

The background of the cover is a circular collage of images. At the top, there are brown, irregularly shaped objects, possibly food waste or agricultural byproducts. Below that is a layer of clear, tangled plastic waste. The middle section features a large quantity of dark blue grapes, some with green leaves. At the bottom of the collage, there is a pile of broken glass and other debris. A large white circle is overlaid on the bottom right of the collage, containing the title and logo.

Circular Economy Resource Recovery Report 2022-23

Summary of Findings



Government of South Australia

Green Industries SA

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 2024. 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.

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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
'000 tonnes	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 2022-23
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 2022-23 financial year.

Summary of 2022-23 results

In SA the resource recovery sector contributes **\$811 million** to the state economy ▲

An estimated **5,160,000 tonnes** of waste material was generated in SA ▲

Of recovered materials **93.0%** was reprocessed locally in SA ▲

4,240,000 tonnes of this material was recovered for further use ▲

914,000 tonnes was sent to landfill ▲

SA achieved a recovery rate of all materials **82.3%** ▲

Energy was recovered from **194,000 tonnes** of waste ▼

Local government collected **697,000 tonnes** of kerbside waste ▲

Environmental savings are estimated to be **1,670,000 tonnes** Greenhouse gas equivalents ▲

SA local government achieved **51.2%** recovery rate ▲

19,400 Terajoules Energy savings ▲

Adelaide Metropolitan councils achieved **53.6%** recovery rate ▲

6,400 Megalitres Water savings ▼



Table S1 Summary of resource recovery, landfill disposal and waste generation, SA, 2022-23

	Standard reporting materials	Separately reported materials	Total
Resource recovery [million tonnes]	3.18	1.06	4.24
Landfill disposal [million tonnes]	0.89	0.03	0.91
Waste generation [million tonnes]	4.07	1.09	5.16
Recovery rate [%]	78.2%	97.4%	82.3%

Recovery by material

Table S2 Summary of resource recovery by material type, SA, 2022-23

Recovered material	Tonnes	Trend (compared to previous year)
Masonry [inc. clays, fines, rubble and soil]	2,290,000	▲
Metals	507,000	▲
Organics	1,100,000	▼
Cardboard and paper	216,000	▲
Plastics	30,000	▼
Glass	74,000	▲
Other Materials	26,000	▼

Performance against state waste targets

In 2020, Green Industries SA released *South Australia's Waste Strategy 2020-25*. The strategy sets waste diversion and reduction targets 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, quarantine waste and some hazardous waste. A summary of progress so far based on 2022-23 data is provided in Table S3.

Table S3 Summary of state waste targets and progress on them

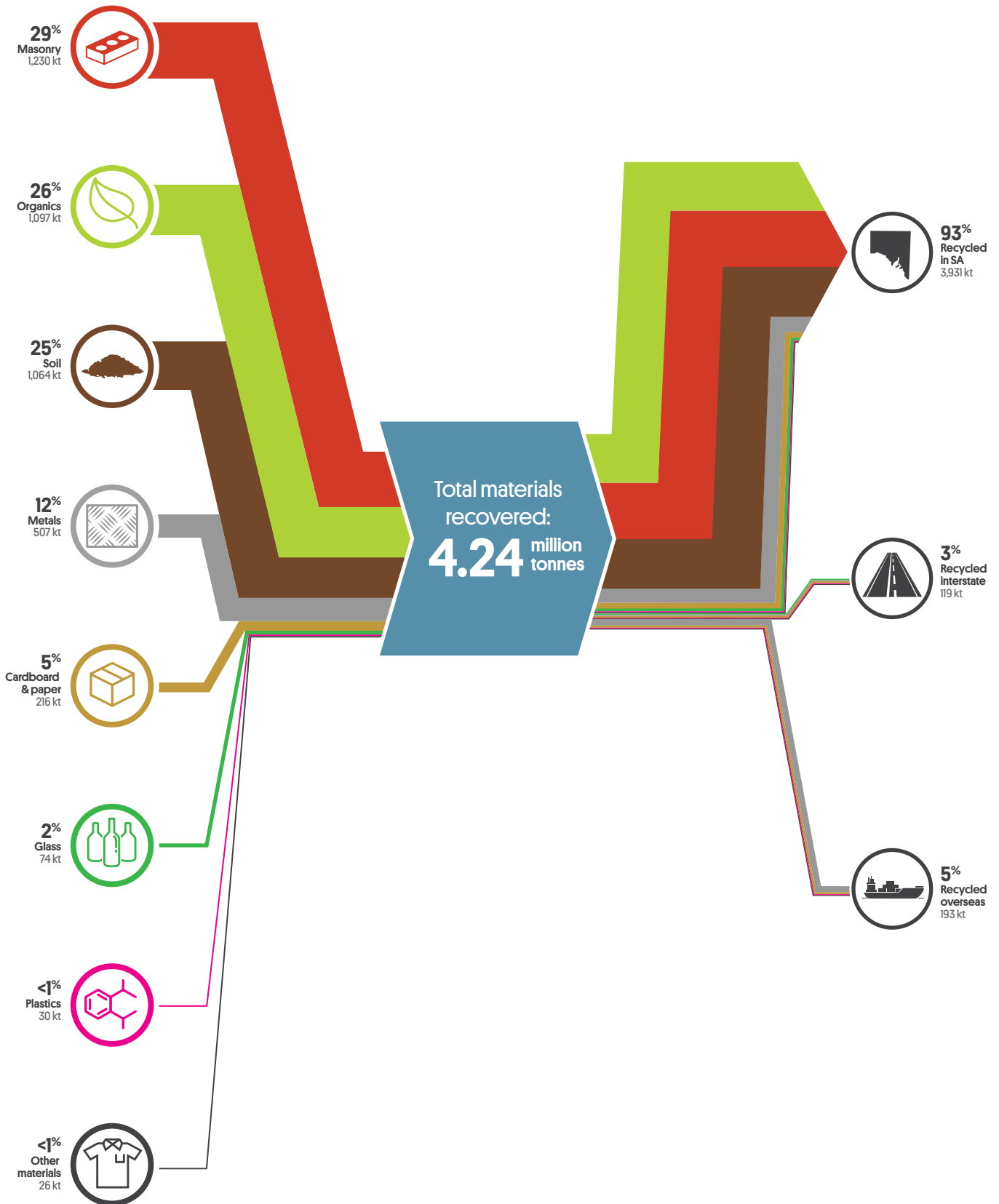
Topic	Target	Progress
Landfill diversion	Zero avoidable waste to landfill by 2030	SA disposed about 914,000 tonnes of waste to landfill in 2022-23, an increase from 885,000 tonnes in 2021-22.
Waste generation	5% reduction in waste generation per capita from a 2020 baseline	Waste generation per capita showed 4% reduction in 2022-23 compared to 2021-22. 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 2022-23: <ul style="list-style-type: none"> - MSW 62% - C&I 76% - C&D 97%



Figure S1 Resource recovery, including energy recovery, SA, 2022-23, by material and destination, not including e-waste or materials reused

Material stream

Destination for processing



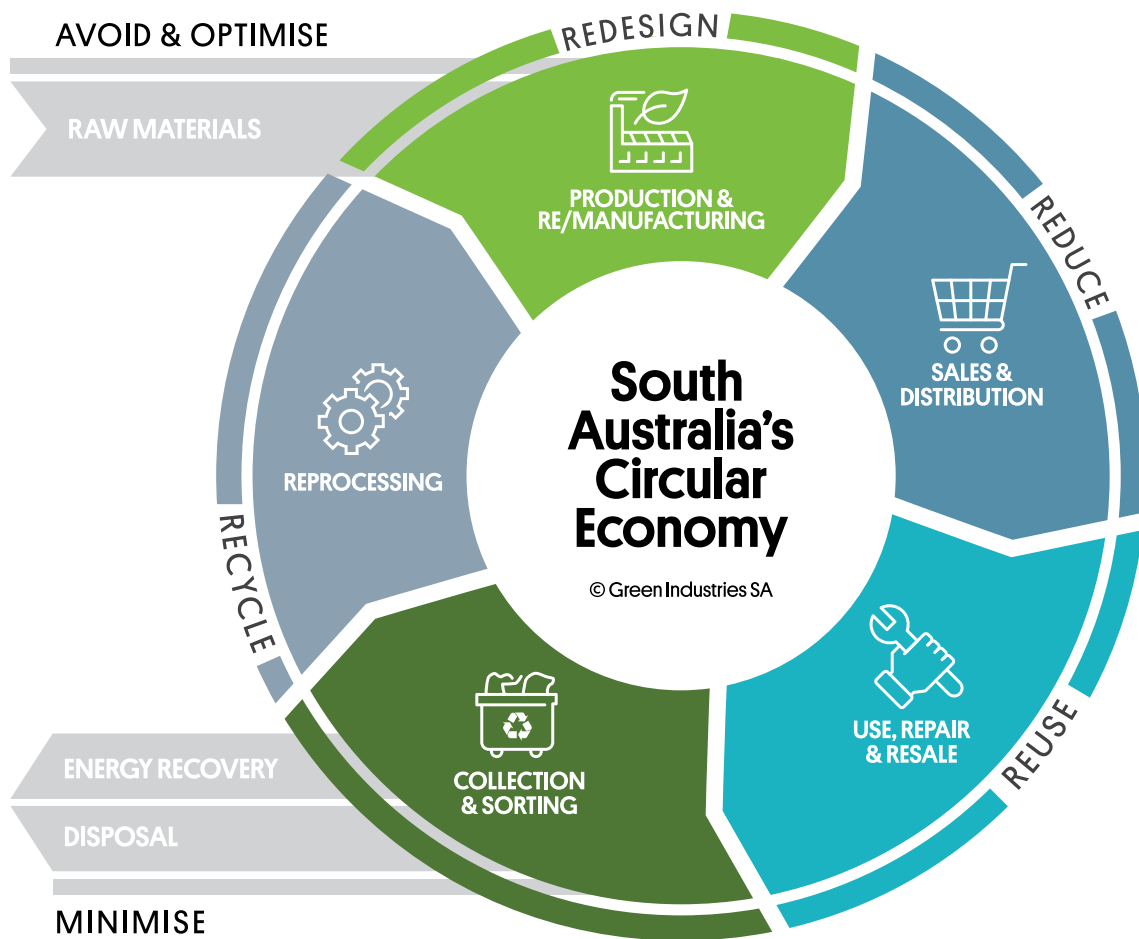


1

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 of 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 *South Australia’s Waste Strategy 2020-25* [Green Industries SA 2020], which defines targets for waste reduction and waste diversion¹ 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]

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

The *Circular Economy Resource Recovery Survey 2022-23* (the survey) asked recyclers, reprocessors, the reuse sector and the energy recovery industry in SA about their operations in 2022-23. 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 ²	% 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			

² 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

Overview

Overall waste generation was 5.16 million tonnes (4.88 million tonnes in the previous year) and SA recovered about 4.24 million tonnes of material in 2022-23. Disposal to landfill was about 914,000 tonnes resulting in a recovery rate of 82.3% in the 2022-23 financial year (81.9% in 2021-22).



Table 2 Annual SA resource recovery and landfill diversion performance for 2022-23 compared to 2021-22 and 2003-04

Parameter	2003-04	2021-22	2022-23	Change
				03-04 to 22-23
Resource recovery ('000 tonnes)				
Standard reporting materials	1,880	3,389	3,179	69%
Separately reported materials	162	604	1,064	557%
Total	2,042	3,994	4,244	108%
Landfill disposal ('000 tonnes)				
Standard reporting materials	1,258	676	886	-30%
Separately reported materials	20	209	28	40%
Total	1,278	885	914	-28%
Waste generation ('000 tonnes)				
Standard reporting materials	3,138	4,065	4,065	30%
Separately reported materials	182	813	1,092	500%
Total	3,320	4,878	5,158	55%
Recovery rate (%)				
Standard reporting materials	59.9%	83.4%	78.2%	31%
Total	61.5%	81.9%	82.3%	34%
SA population (persons)	1,534,000	1,821,000	1,852,000	21%
Per capita recovery (kg/person/yr)				
Standard reporting materials	1,230	1,861	1,717	40%
Total	1,330	2,193	2,292	72%
Per capita disposal (kg/person/yr)				
Standard reporting materials	820	371	478	-42%
Total	830	486	494	-41%
Per capita waste generation (kg/person/yr)				
Standard reporting materials	2,050	2,232	2,195	7%
Total	2,160	2,679	2,785	29%
SA Gross State Product (GSP) (\$ millions)	\$91,029	\$129,272	\$134,209	47.4%
Performance metrics per GSP ('000 tonnes/\$ million GSP)				
Total recovery	22.4	30.9	31.6	-41.0%
Total disposal	14.0	6.8	6.8	-51.5%
Total waste generation	36.5	37.7	38.4	5.4%

Progress since the first survey year (2003-04)

Since 2003-04, waste generation has increased, but the trend shows increasing recovery and declining disposal over time. The recovery rate has been consistently around 82-83% for the past five years.

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

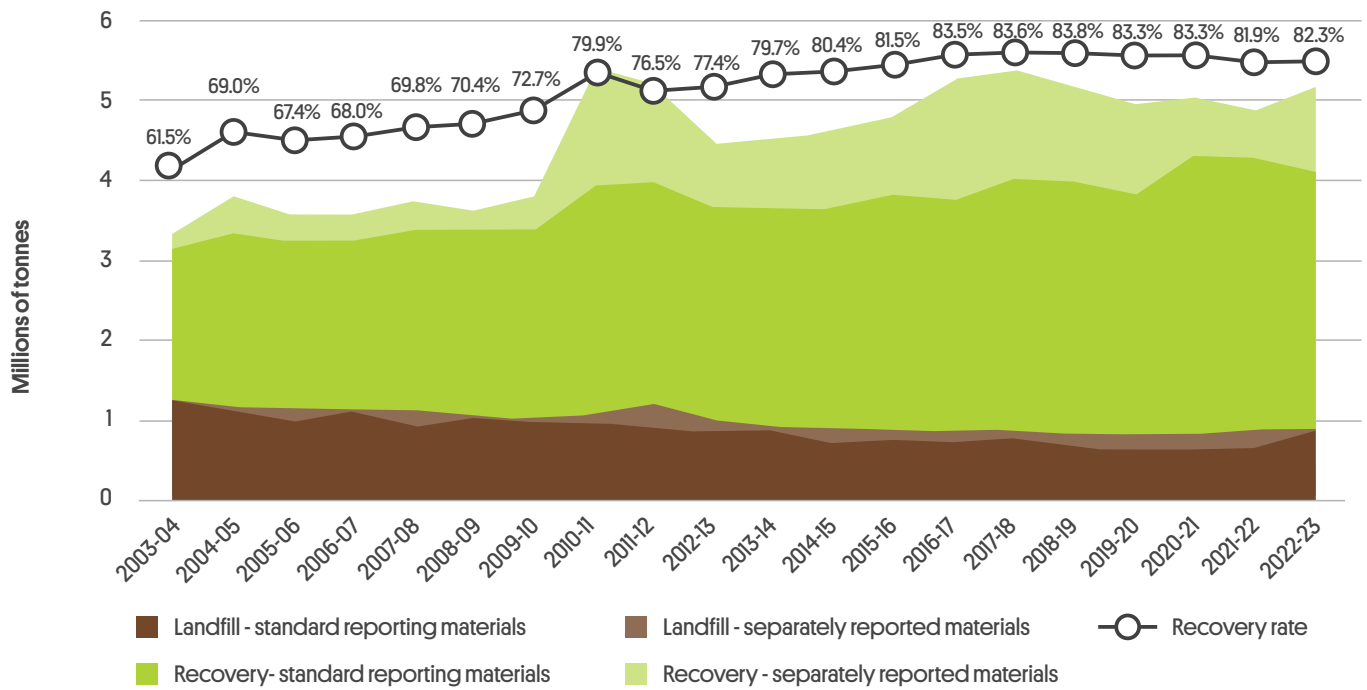


Figure 3 Trend in resource recovery in SA since 2003-04 by material category, including kilotonnes per million dollars of gross state product (GSP)

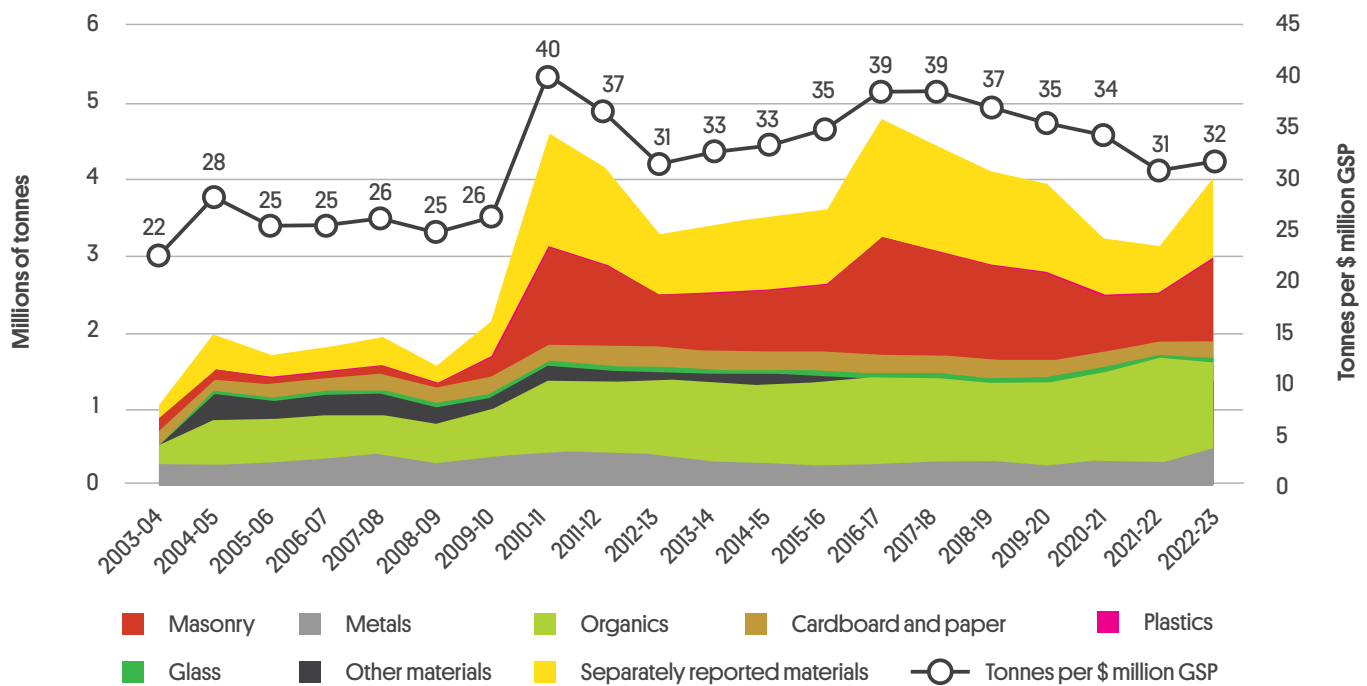
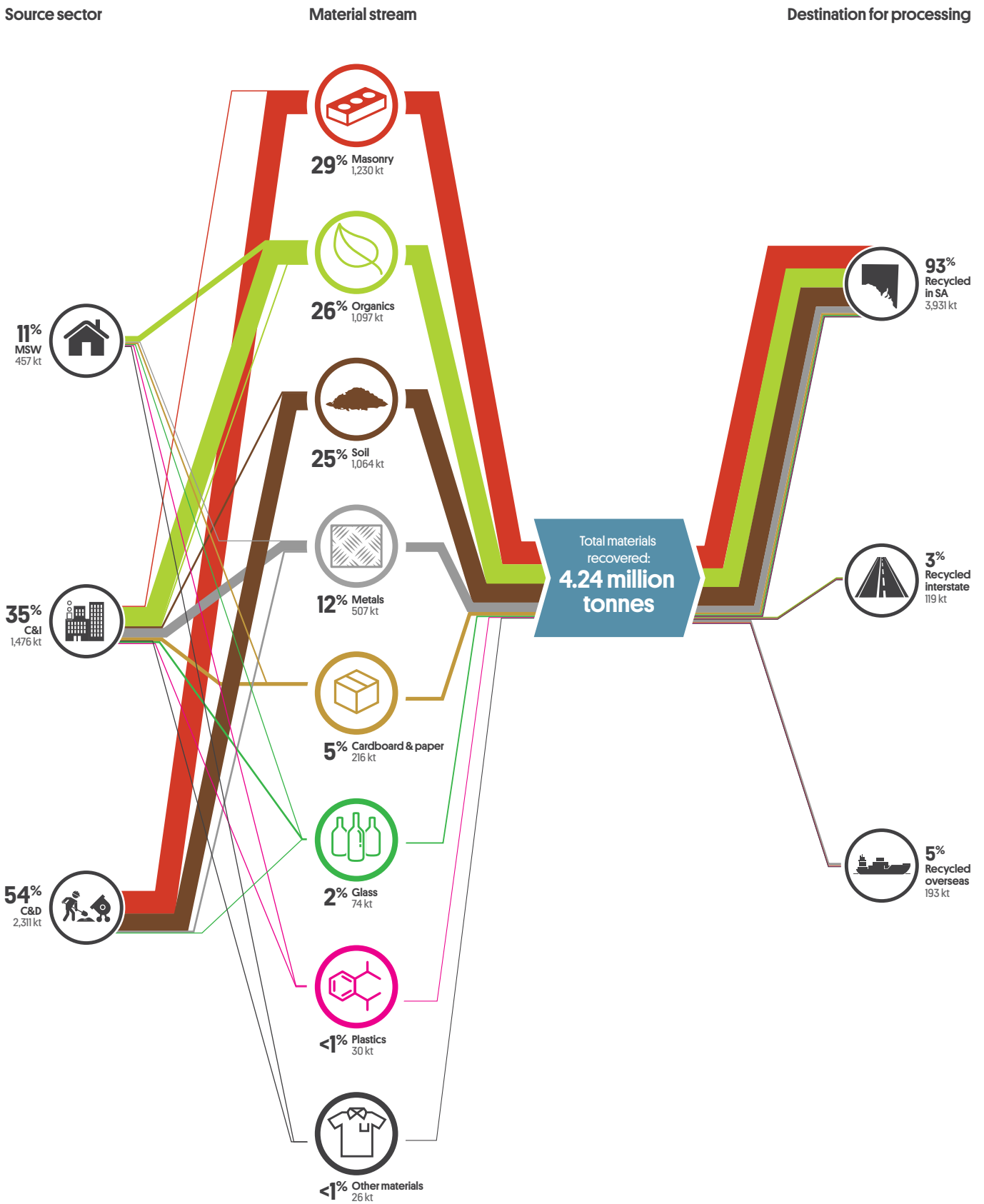


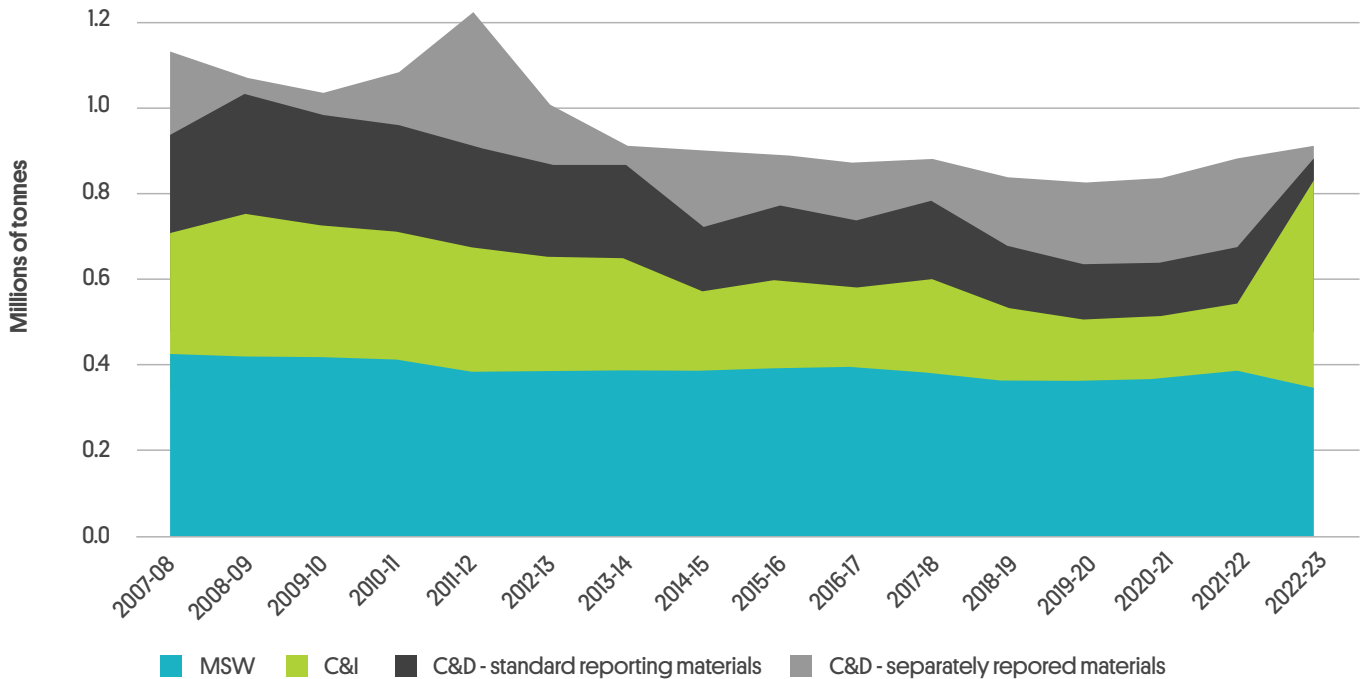
Figure 4 Resource recovery, including energy recovery, SA, 2022-23, by material, source stream and destination, not including e-waste or material reused



Landfill disposal

SA disposed about 914,000 tonnes of waste to landfill in 2022-23, an increase from the 885,000 tonnes landfilled in 2021-22. 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



Source streams

The source stream origin for SA waste and recovered materials in 2022-23 is shown in Table 3, Figure 6 and Figure 7. Recovered materials mostly comprised C&D waste [54%], followed by C&I [35%] and MSW [11%].

The estimated recovery rate for C&D was the highest in 2022-23 at 97%, followed by C&I at 75% then MSW at 57%.

Table 3 South Australia recovery and landfill disposal by source stream in 2022-23³

Sector	Recovery		Landfill disposal		Recovery rate
	'000 tonnes	% of total	'000 tonnes	% of total	
MSW	457	11%	347	38%	57%
C&I	1,476	35%	494	54%	75%
C&D	2,311	54%	73	8%	97%
Total	4,244	-	914	-	82%

³ Recovery rates by source stream listed in Table 4 include material from metropolitan and regional SA. In contrast, only metropolitan recovery is included in Table S3 and Table 7.

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

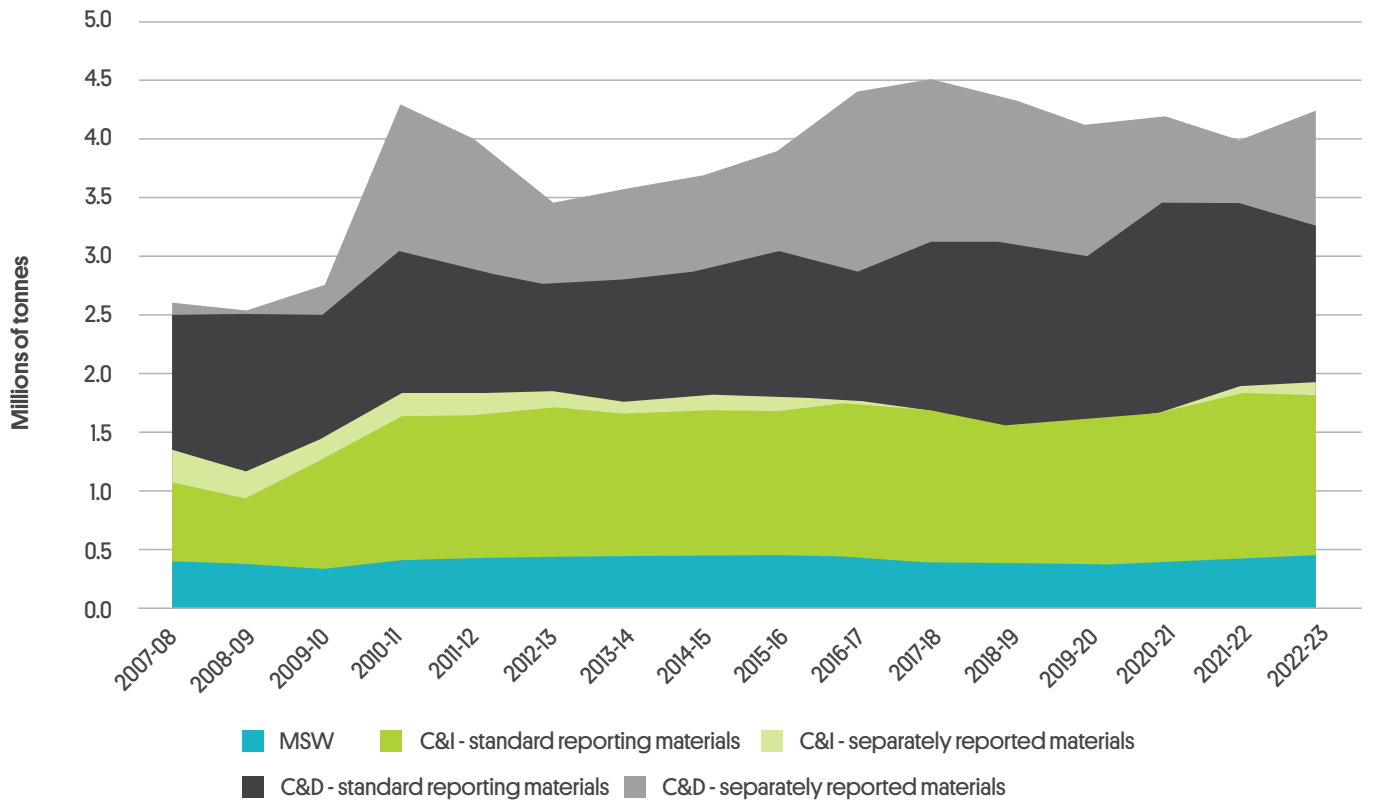
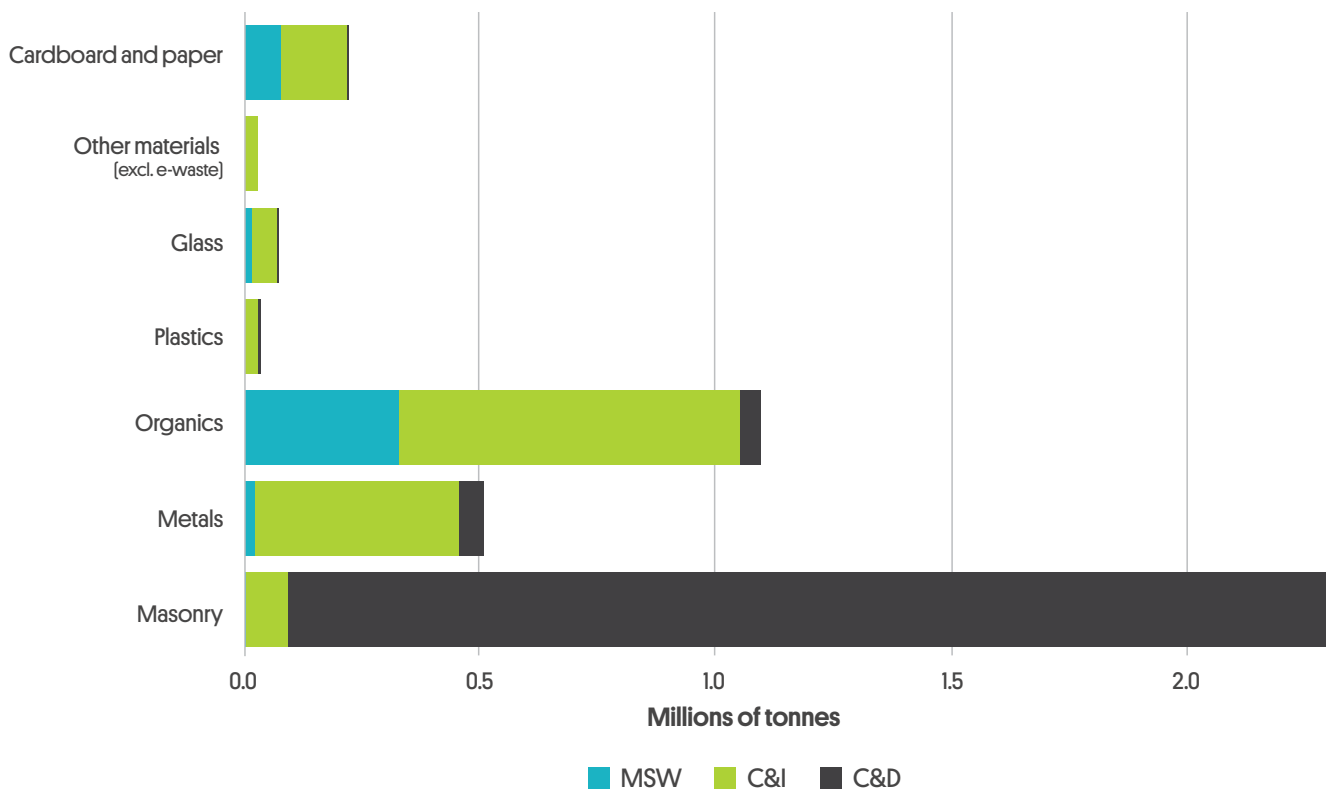


Figure 7 Source stream of recovered materials by material category, SA, 2022-23



Geographical origin

Metro SA contributed about 3,421,000 tonnes [81%] of the state's total recovered materials in 2022-23, and 656,000 tonnes [72%] of total disposed waste. About 84% of waste generated in metropolitan SA was recovered.

Regional SA contributed 823,000 tonnes [19%] of total recovered materials in the 2022-23 financial year. Regional SA disposed of about 258,000 tonnes [28% of all SA disposal] of waste to landfill, achieving a recovery rate of 76%.

Table 4 SA recovery and landfill disposal by geographical origin in 2022-23

Sector	Recovery		Landfill disposal		Recovery rate
	'000 tonnes	% of total	'000 tonnes	% of total	Percentage
Metro	3,421	81%	656	72%	84%
Regional	823	19%	258	28%	76%
Total	4,244		914		82%

Destination for recovered materials

In 2022-23, about 3,931,000 [92.6%] of recovered materials were reprocessed in SA, 2.8% of materials were reported as reprocessed interstate and 4.6% reprocessed overseas.

Figure 8 Destination for recovered materials



All masonry and separately reported materials [clay, fines, rubble and soil] was reprocessed locally.

A high proportion of organics [97%], glass [97%], plastics [85%], metals [69%], and most cardboard and paper [51%] were reported as reprocessed in SA. 'Other' materials were mostly reprocessed in SA [59%] but with notable quantities sent overseas [27%].

Energy recovery

Table 5 shows total resource recovery of SA materials in 2022-23, split between recycling and energy recovery. Energy recovery is defined as processes through which wastes are collected, sorted and processed to recover energy in usable form, for example process heat, steam or in electricity generation.

About 194,000 tonnes of SA materials were estimated as recovered for their energy value in 2022-23, compared to 308,000 tonnes in the previous year.

Table 5 Material and energy recovery, SA, 2022-23

Recovery type	'000 tonnes	Contribution to recovery rate (%)
Material recovery	4,050	95%
Energy recovery	194	5%
Total (resource recovery)	4,244	-

Market value of resource recovery

The total value of resource recovery in SA in 2022-23 is estimated at about \$811 million.

The top 3 contributors were:

- Scrap metals (\$465 million)
- Recovered organics (\$249 million), particularly meat rendering products such as tallow
- Scrap plastics (\$37 million).

2.2 Performance against state targets

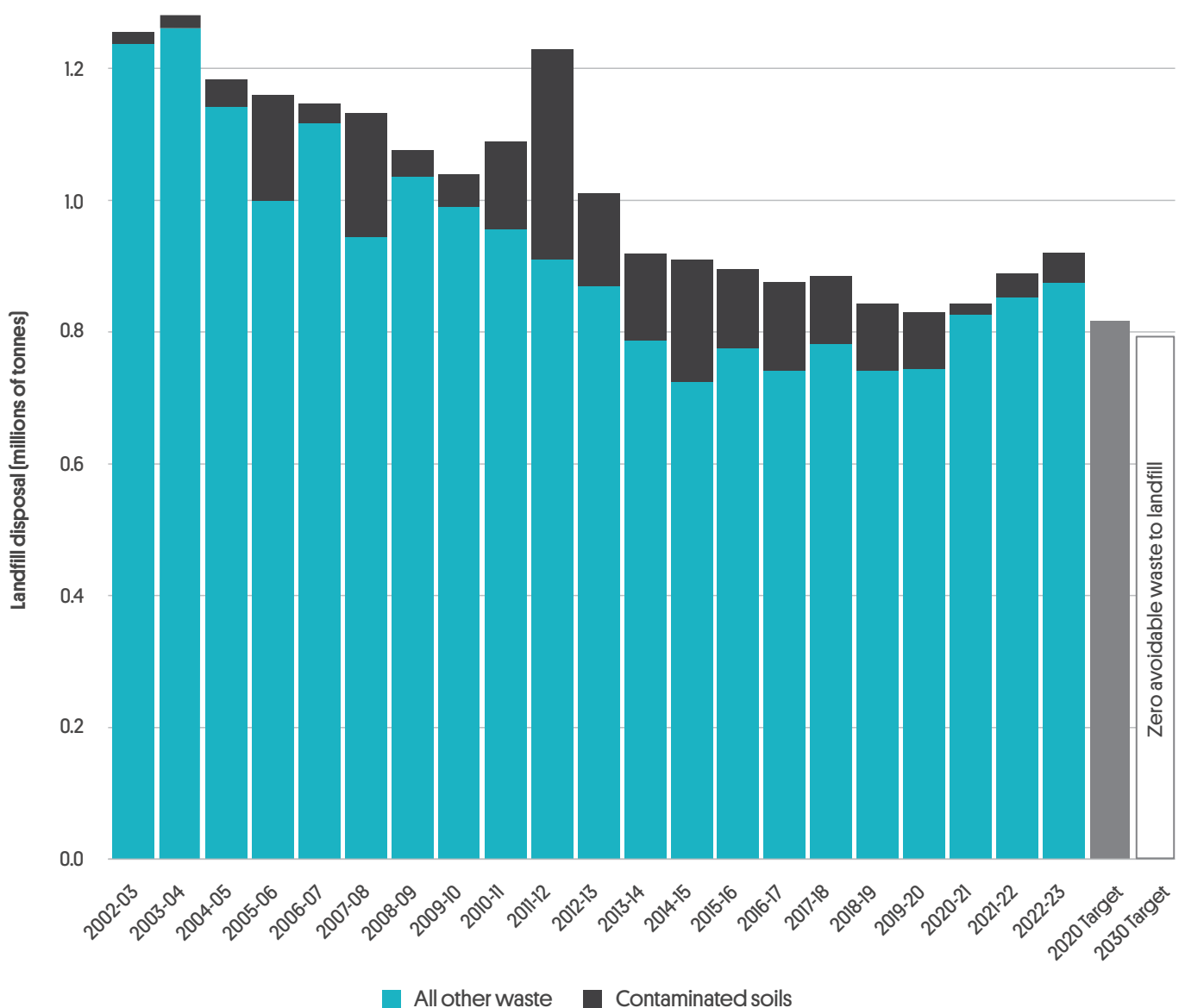
Landfill diversion target

South Australia's Waste Strategy 2020-25 sets out a goal for zero avoidable waste to landfill by 2030. The State disposed of about 914,000 tonnes of waste to landfill in 2022-23, an increase from 885,000 tonnes in 2021-22, 840,000 tonnes in 2020-21 and 827,000 tonnes in 2019-20. A range of actions will need to be implemented to achieve SA's ambitious landfill target for 2030.

Figure 12 shows SA's landfill disposal trend since 2002-03.

SA had a 2020 target for reducing waste to landfill by 35% from a 2002-03 baseline. The landfill quantities in 2022-23 are equivalent to a reduction of 27% against the 2002-03 levels.

Figure 9 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 5% reduction in waste generation per capita from a 2019-20 baseline. Table 6 summarises a five-year trend in waste generation per capita for all reported materials. Waste generation per capita rose by 106 kilograms (4%) in 2022-23 compared to 2021-22 and declined by 0.5% since 2019-20.

Table 6 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	2022-23	Change (%)	Target
							21-22 to 22-23	2025
Waste generation per capita [kg/person/yr]	3,090	2,960	2,800	2,844	2,679	2,785	4.0%	5% reduction from 2020 baseline

Metropolitan diversion target

SA has established targets for waste diversion from landfill from its metropolitan region by source stream. The Metropolitan Adelaide goal for 2023 is 65% diversion for MSW, 85% diversion for C&I, and 90% diversion for C&D. Table 7 presents the diversion rate achieved in metropolitan SA in 2022-23, together with State targets for 2023 and 2025.

In 2022-23, the metropolitan area C&D recovery rate was 97.4%, C&I source stream recovery rate was 75.6%, and the MSW recovery rate was 61.7%. In contrast, in 2021-22, the C&I recovery rate was 88.2%, the C&D recovery rate was 87.2%, and the MSW recovery rate was 55.9%. The significant variation between 2022-23 and 2021-22 is primarily due to a change in the way the source streams of waste to landfill were assessed.

Table 7 Metropolitan diversion rate for SA in 2022-23, including state targets to 2025

Source sector	2022-23 diversion rate	Metropolitan diversion target	
		2023	2025
MSW	61.7%	65%	75%
C&I	75.6%	85%	90%
C&D	97.4%	90%	95%

2.3 Local government recovery

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

About 697,000 tonnes of kerbside materials were collected at kerbside, 535,000 tonnes from the metro area and 162,000 tonnes from regional areas.

Overall kerbside collections

Table 8 shows data on materials collected in household residual, recycling and organics bins at kerbside in SA in 2021-22. About 697,000 tonnes of kerbside materials were collected in SA, of which 535,000 tonnes were from the metro region and 162,000 tonnes were from regional areas. This was very similar to last year. Most kerbside waste was collected in residual bins (340,000 tonnes), followed by organics bins (228,000 tonnes), and recycling bins (129,000 tonnes).

SA's recovery rate for kerbside waste in 2022-23 was an estimated 51.2%, slightly higher than the previous year's rate of 49%. Recovery was higher for metropolitan councils (53.6%) than regional councils (43.6%). Compared to the previous year, performance in 2022-23 was slightly improved for both metropolitan and regional SA.

Table 8 Materials collected from households at kerbside in SA in 2022-23

Region	Collected at kerbside (tonnes)				Recovery rate (%)	Change
	Residual	Recycling	Organics	Total		
Metro	248,000	100,000	187,000	535,000	53.6%	▲
Regional	91,000	30,000	41,000	162,000	43.6%	▲
SA	340,000	129,000	228,000	697,000	51.2%	▲

Coverage

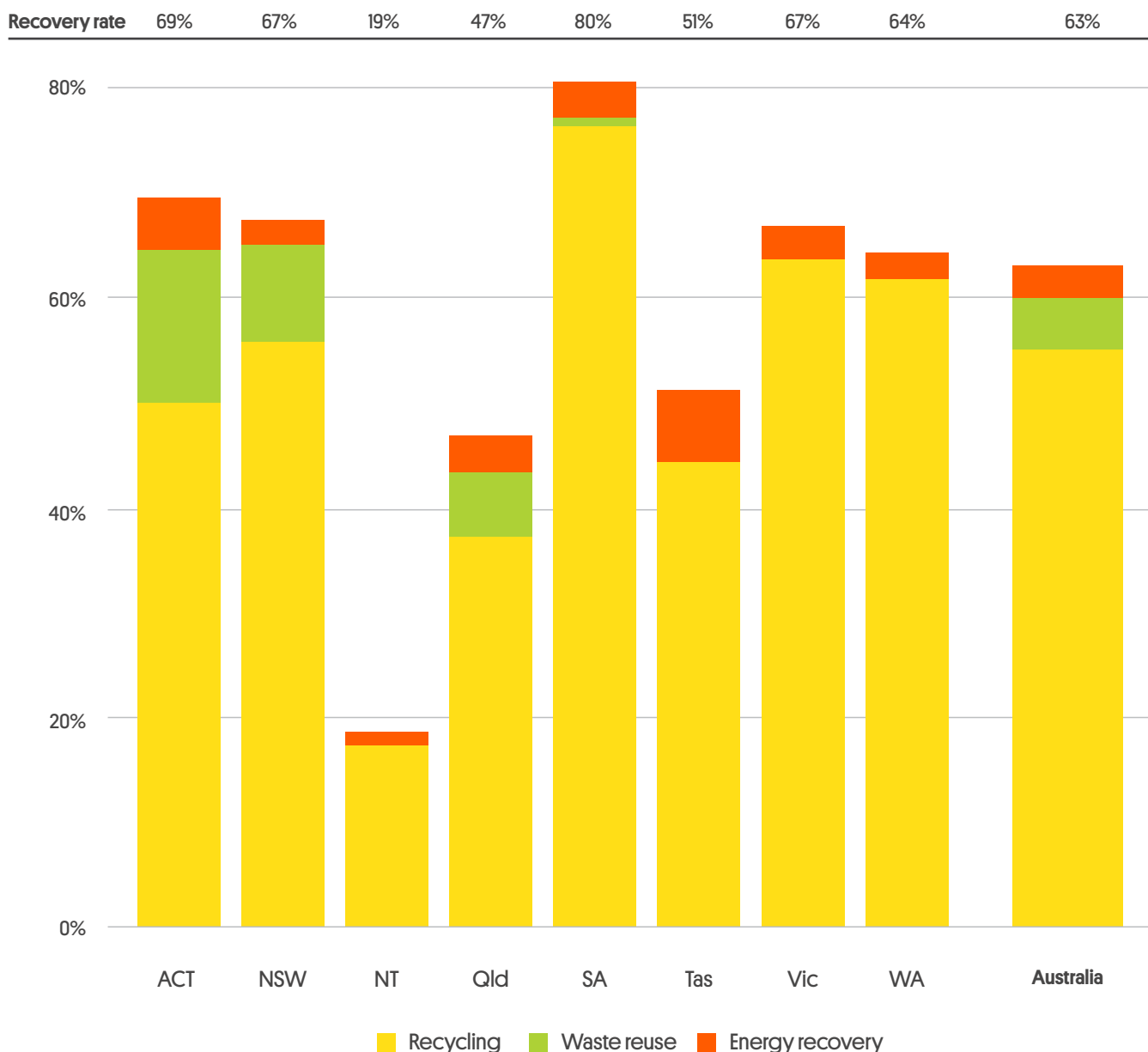
In SA 99% of households live in a council area providing a residual waste service, 97% have a recycling service and 91% have an organics service. In metropolitan Adelaide, about 94% of household have a 3-bin system.

2.4 Comparative performance with other jurisdictions

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

Figure 10 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 recovery rate of 80%.⁴ The next highest rate was ACT at 69% and NSW and Vic at 67%. Overall, Australia achieved a recovery rate of 63% in 2020-21.

Figure 10 Resource recovery and recycling rates by jurisdiction, 2020-21



Source: National Waste Report 2022 [Blue Environment 2022]

⁴ This differs from the value reported in the CERRR 2020-21 due to differences in method.



2.5 Reuse and the circular economy

Reuse

Reuse is the reallocation of products or materials to a new owner or purpose without reprocessing or remanufacture. This promotes the cycling of material without the need to consume new resources. Longstanding reuse networks include charities, non-government organisations, community groups and online trading platforms (e.g. Gumtree). Items and products commonly recirculated include clothing, food, home furniture, whitegoods, vehicles and electronics.

Reusing clothes instead of landfilling them reduces 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. Nationally, the charitable recovered clothing industry provides 5,300 jobs and volunteer places for 35,000 people again promoting the economic value in reuse practices.

Some items excluded would contribute significant volumes to overall reuse in SA but are difficult to measure. The quantities and estimated values represent only a portion of reuse in SA and so highlights the importance of the reuse economy from environmental and economic standpoints.

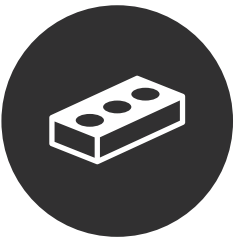
Table 9 Reuse in SA in 2022-23 based on survey results

Reuse material	Tonnes	Estimated value of reuse material (\$/tonne)	Estimated value of reuse materials in SA (\$m/yr)
Food rescue	3,900	\$6,000	\$23.6
Clothing	3,100	\$1,700	\$5.3
Home furnishings and goods	1,900	\$15,000	\$28.7
Books	500	\$1,000	\$0.5
Electrical goods	200	\$11,800	\$2.0



3

Material resource recovery reports



3.1 Masonry

About 2.29 million tonnes of masonry was recovered in SA in 2022-23 which is an increase from 2021-22 [2.03 million tonnes]. The masonry recovery figures are significantly affected by a small number of recycler returns with data quality issues, therefore there may be some variation between calculated recovery and actual recovery, especially for bricks.

Clay, fines, rubble and soil contributed the greatest proportion of reported masonry materials [46%] and made up a larger share of the total masonry recovered than in 2021-22 when it was about 30%. Concrete was the next largest contributor [44%], followed by asphalt [9%], bricks [1%] and plasterboard [<1%]. The quantity of bricks reported recovered was significantly lower than what was reported in 2021-22.

Table 10 Masonry recovered, SA, 2022-23

Material type	Net recovery ('000 t)	Emissions saved '000 tonnes CO ₂ -e	Energy saved TJ LHV	Water saved ML
Asphalt	208	6	494	183
Bricks	16	0	4	20
Concrete	1,005	20	352	1,286
Plasterboard	2	0	1	0
Clay, fines, rubble and soil	1,064	94	1,512	468
Total	2,290	120	2,360	1,960

Figure 11 Masonry recovered since 2003-04 – concrete and clay, fines, rubble and soil

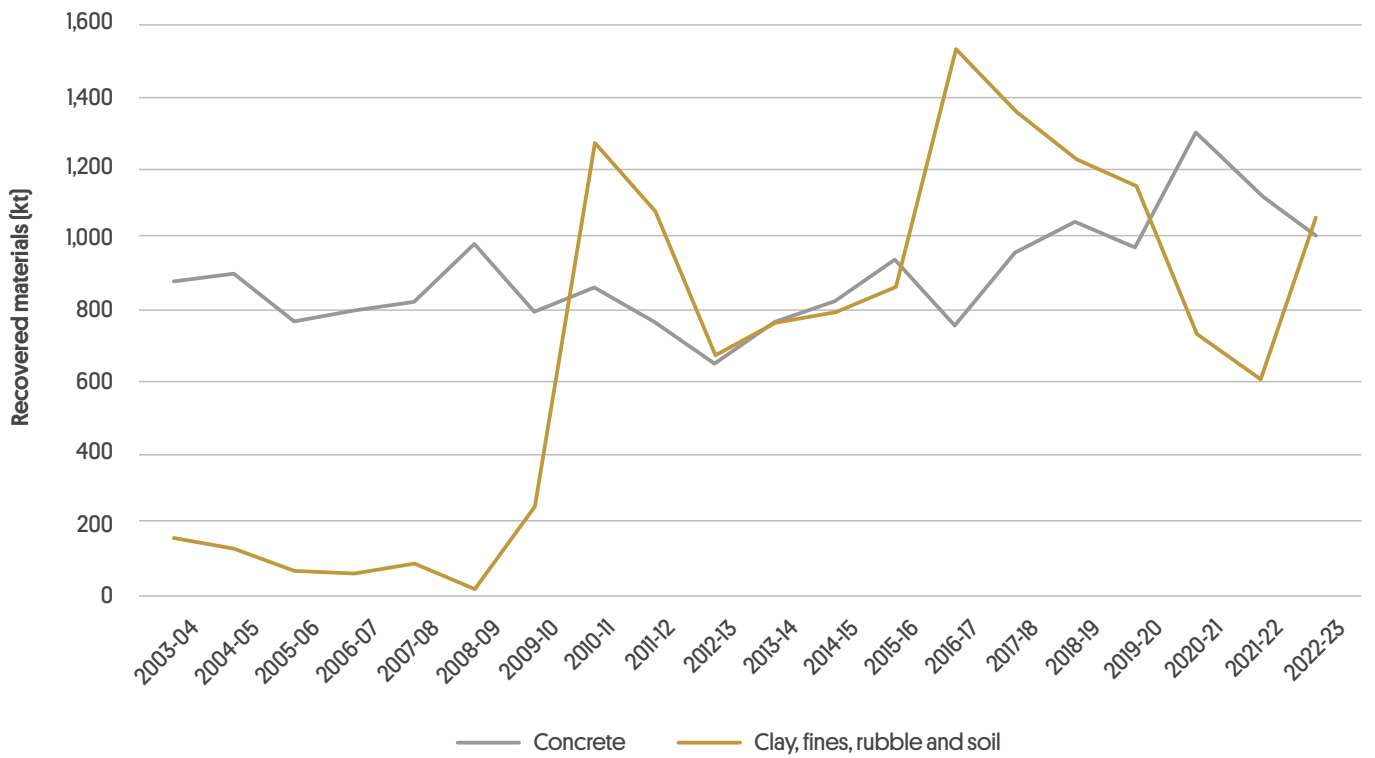
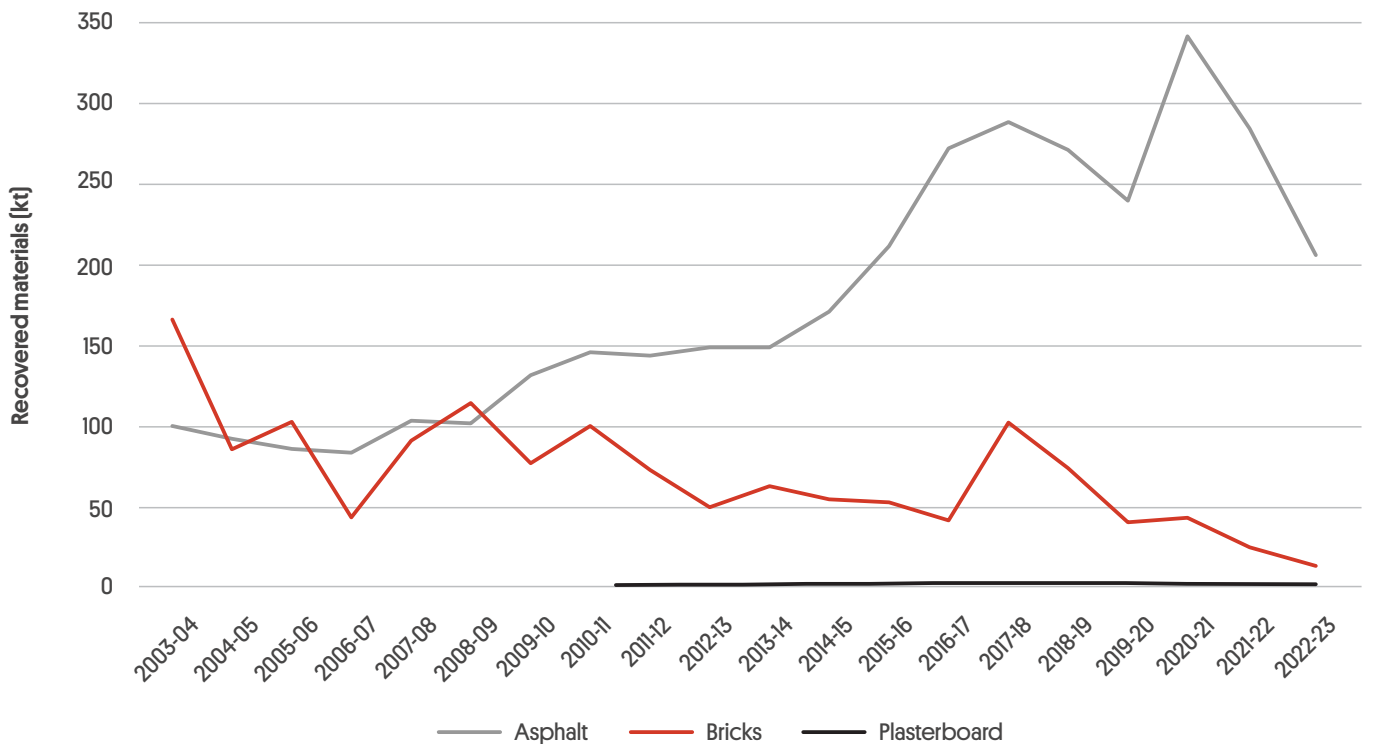


Figure 12 Masonry recovered since 2003-04 – asphalt, bricks and plasterboard





3.2 Metals

Recovery of scrap metals increased in the 2022-23 financial year to about 507,000 tonnes, compared to the previous year's 329,000 tonnes. Recovered metals were mostly iron and steel (433,000 tonnes), followed by aluminium (41,000 tonnes), non-ferrous metals [excluding aluminium and copper] (18,000 tonnes), copper (15,000 tonnes) and mixed metals (<1,000 tonnes).

Table 11 Metals recovered, SA, 2022-23

Material type	Net recovery ('000 t)	Emissions saved '000 tonnes CO ₂ -e	Energy saved TJ LHV	Water saved ML
Iron and steel	433	191	3,244	-1,022
Aluminium	41	680	8,427	1,196
Non-ferrous metals	33	29	1,190	197
Copper	15			
Other Non-ferrous	18			
Mixed metals	<1			
Total	507	900	12,900	400

Figure 13 Metals recovered since 2003-04 – iron and steel

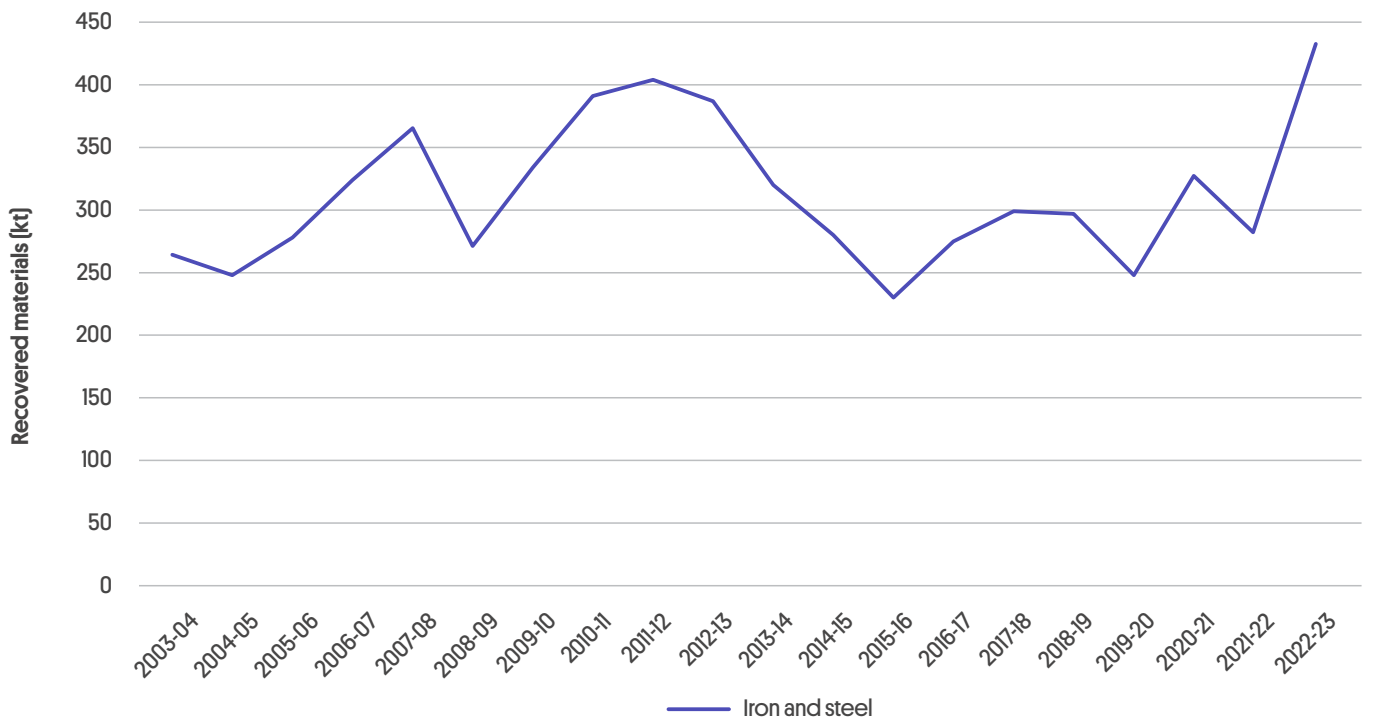


Figure 14 Metals recovered since 2003-04 – aluminium and other non-ferrous metals





3.3 Organics

Organics recovery remained strong in 2022-23, with almost 1.1 million tonnes of organic materials recovered. ‘Other organics’ contributed most to the overall organics recovery [59%, 651,000 tonnes]. About 332,000 tonnes of garden organics were recovered contributing about 30% towards overall organics recovery.

Reported timber recovery declined strongly to 68,000 tonnes [6% of total organics recovery]. Food organics recovery tripled to 47,000 tonnes [4%].

About 204,000 tonnes of food organics and garden organics were reported as ‘mixed food organics and garden organics’ or ‘FOGO’. Growing numbers of councils in both metropolitan and regional SA are offering kerbside FOGO trials and services. FOGO has been allocated across the food organics and garden organics in Table 24 in the assumed ratio 19% food organics and 81% garden organics.

Table 12 Organics recovered, SA, 2022-23

Material type	Net recovery ('000 t)	Emissions saved ‘000 tonnes CO ₂ -e	Energy saved TJ LHV	Water saved ML
Food organics	47	27	8	21
Garden organics	332	222	103	1,854
Timber	68	5	325	-1
Other organics	651	313	1,409	150
Meat rendering	221			
Waste grease and fat	82			
Waste sludge and biosolids	132			
Organics – other	216			
Total	1,097	567	1,845	2,024

Figure 15 Organics recovered since 2003-04

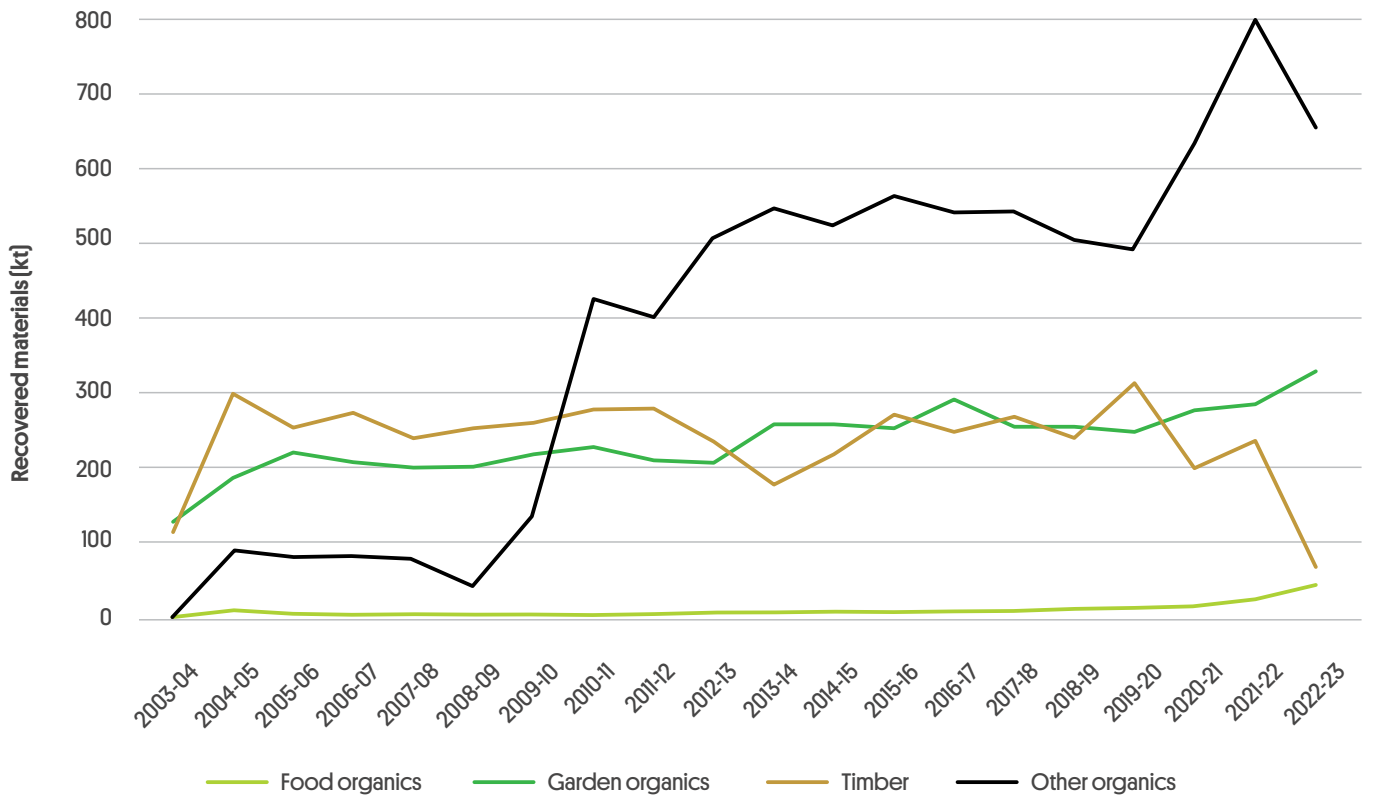
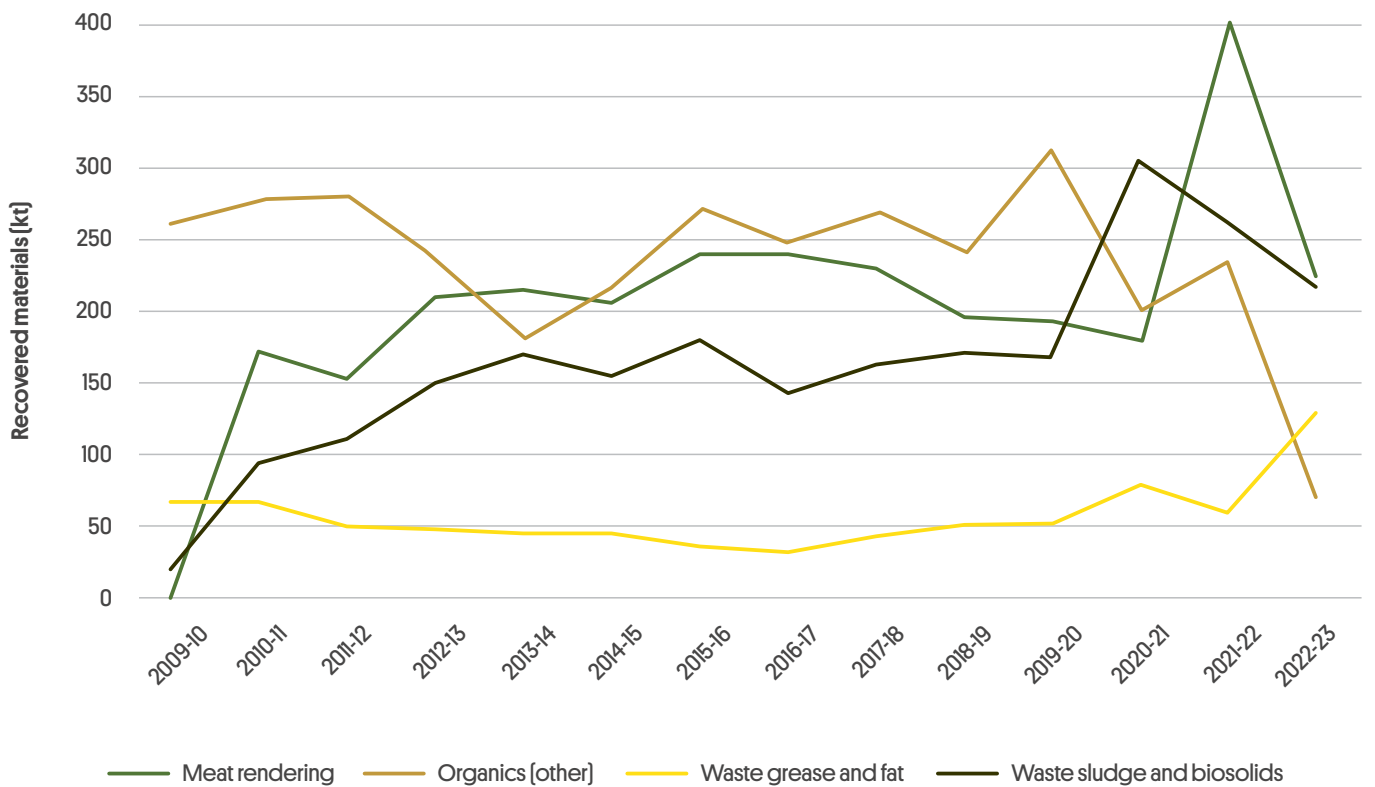


Figure 16 Other organics recovered since 2009-10





3.4 Cardboard and paper

Recovery of scrap cardboard and paper rose slightly with about 216,000 tonnes of cardboard and paper recovered in SA. Cardboard and waxed cardboard accounted for 106,000 tonnes, magazines and newsprint 75,000 tonnes and printing and writing paper totalled 35,000 tonnes. A small amount of liquid paperboard was recovered (486 tonnes).

Table 13 Cardboard and paper recovered, SA, 2022-23

Material type	Net recovery ('000 t)	Emissions saved '000 tonnes CO ₂ -e	Energy saved TJ LHV	Water saved ML
Cardboard and waxed cardboard	106	5	12	297
Liquid paperboard	<1	<1	<1	<1
Magazines and newsprint	75	<1	<1	5
Printing and writing paper	35	5	-3	44
Total	216	10	10	346

Figure 17 Cardboard and paper recovered since 2003-04 – cardboard and waxed cardboard, magazines and newsprint and printing and writing paper

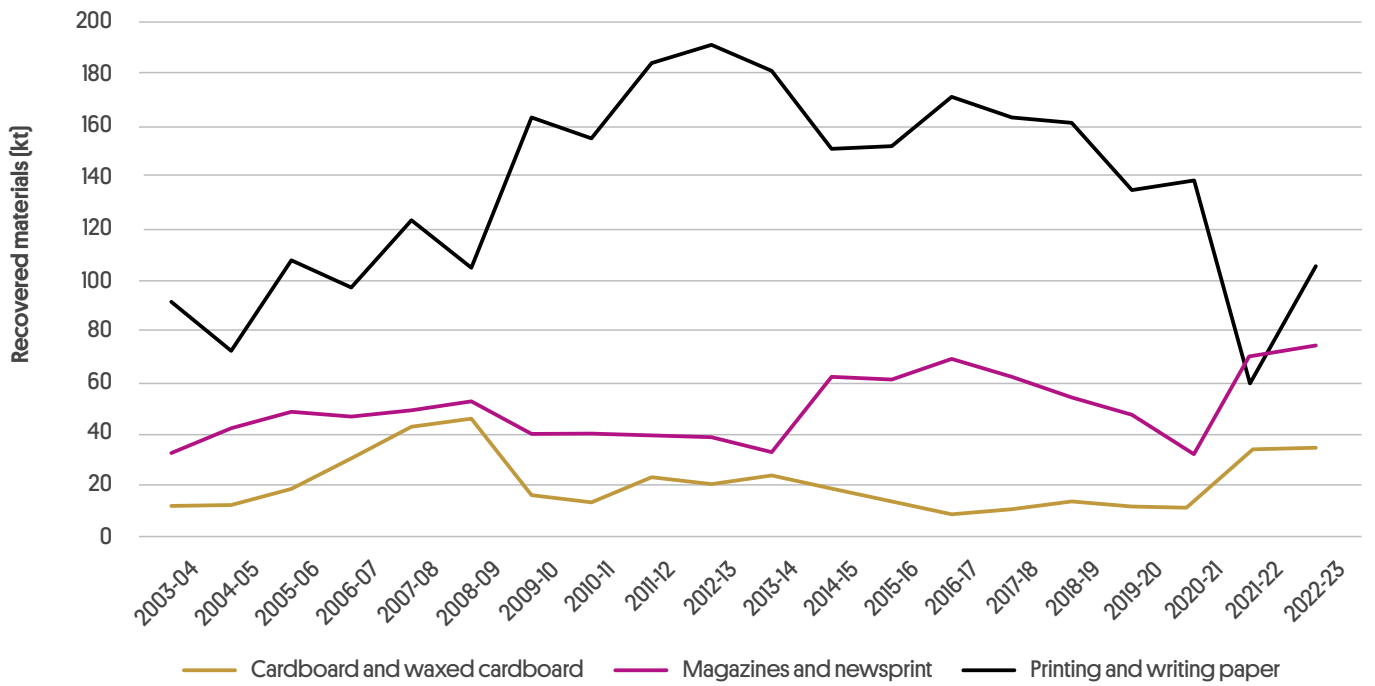
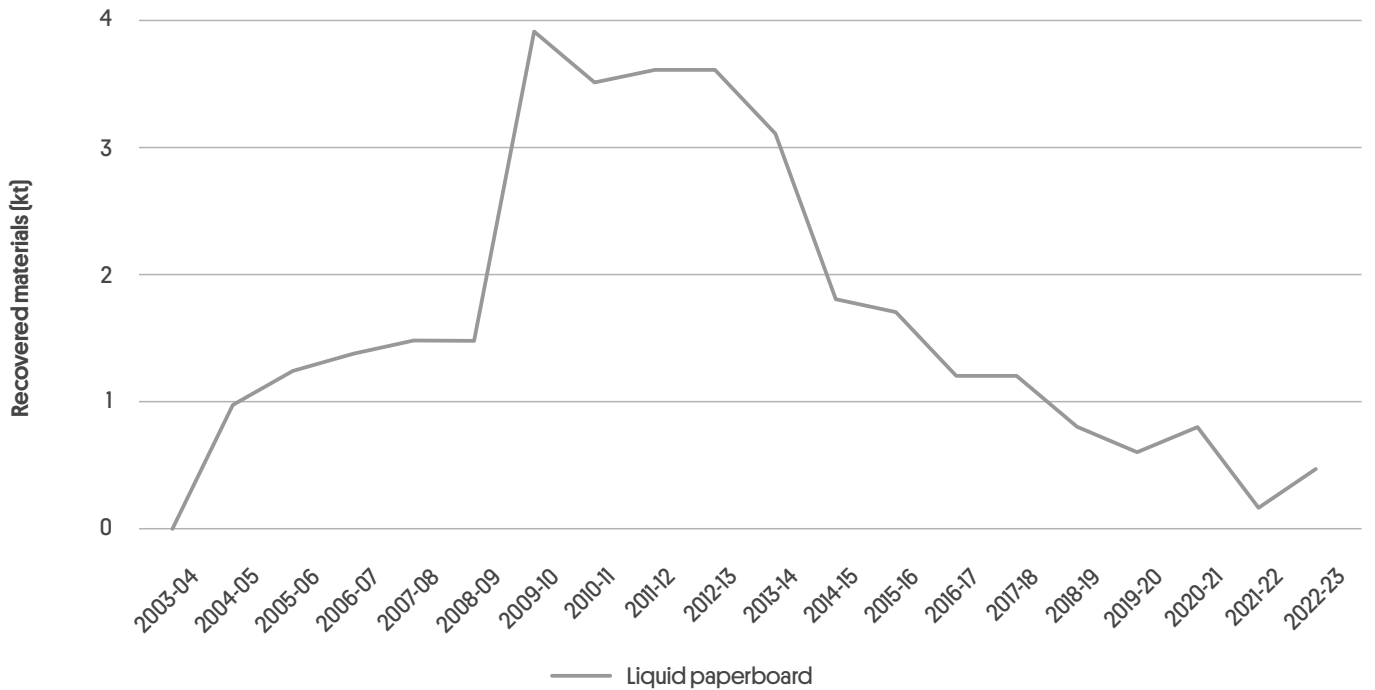


Figure 18 Cardboard and paper recovered since 2003-04 – liquid paperboard





3.5 Plastics

SA recovered 30,000 tonnes of plastics in 2022-23, a slight drop from the 33,000 tonnes recovered in 2021-22. Table 28 summarises 2022-23 plastics recovery and Figure 26, Figure 27 and Figure 28 show plastics recovery trends since 2003-04.

Mixed plastics recovery was about 1,000 tonnes in 2022-23 which is an increase from 2021-22. Recovery of individual polymer types was similar to 2021-22. The Australian Government’s ban on the export of mixed plastics was implemented in July 2021. Recovered plastics in 2022-23 were mostly HDPE [39%], PET [29%] and PP [16%].

Table 14 Plastics recovered, including energy recovery, SA, 2022-23

Material type	Net recovery ('000 tonnes)	Emissions saved '000 tonnes CO ₂ -e	Energy saved TJ LHV	Water saved ML
Polyethylene terephthalate	9	5	245	306
High density polyethylene	12	5	288	131
Polyvinyl chloride	<1	0	0	0
Low density polyethylene	2	<1	2	1
Polypropylene	5	1	75	66
Polystyrene	1	<1	10	9
Mixed and/or other plastics	1	<1	21	18
Total	30	10	600	500

Figure 19 Plastics recovered since 2003-04 – PET, HDPE, LDPE, PP and mixed and/or other plastics

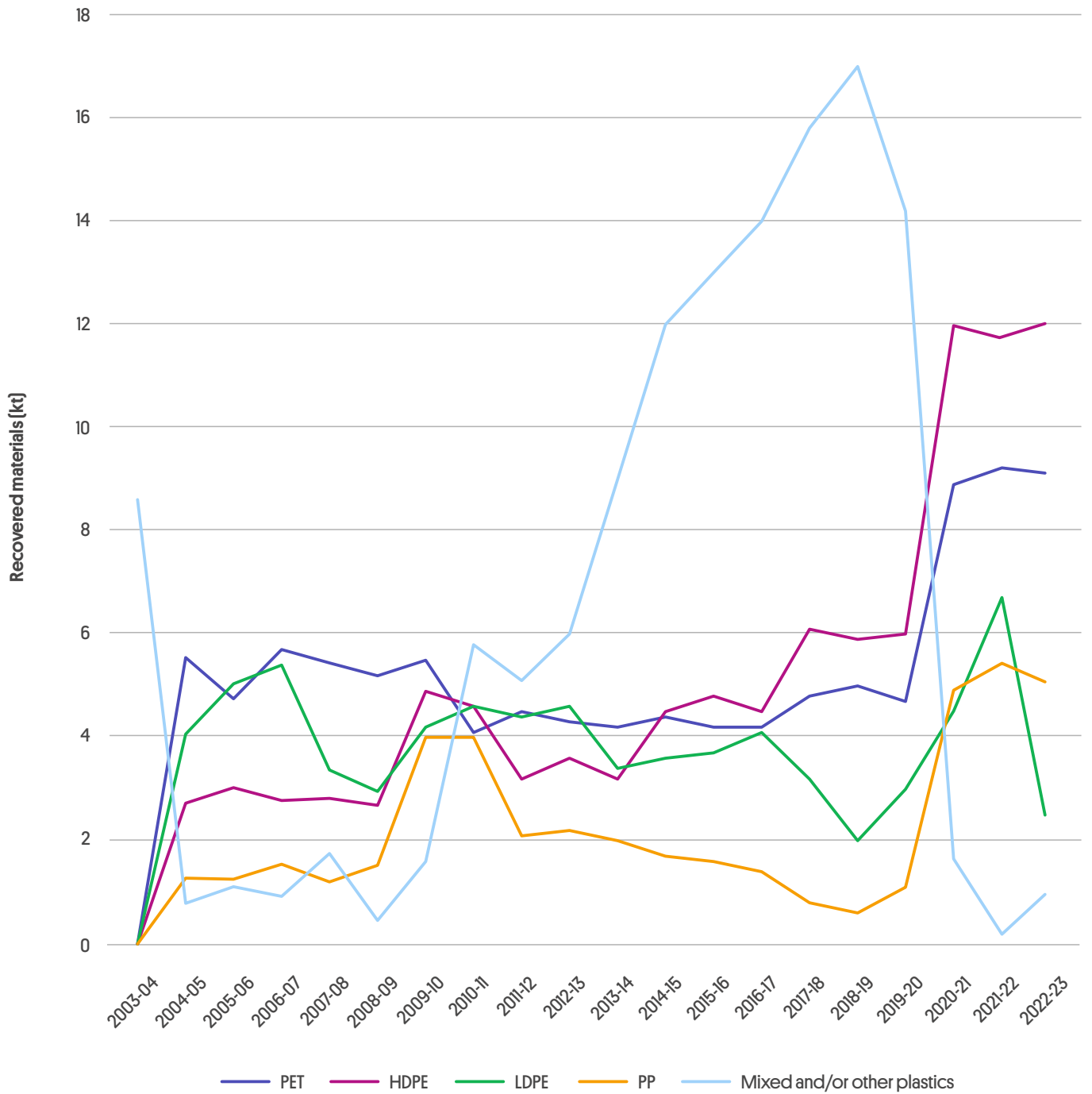
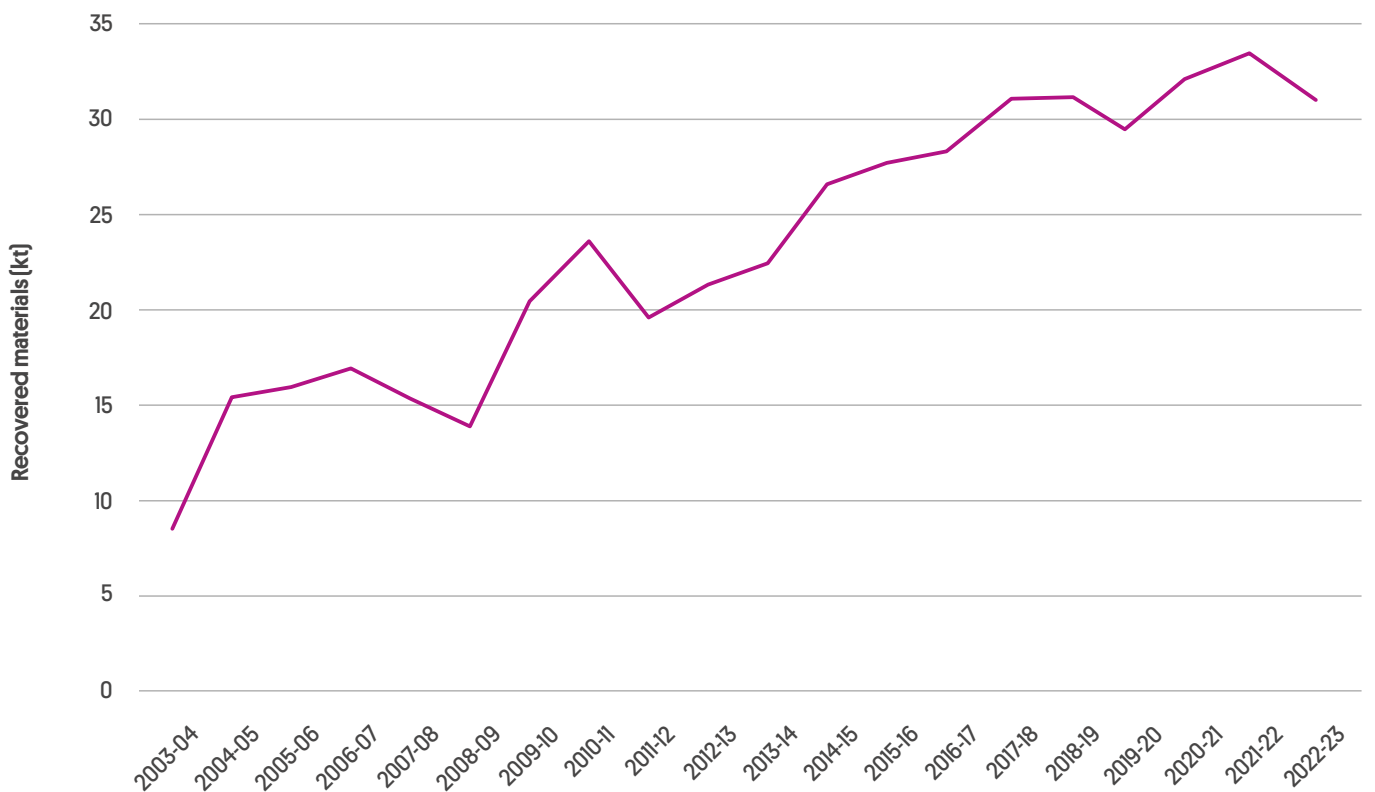


Figure 20 Plastics recovered since 2003-04 – PVC and PS



Figure 21 Plastics recovered since 2003-04 – all plastics







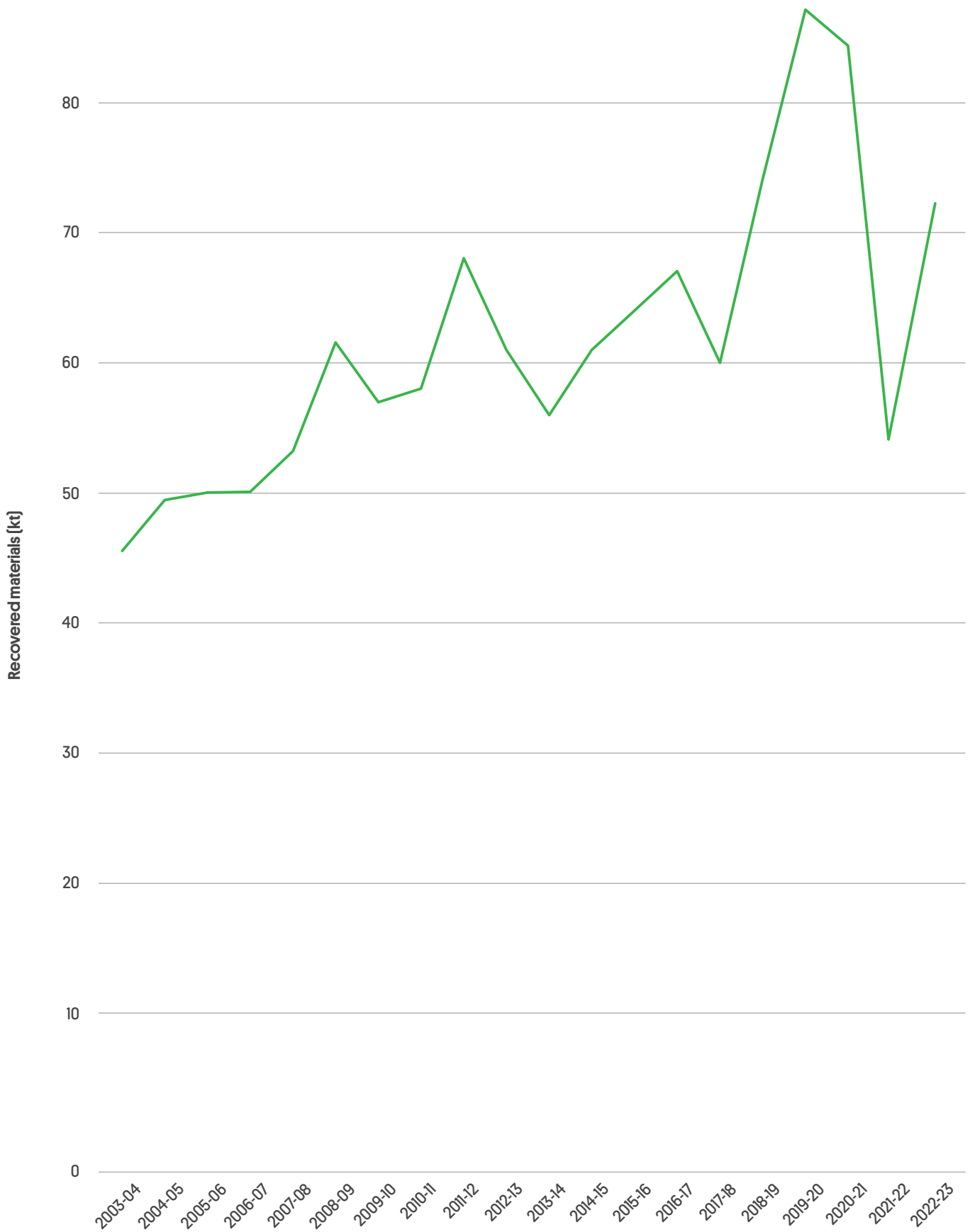
3.6 Glass

SA recovered about 74,000 tonnes of scrap glass in 2022-23. Recovered glass was mostly containers; 82% of overall volumes in 2022-23 was glass from food and beverage containers and 18% other glass.

Table 15 Glass recovered, SA, 2022-23

Material type	Net recovery ('000 tonnes)	Emissions saved '000 t CO ₂ -e	Energy saved TJ LHV	Water saved Megalitres
Glass from food and beverage containers	60			
Other glass	13			
Total	74	39	327	68

Figure 22 Glass recovered since 2003-04





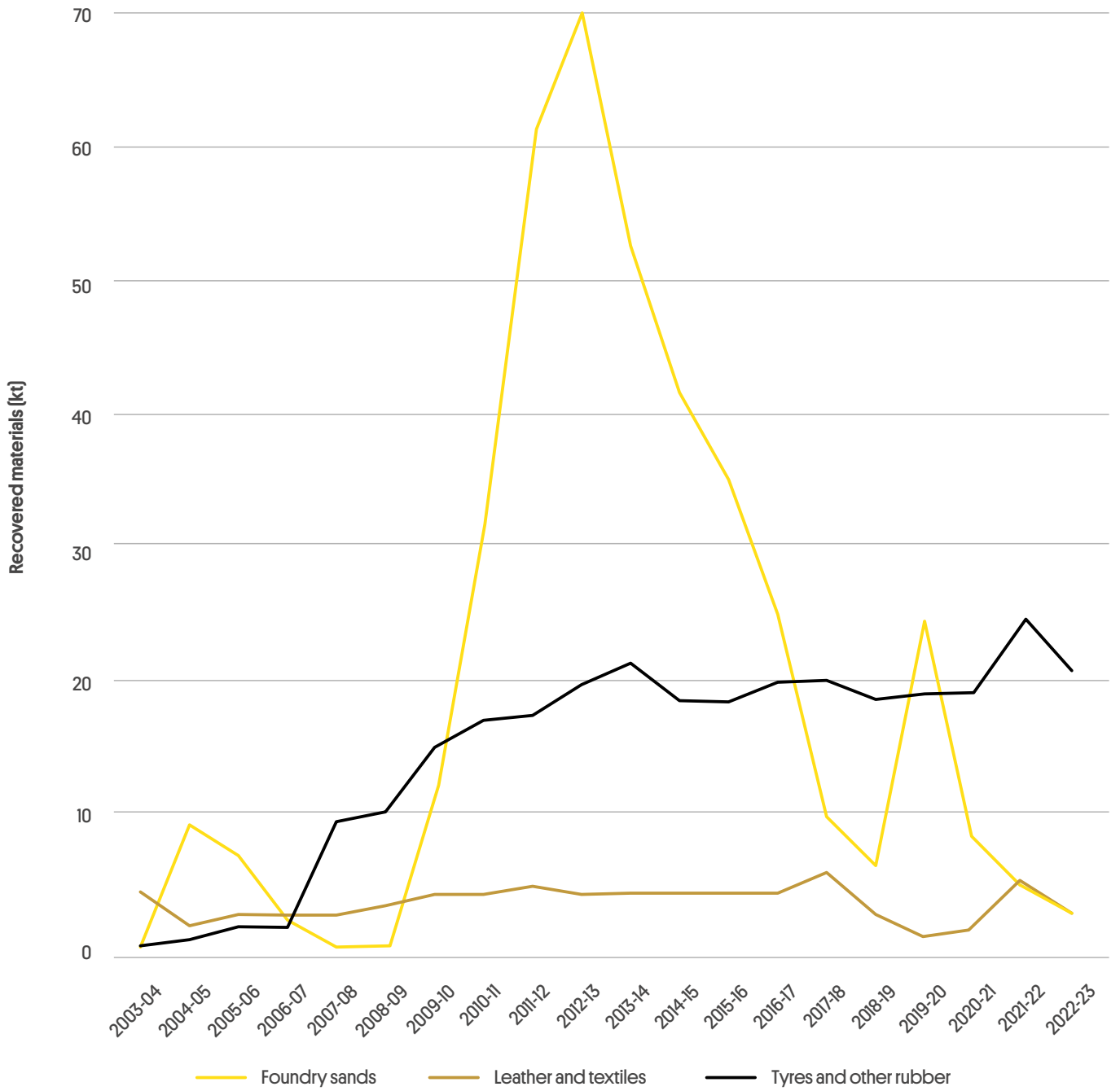
3.7 Other materials

The ‘other materials’ category includes fly ash, foundry sands, leather and textiles, and tyres and other rubber. Tyres and other rubber contributed the most to overall recovery in this category (80%). The combined recovery of these materials was about 26,000 tonnes, [34,000 tonnes in the previous year]. Minimal quantities of foundry sands have been recovered since 2019-20 and no fly ash since the closure of the Port Augusta Power Station. Leather and textiles recovery fell to 3,000 tonnes.

Table 16 Other materials recovered, SA, 2022-23

Material type	Net recovery ('000 tonnes)	Emissions saved '000 t CO ₂ -e	Energy saved Tj LHV	Water saved Megalitres
Fly ash	0			
Foundry sands	2			
Leather and textiles	3			
Tyres and other rubber	21	22	1,314	1,072
Total	26	22	1,314	1,072

Figure 23 Other materials recovered since 2003-04 – foundry sands, leather and textiles and tyres and other rubber



4

Material flow analyses

4.1 Introduction to material flow analysis

Material flow analysis (MFA) uses the principal of conservation of mass to analyse the physical flows of materials into, through and out of a given system. The materials covered in this section are metals, cardboard and paper, plastics, glass, textiles, and tyres.

The MFA diagrams portray materials flowing to and from processes within a system.

Table 17 Material flow analysis processes

Process	Definition
Atmosphere	Dispersal to the atmosphere.
Energy recovery	The process of recovering energy that is embodied in solid waste.
Environment	Dispersal to the open environment, and could also be termed 'leakage'. Examples include tyre dust from tyres and other microplastics dispersed directly to the open environment. Subsequent clean-up may occur for larger objects, e.g. litter, which would then typically be disposed to landfill. From the perspective of the MFA modelling, materials dispersed to the open environment, which are subsequently cleaned up, will be modelled as going directly to another fate, such as landfill or sorting, and not via the 'Environment' process.
Export	The downstream process of post-consumption materials going to export.
Import primary	The upstream process of incoming system materials from imported primary sources.
Import recycled	The upstream process of incoming system materials from imported recycled sources.
Landfill	Disposal of all materials to landfill. Includes onsite disposal.
Local primary	The upstream process of incoming system materials from local primary sources.
Manufacturing	All processes that transform materials into saleable products.
Open loop	The downstream process of materials going to other local material systems. From a reprocessing standpoint, this could be considered manufacture of new products different to those from which the recovered material was derived.
Reprocessing	All post-sorting processes that physically transform [i.e. reprocess] materials and products that are then [typically] input ready for the manufacture of new products.
Sorting	All post-use processes that sort/separate products into discrete material streams prior to processes that physically transform [i.e. reprocess] materials and products that are then [typically] input ready for the manufacture of new products.
Use	Use phase of the products containing the materials. Includes stocks of materials that are in use.

4.2 Material flow analyses results

The results of the MFA modelling are summarised in the following section, covering one material category (metals, cardboard and paper, plastics and glass) or material type (textiles and tyres).

Please note that the recovery quantities calculated via MFA may differ slightly from those presented in Section 2 and 3 above because they draw on estimates of material consumption and lifespans.

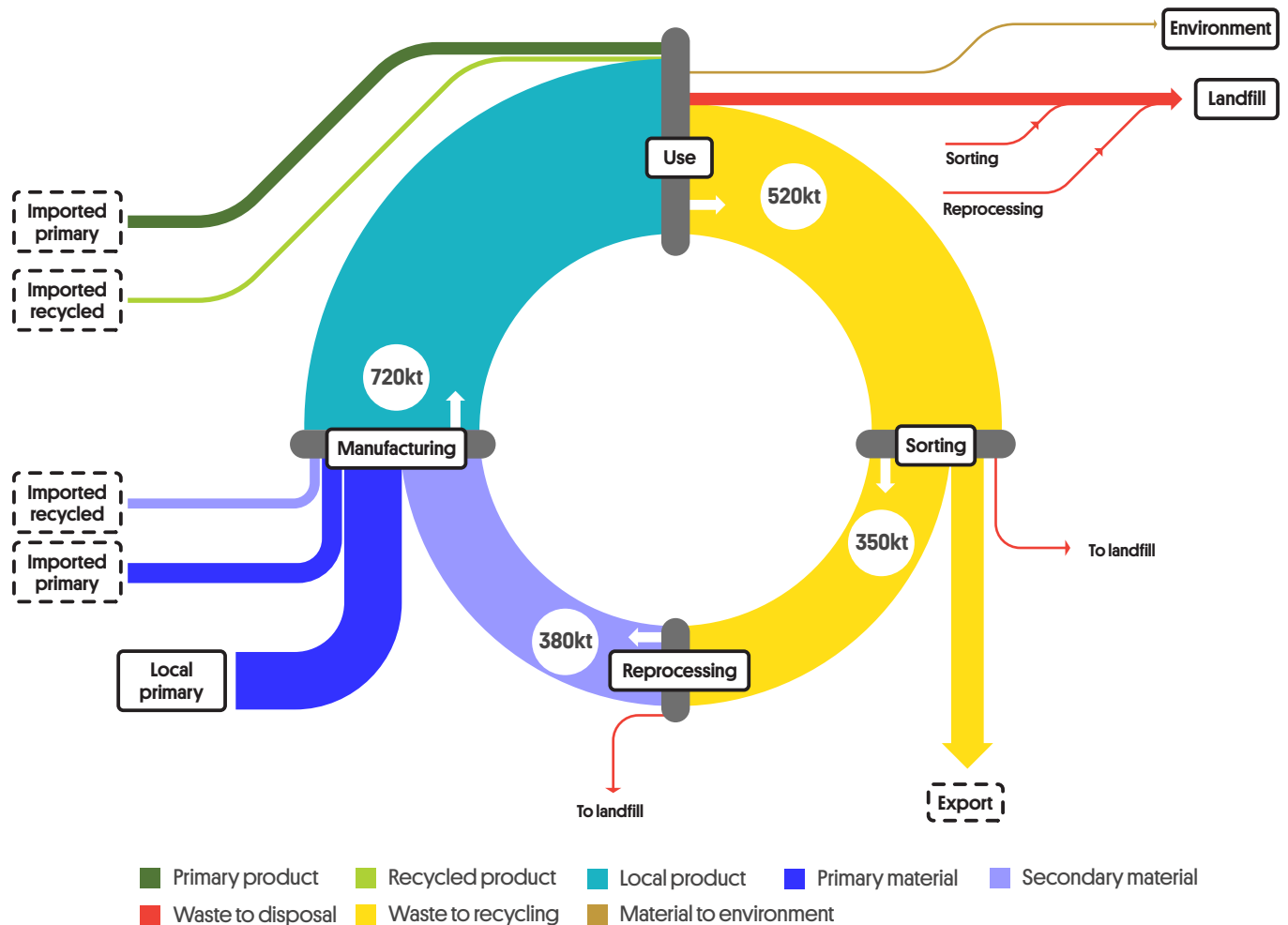
Metals

Metals are valuable and have well-established recycling systems, leading to correspondingly high recovery rates across Australia. 797,000 tonnes of metals was consumed in SA with 575,000 tonnes of metal wastes was generated, of which 505,000 tonnes was recovered. SA's metals recovery rate was estimated at 88%.

Metals recovery is supported by strong export markets and minor losses at sorting facilities and smelters. Metals had the highest estimated recycled content rate out of the modelled materials at about 56%.

Figure 24 Metals flows in SA, 2022-23

Metals flows in SA, 2022-23



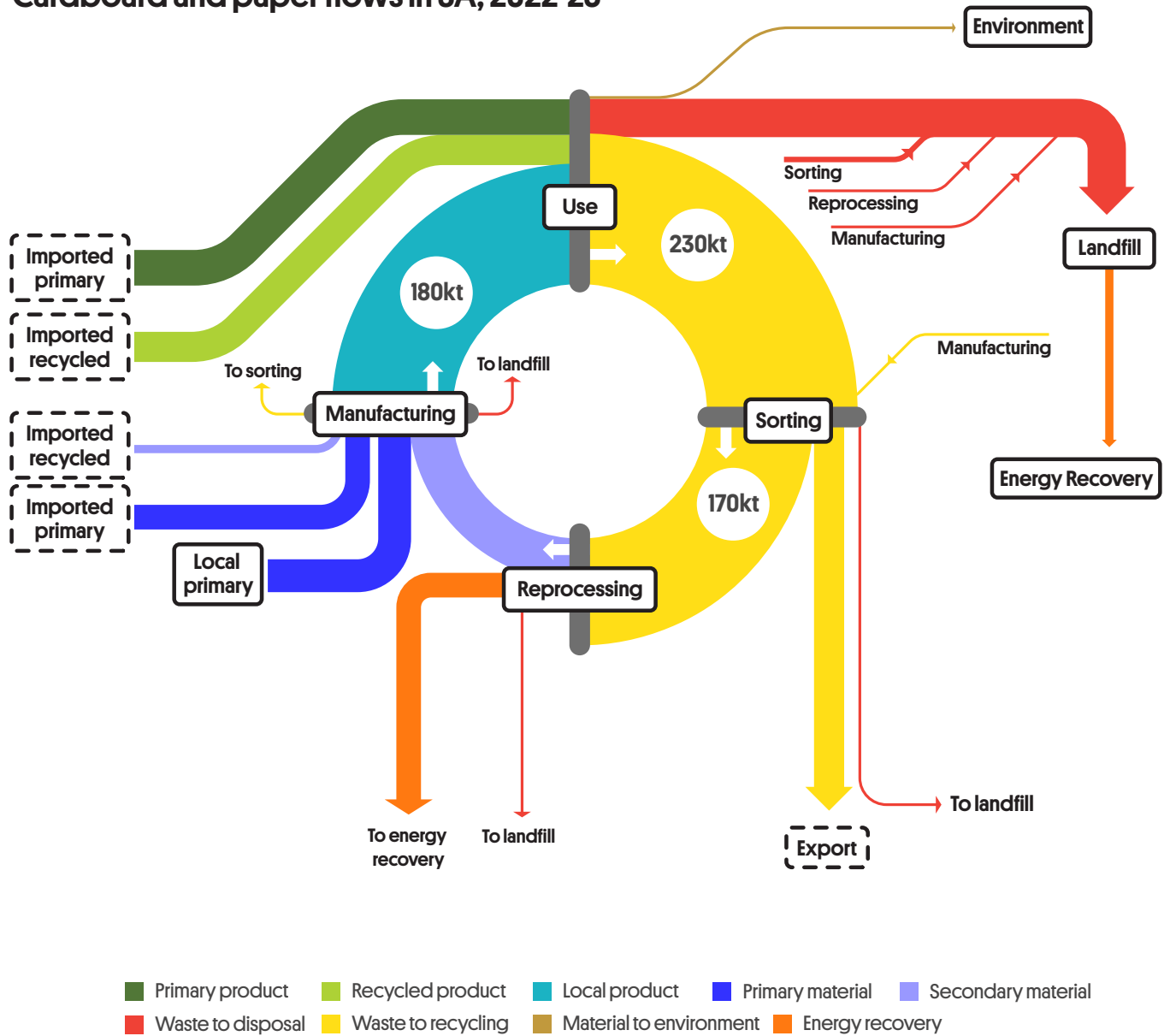
Paper and cardboard

294,000 tonnes of cardboard and paper was consumed in SA in 2022-23 of which about 216,000 tonnes, or 74%, was recovered. Recycling and energy recovery contributed similar proportions towards overall recovery.

Significant quantities [over 50,000 tonnes] of cardboard and paper were exported from SA for recovery in 2022-23.

Figure 25 Cardboard and paper flows in SA, 2022-23

Cardboard and paper flows in SA, 2022-23

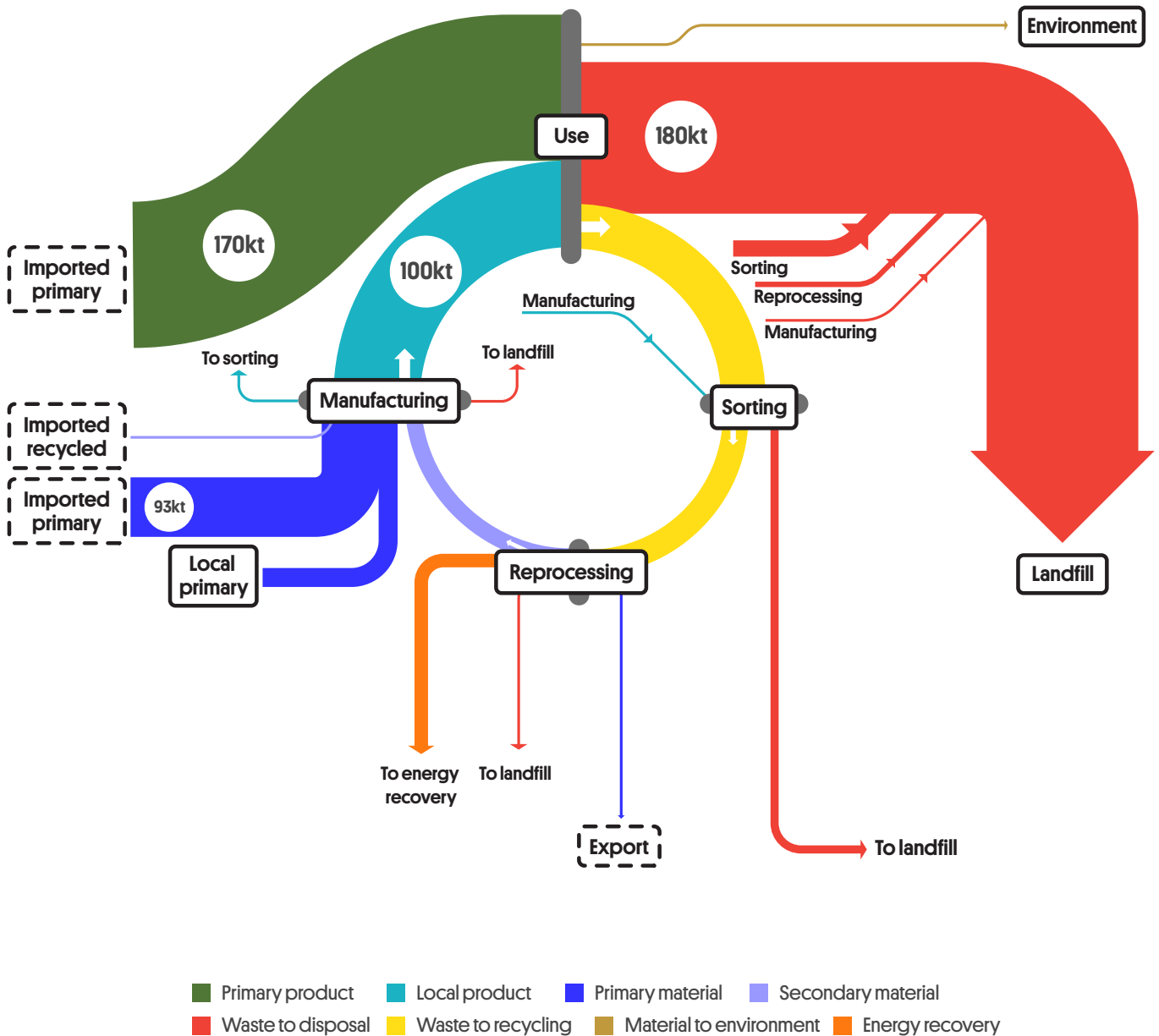


Plastics

About 30,000 tonnes of plastics were recovered and comprised 16,000 tonnes for energy recovery and 14,000 tonnes for recycling. The MFA shows that most plastic losses to landfill occur after the use stage. A high proportion of material goes from households or businesses to landfill. Losses also occur at sorting facilities.

Figure 26 Plastics flows in SA, 2022-23

Plastics flows in SA, 2022-23



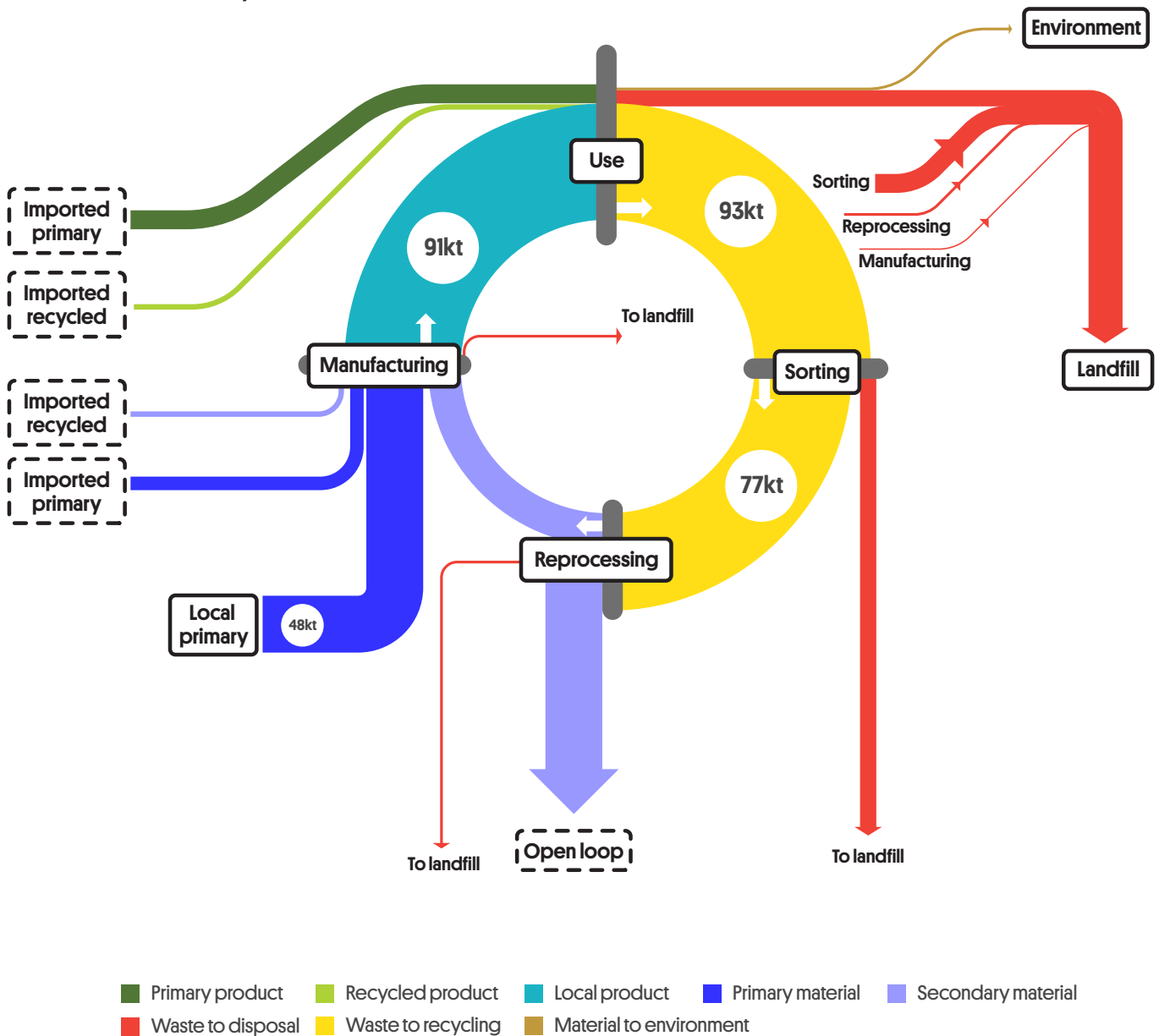
Glass

About 112,000 tonnes of glass was consumed in SA in 2022-23 with 109,000 tonnes of glass waste generated, of which about 74,000 tonnes, or 68%, was recovered. Glass recovery is supported by strong kerbside collection systems, container deposits and local container-to-container manufacturing. Glass breakages during sorting are a key contributor to landfilled quantities.

Glass waste exports across Australia effectively ceasing since restrictions came into effect in 2021.

Figure 27 Glass flows in SA, 2022-23

Glass flows in SA, 2022-23



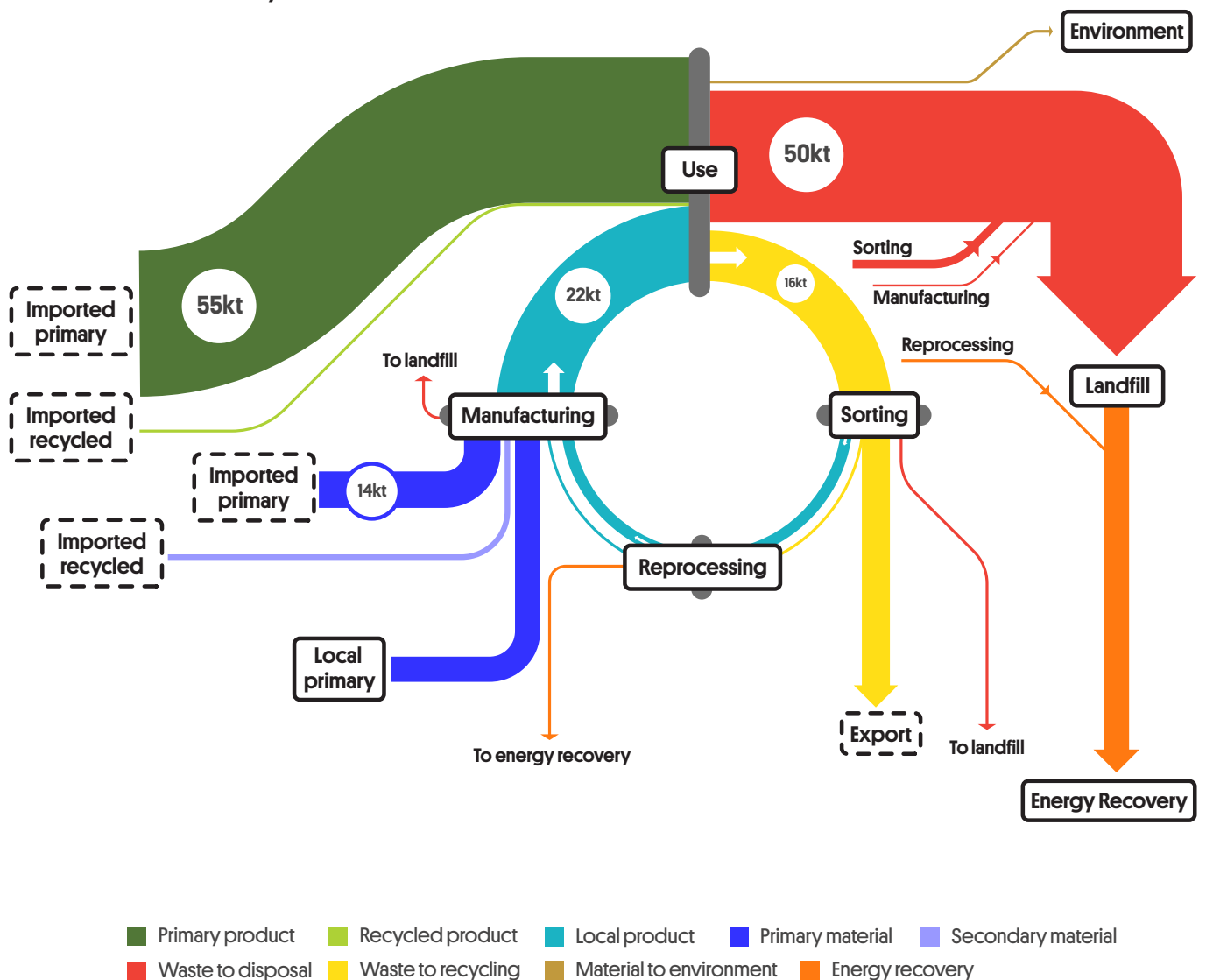
Textiles

About 68,000 tonnes of textile was consumed in SA in 2022-23, with 64,000 tonnes of textiles waste generated, of which about 10,000 tonnes of textiles was modelled as recovered. This is higher than recovery reported above as the MFA estimates for some local and international reuse of clothing and other textiles that may not have been captured via the survey or in exports data. Most recovered textiles were sent overseas for reuse or recycling. Less than 100 tonnes was recycled locally in 2022-23.

The figure below shows a local reuse flow from 'sorting' to 'use', which suggests about 3,400 tonnes of clothing and textiles were recirculated and reused in SA.

Figure 28 Textiles flows in SA, 2022-23

Textile flows in SA, 2022-23

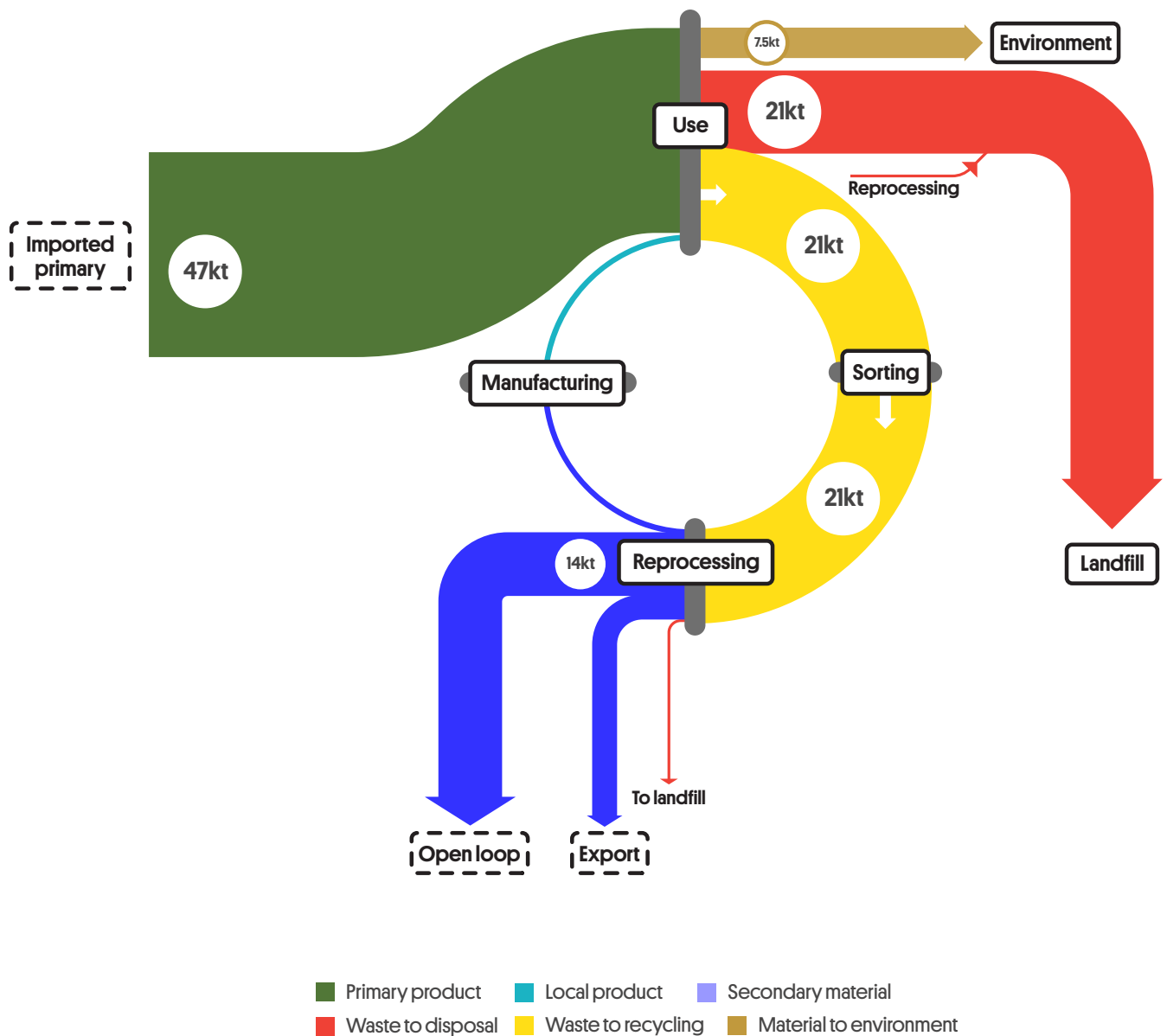


Tyres

About 48,000 tonnes of tyres was consumed in SA in 2022-23 with 46,000 tonnes of tyres reached end of life, of which 21,000 tonnes, or 45%, were recovered⁵. Tyres wear during use, producing a tyre dust flow from 'use' to 'environment'. About 25% of estimated tyre recovery was overseas.

Figure 29 Tyres flows in SA, 2022-23

Tyres flows in SA, 2022-23



⁵ Tyre recovery is underestimated because the ABS exports data excludes low value exports and some exporters use incorrect codes. The inclusion of tyre dust losses to the environment also reduces the recovery rate.



5

Electrical and electronic 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.

Reported e-waste recovery in SA increased 40% from 2021-22 to 8,220 tonnes. The quantity of batteries reported recovered greatly increased in 2022-23. The huge apparent change in the volume of printer cartridges recovered was due to new insights into the collection process of printer cartridges for recycling in SA from a major processor.



Table 18 Reported tonnes of e-waste, SA, 2022-23

E-waste type	2022-23 (tonnes)
Printer cartridges	980
Compact fluorescent lamps	0
Batteries	3,490
Computers	1,590
Televisions/monitors	1,830
Mobile phones	3.6
Other e-waste	330
Total	8,220

Figure 30 Reported e-waste recovered since 2009-10 (batteries, televisions and monitors, computers and other e waste)

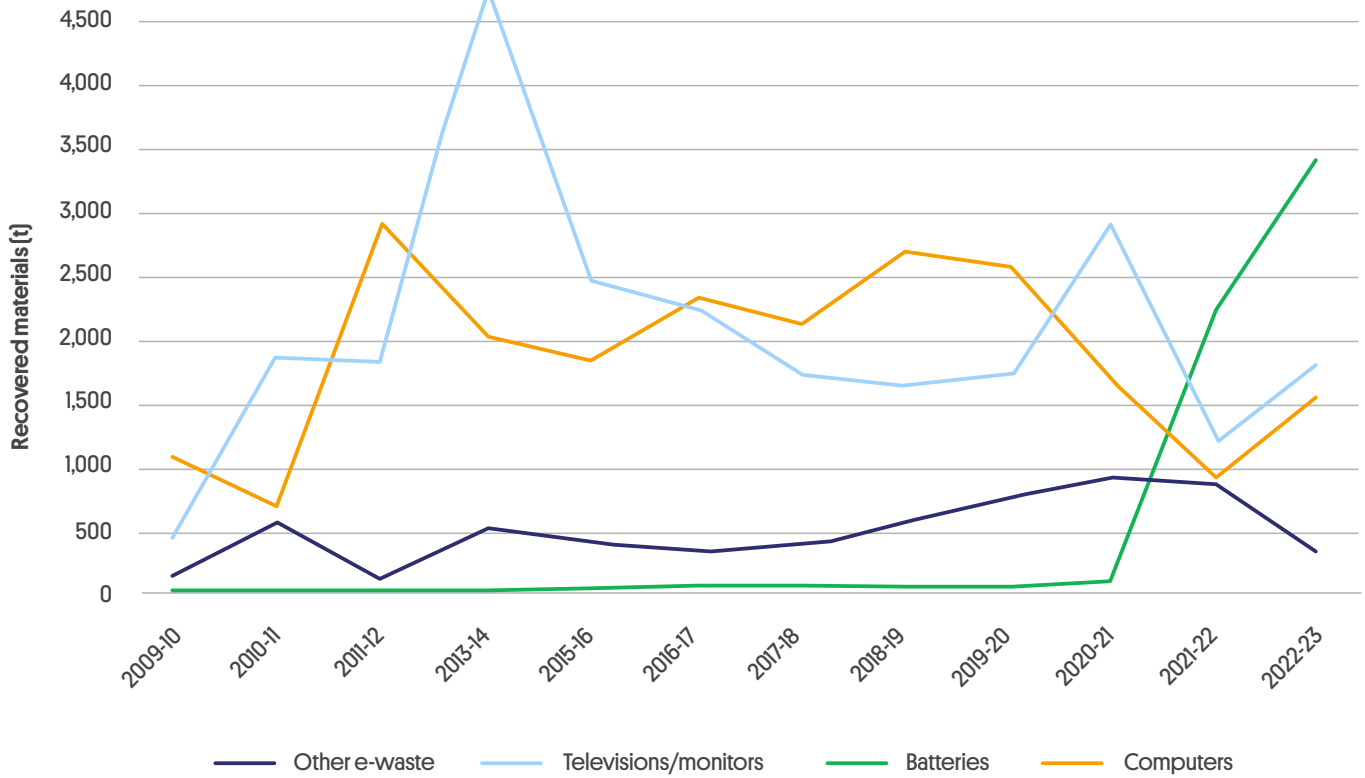
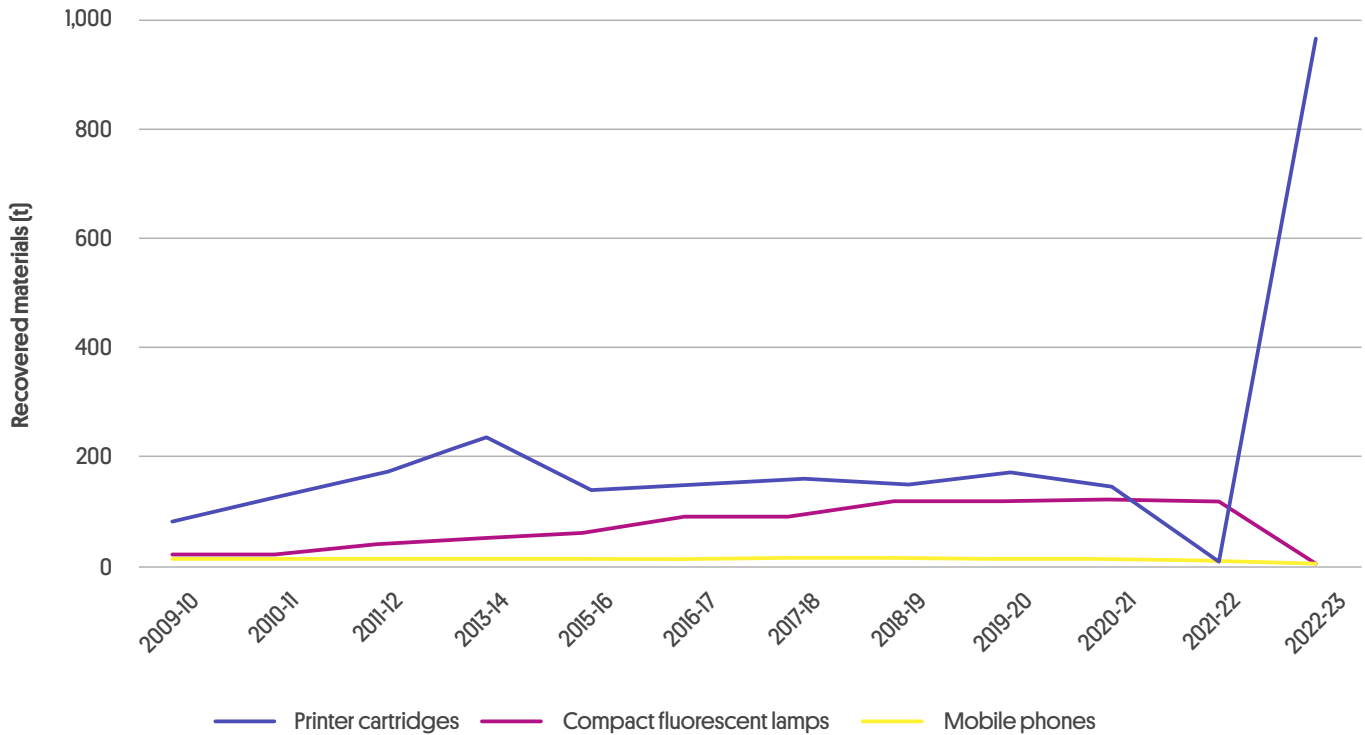


Figure 31 Reported e-waste recovered since 2009-10 (compact fluorescent lamps, printer cartridges and mobile phones)





ab

10

yo-yo
Lactose Free
kids

Muesli
PREMIUM
MILK

6

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 387,000 tonnes of packaging materials in 2022-23, comprising about 38,000 tonnes [10%] CDL materials and 348,000 tonnes [90%] non CDL materials.

Table 19 Estimated packaging recovered in SA in 2022-23 ('000 tonnes)

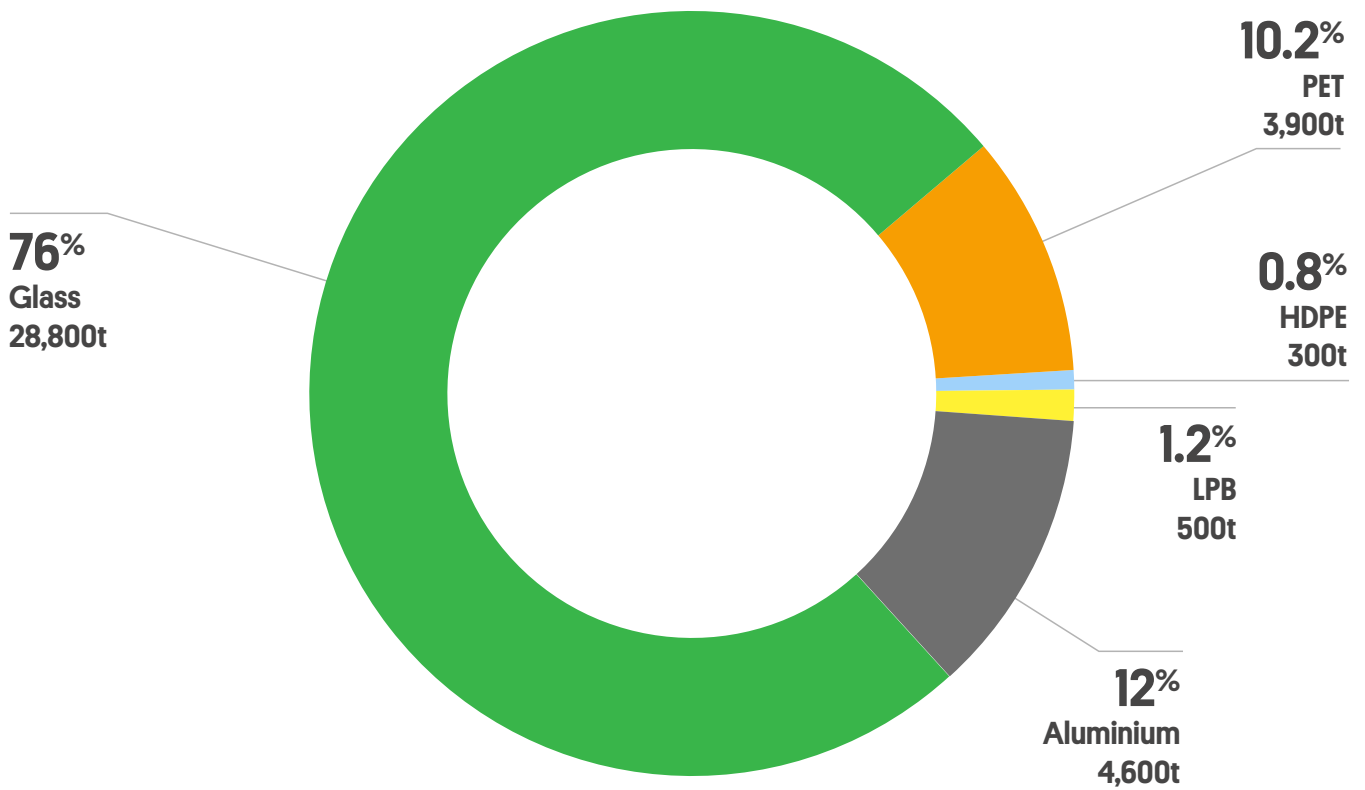
Packaging type	Recovered (tonnes)			Packaging as a proportion of total recovery
	CDL	Other	Total	
Aluminium cans	4.6	0.1	4.7	1%
Cardboard packaging	0.0	160.3	160.3	41%
Glass bottles and jars	28.8	128.1	156.9	41%
HDPE packaging	0.3	21.2	21.5	6%
LDPE packaging	0.0	5.1	5.1	1%
Liquid paperboard cartons	0.5	0.9	1.4	<1%
Other plastics packaging	0.0	0.0	0.0	0%
PET packaging	3.9	12.7	16.6	4%
Polypropylene packaging	0.0	14.2	14.2	4%
Polystyrene packaging	0.0	0.4	0.4	<1%
PVC packaging	0.0	0.0	0.0	0%
Steel cans	0.0	5.4	5.4	1%
Total	38.1	348.4	386.5	-

6.1 Container deposit legislation

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

South Australians returned about 38,000 tonnes of containers to CDL locations across the State with the bulk of these materials glass containers (28,800 tonnes, 76% by weight) of total CDL materials.

Figure 32 Relative proportions of returned container deposit legislation materials by weight, SA, 2022-23



The return rates for CDL were high for glass and aluminium at over 80%, while plastics packaging and liquid paperboard exhibited more moderate return rates. The return rates for aluminium, glass, PET and HDPE remained similar to return rates in the previous year.

Table 20 Return rates for SA's container deposit legislation materials in 2022-23

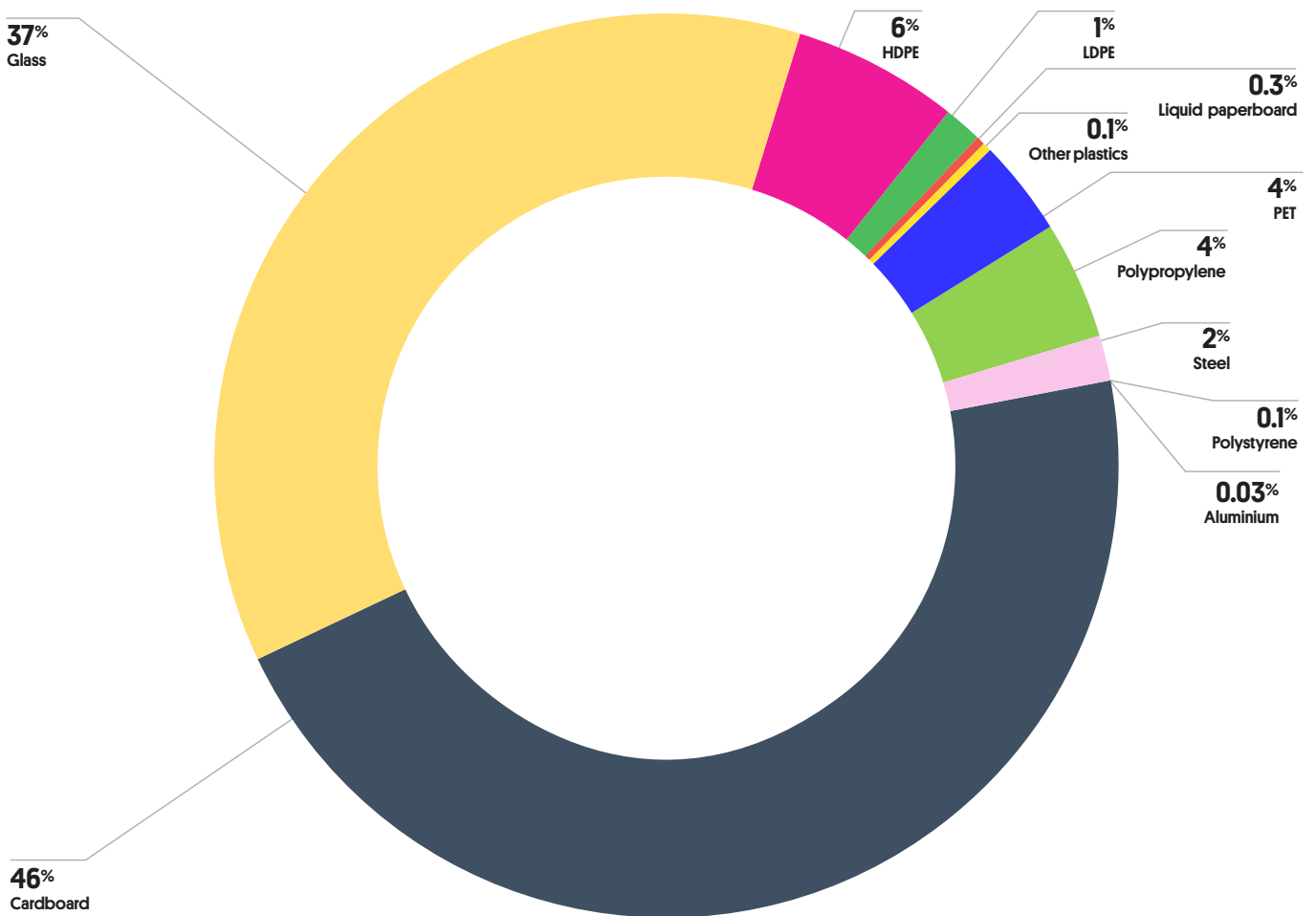
Packaging material	'000 tonnes	Return rate [%]
Glass	29	86%
Aluminium	4.6	81%
PET	3.9	67%
Liquid paperboard	0.5	51%
HDPE	0.3	63%



6.2 Other packaging materials

Non-CDL recovered packaging material from 2022-23 included Cardboard packaging [46%], and glass bottles and jars [37%].

Figure 33 Relative proportions of other (non-CDL) packaging materials, SA, 2022-23



7

Resource recovery value

The total value of resource recovery in SA in 2022-23 is estimated at about \$811 million.

Metals recovery (\$465 million) was the greatest contributor to resource recovery value with organics (\$249 million) second.

Table 21 Estimated resource value for recovered materials in SA in 2022-23

Material category or type	Quantity recovered ('000 tonnes)	Estimated on-sale price (\$/tonne)	Estimated value (\$ millions)
Masonry	1,230	\$11	\$14
Metals – iron and steel	433	\$558	\$242
Metals – non-ferrous including aluminium	74	\$3,033	\$224
Organics – meat rendering	111	\$2,000	\$221
Organics – garden, food and timber	447	\$61	\$27
Organics – other	429	Variable	Not calculated
Cardboard and paper	216	\$107	\$23
Plastics	30	\$1,229	\$37
Glass	74	\$116	\$9
Other materials (including tyres and other rubber, leather and textiles and foundry sands)	26	\$237	\$6
Separately reported materials and clean fill	1,064	\$8	\$9



Figure 34 Estimated market value of resource recovered materials, SA, 2022-23

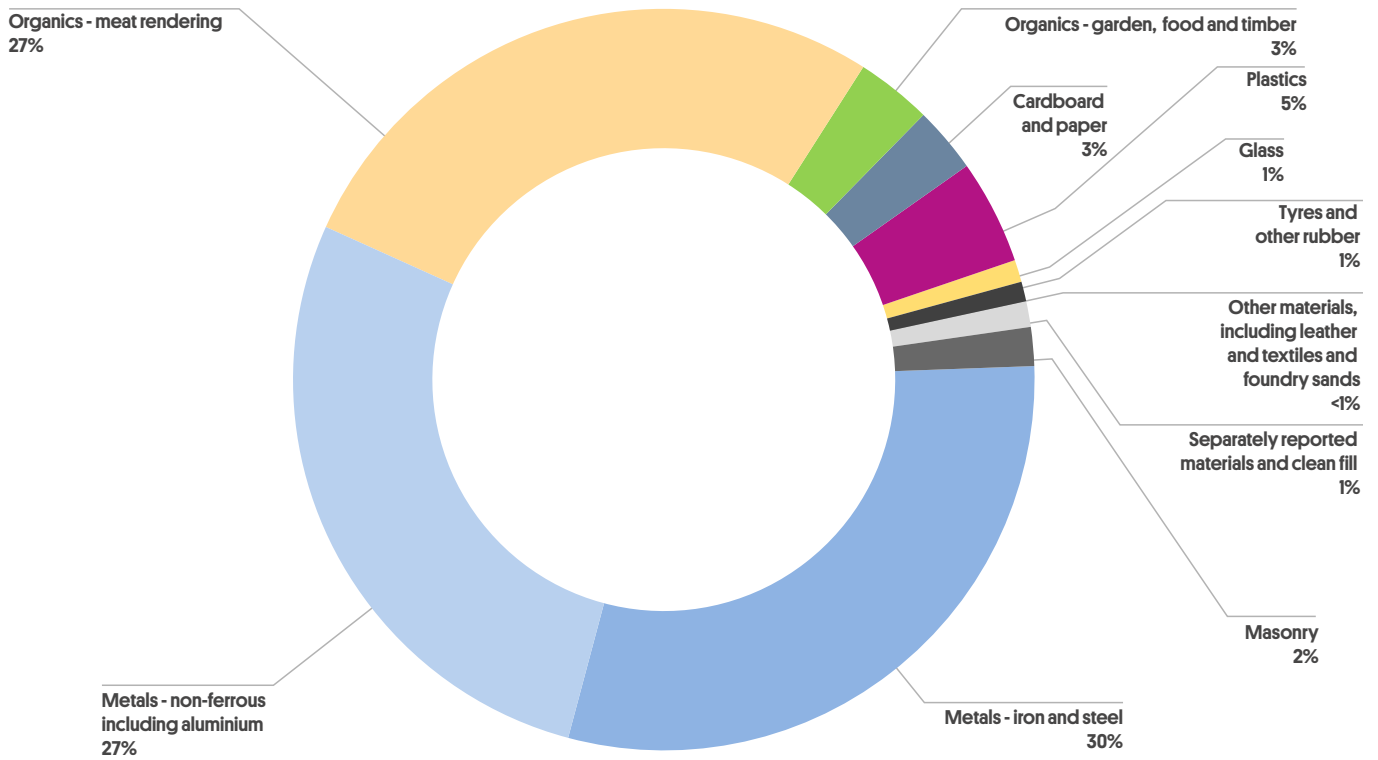
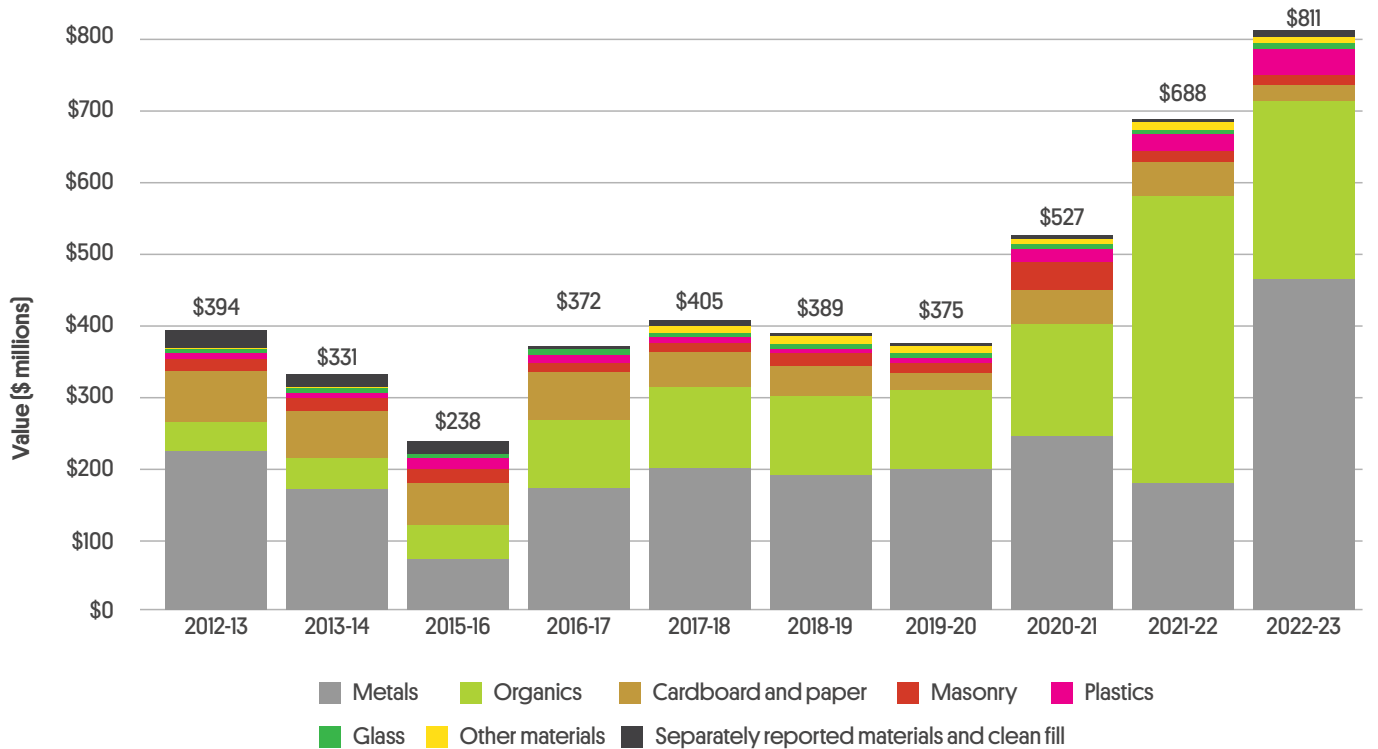


Figure 35 Estimated market value of resource recovered materials in SA, 2012-13 to 2022-23⁶



⁶ Historical values have been adjusted to account for inflation.

8

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) are wasted. Materials prone to biological decay (i.e. organics) generate and release the potent greenhouse gas methane when landfilled.

Resource recovery in SA in 2022-23 achieved the following estimated environmental benefits

Table 22 Estimated environmental benefits of recycling in SA in 2022-23

Material type	Recycling '000 tonnes	Emissions avoided '000 tonnes CO ₂ -e	Energy saved TJ LHV	Water saved Megalitres
Total	4,010	1,670	19,400	6,400



8.1 Greenhouse gas emission savings

Through recycling its materials in 2022-23, SA saved about:



1.67 million tonnes
of carbon dioxide equivalent (CO₂-e)

Emission savings due to recycling in 2022-23 are approximately equivalent to:

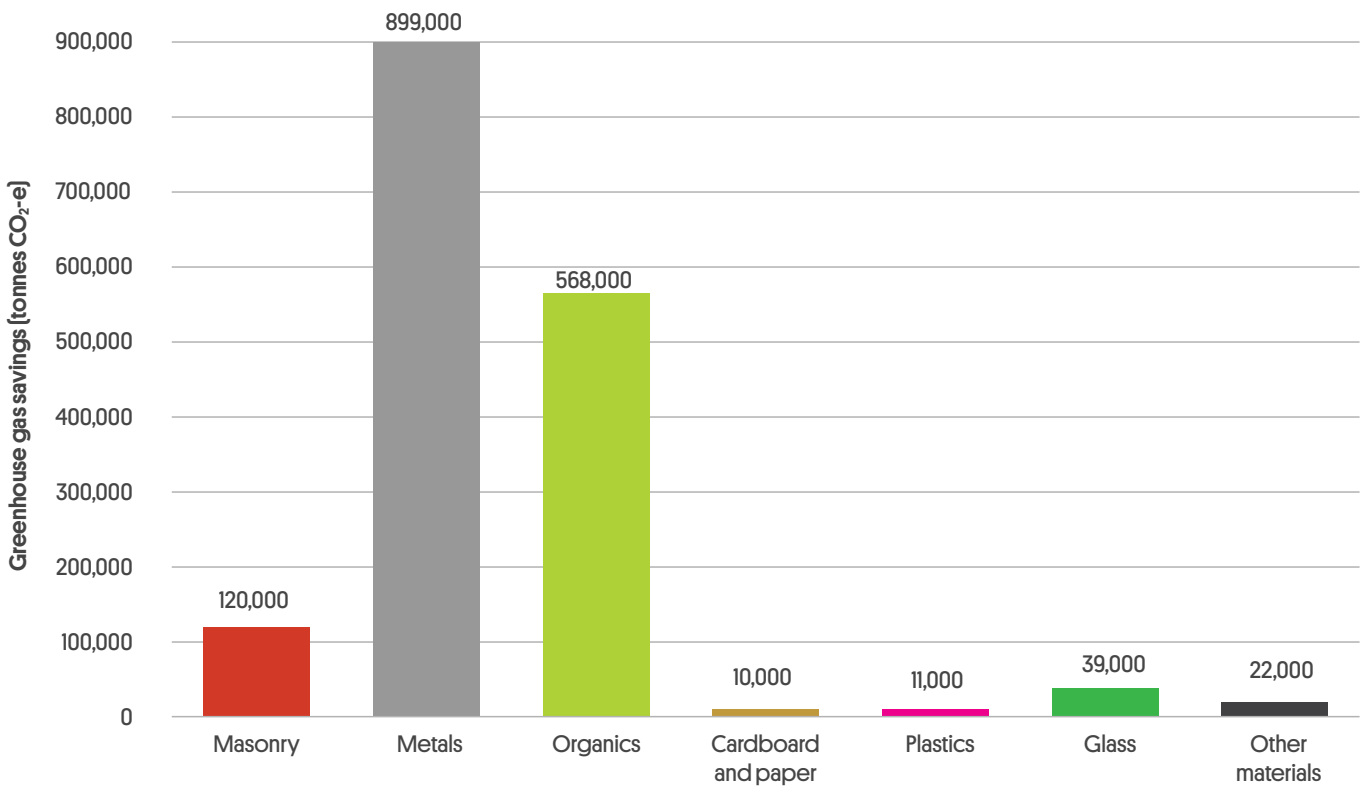


the CO₂ absorbed by
2.50 million trees



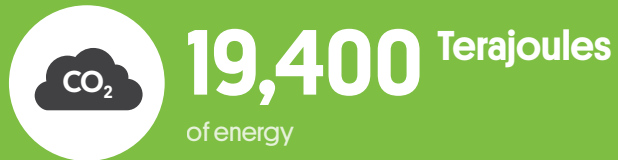
emissions from
334,000 cars
off the road in one year

Figure 36 Estimated greenhouse gas emissions savings due to recycling, SA, 2022-23



8.2 Energy savings

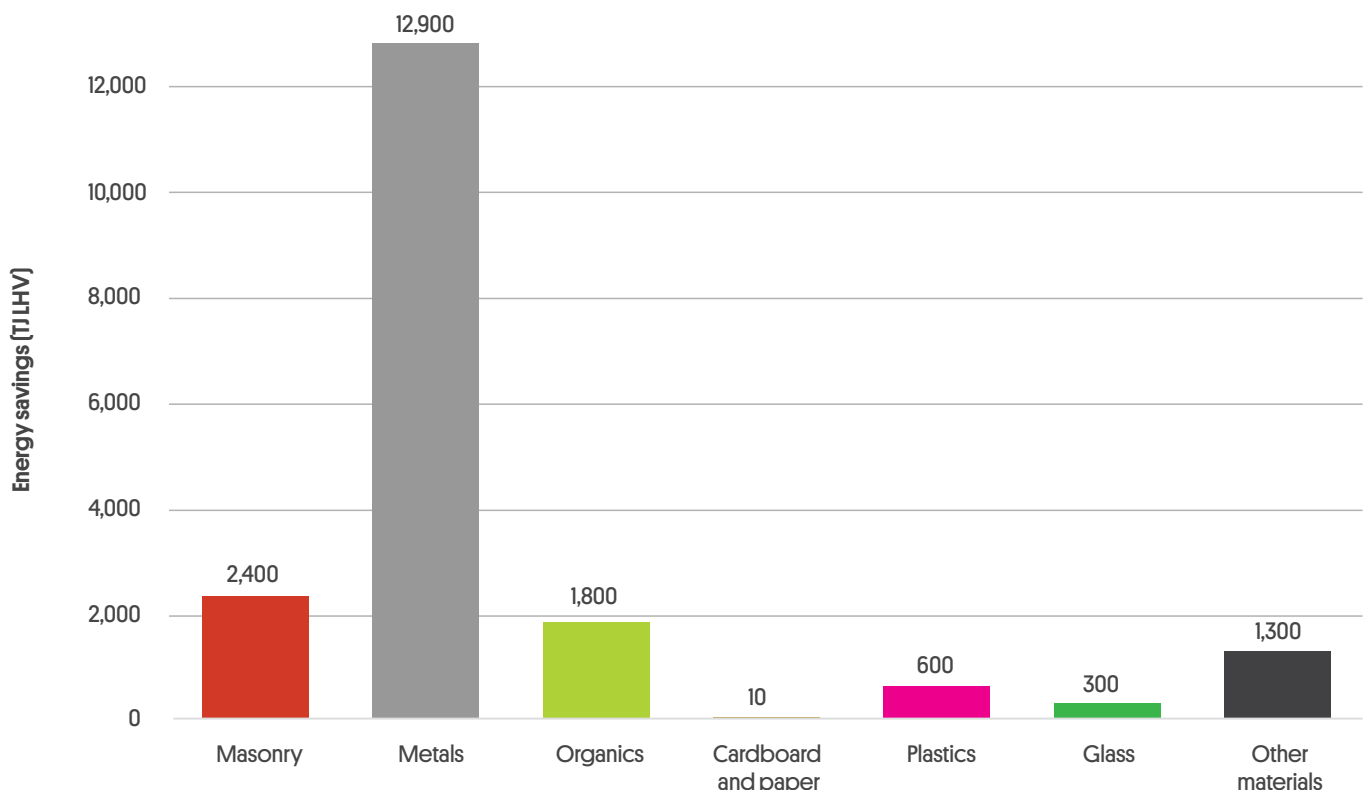
Through recycling its materials in 2022-23, SA saved about:



Energy savings due to recycling in 2022-23 are approximately equivalent to:



Figure 37 Estimated energy savings due to recycling, SA, 2022-23



8.3 Water savings

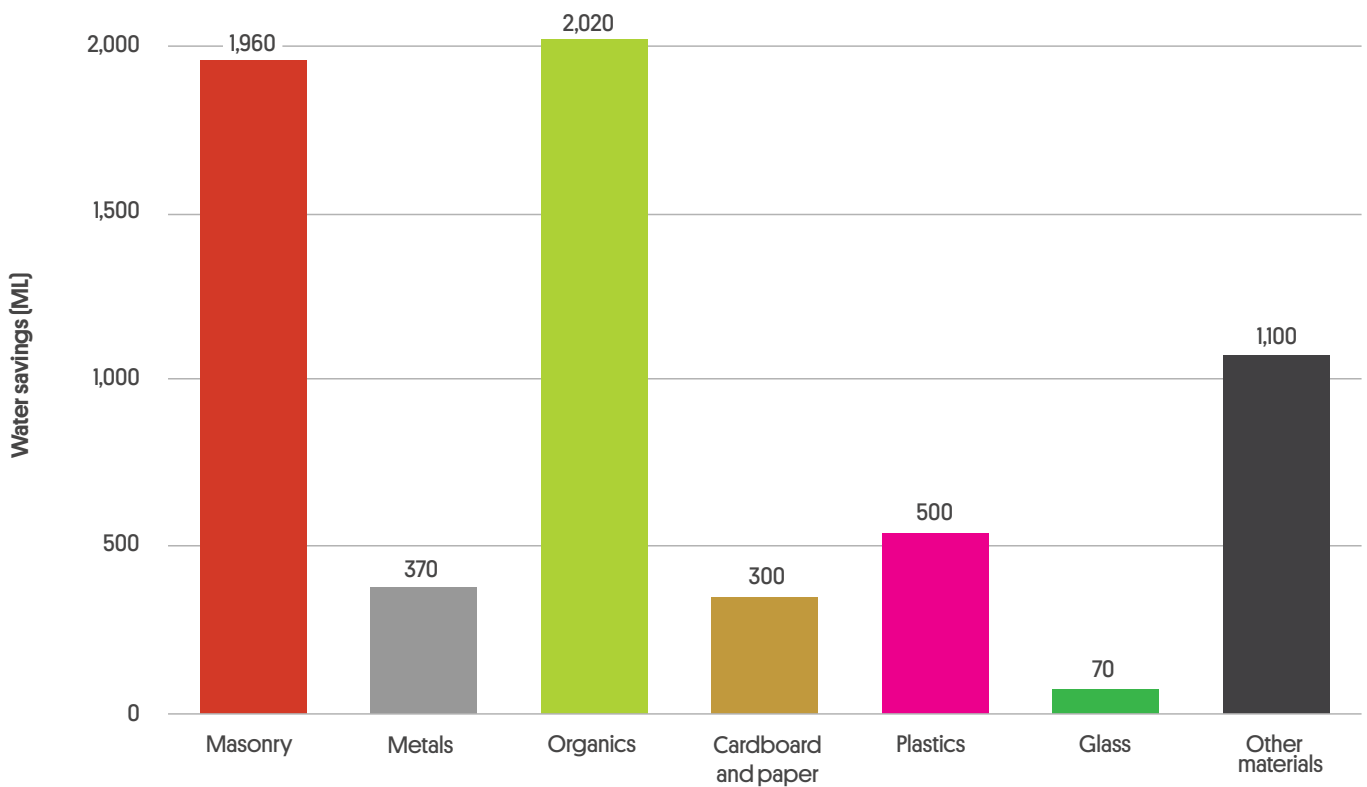
Through recycling its materials in 2022-23, SA saved about:



Water savings due to recycling in 2022-23 are approximately equivalent to:



Figure 38 Estimated water savings due to recycling, SA, 2022-23



Acknowledgements

Green Industries SA would like to acknowledge and thank the following participants of the Circular Economy Resource Recovery Survey 2022-23 and the SA Organics Industry Survey 2022-23. The list below excludes organisations that asked not to be identified.

Agricycling Australia	Jeffries
Adelaide Hills Region Waste Management Authority	Close the Loop
AMTA [MobileMuster]	McMahons Services
ANZRP	Mobius Farms
APR Manufacturing Group	Mulbarton Transport
Van Shaik's Bio Gro	Northern Adelaide Waste Management Authority [NAWMA]
Boral Resources SA Ltd	Nyrstar
Born Again Pallets	Opal Recycling
Ceduna Can & Bottle Pty Ltd	Orora Group
Chevron Glass P/L	ResourceCo
City of Adelaide	REMONDIS Australia Pty Ltd
Clare Valley Waste	Urban Renewal Authority trading as Renewal SA
d'Arenberg	Recycling Plastics Australia
Downer EDI Ltd	South Australian Water Corporation [SA Water]
Ecoplas Australia	Shred-X Pty Ltd
Electronic Recycling Australia	Sims
Enviro Friend Solutions [EFS]	Southern Materials Recovery Facility
FOAMEX South Australia	Statewide Recycling
Green Triangle Recyclers Pty Ltd	YCA Recycling
Hallett Resources Pty Ltd	Foodbank SA
Infrabuild Recycling	Ozharvest
Intercast & Forge Pty Ltd	Save the Children Australia
J Mathews Pty Ltd	Salvos Stores
JA Brauns Investments	Thread Together Limited
JBS Australia - Bordertown	

Kalaini

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