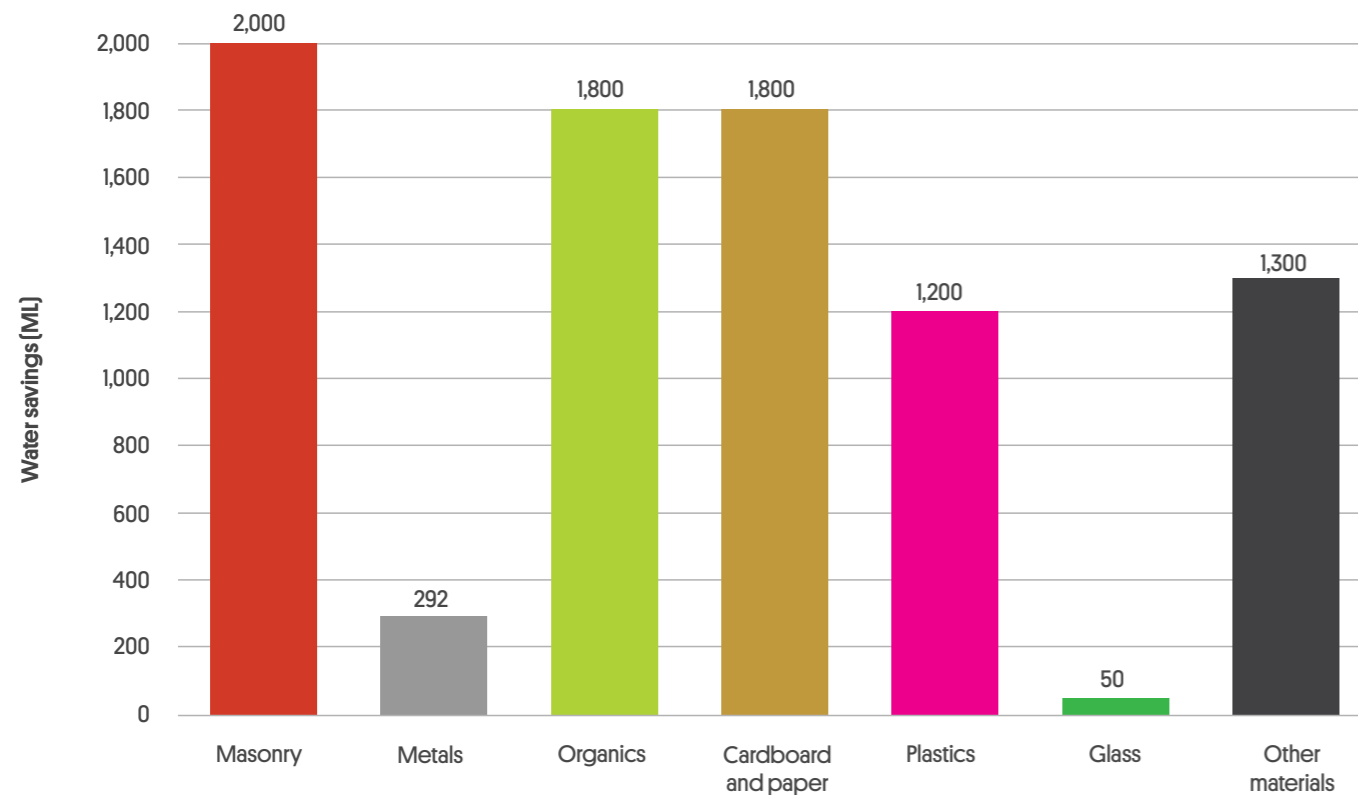


Figure 33 Estimated water savings due to recycling, SA, 2021-22



Acknowledgements

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Agricycling Australia	OneFortyOne Wood Products
APR Manufacturing Group	Opal
Ceduna Recycling	OzHarvest
Central Adelaide Waste and Recycling Authority	Peats Group Ltd
Clare Valley Waste	Recycling Plastics Australia
Downer EDI	Remondis Australia Pty Ltd
Ecoplas Australia	Renewal SA
Electronic Recycling Australia	ResourceCo
Foodbank	SA Composters
Green Triangle Recyclers Pty Ltd	Salvos Stores
Hallett Resources Pty Ltd	Shred-x Pty Ltd
Infrabuild	Sims Metal
Intercast and Forge Pty Ltd	South Australian Water Corporation [SA Water]
J Mathews Pty Ltd	Southern Region Waste Resource Authority
JA Braun Investments Pty Ltd	Statewide Recycling
JBS	Tarac Technologies Pty Ltd
Jeffries	Topcoat Asphalt
MBL Protein	Van Schaik's Biogro
Mobile Muster	
Mobius Farms	
Mulbarton Pty Ltd	



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