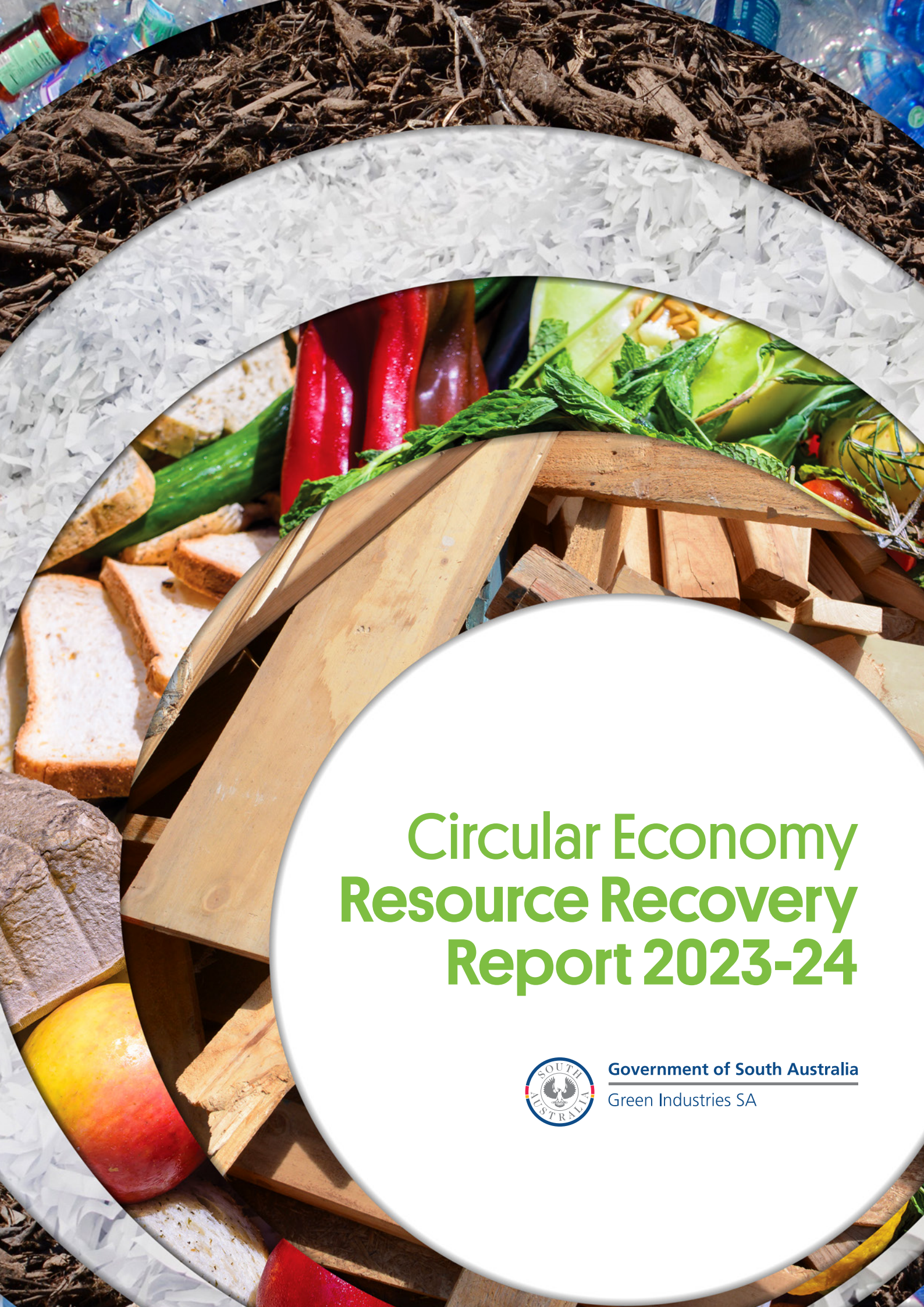


# Circular Economy
# Resource Recovery Report 2023-24

Government of South Australia

Green Industries SA

**Disclaimer**

This report has been prepared for Green Industries SA in accordance with the terms and conditions of appointment dated 15 October 2024, and is based on the assumptions and exclusions set out in our scope of work. Information in this document is current as of 21 February 2025. While all professional care has been undertaken in preparing this report, Blue Environment Pty Ltd cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

The mention of any company, product or process in this report does not constitute or imply endorsement by Blue Environment Pty Ltd.



Blue Environment Pty Ltd
ABN 78 118 663 997
Suite 209, 838 Collins St, Docklands Vic 3008

Email: blue@blueenvironment.com.au
Web: www.blueenvironment.com.au
Phone: 03 9081 0440

Green Industries SA acknowledges and respects the Traditional Custodians whose ancestral lands we live and work upon, and pays respect to their Elders past, present and emerging.

We acknowledge and respect their deep spiritual connections, and the relationship that Aboriginal and Torres Strait Islander people have to Country.

We extend our respect to all Aboriginal and Torres Strait Islander peoples and their nations in South Australia, and across Australia.

Learn about our commitment to Reconciliation

# Contents

# Figures

# Tables

# 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. |
| **$CO_2$-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 |
| **HDPE** | High density polyethylene |
| **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 |
| **PS-E** | Expanded 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. |
| **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 2023-24 |
| **TJ** | Terajoule |
| **Waste reuse** | Reuse of a product or material that has entered a waste and resource recovery facility (for example, the sale of goods from a reuse shop). |

# Acknowledgements

Green Industries SA would like to acknowledge and thank the participants of the Circular Economy Resource Recovery Survey 2023-24 and the SA Organics Industry Survey 2023-24. The list below excludes organisations that asked not to be identified.

Adelaide Hills Region Waste Management Authority

Australian Mobile Telecommunications Association (MobileMuster)

Australia and New Zealand Recycling Platform

Boral Resources SA

Ceduna Can & Bottle

Chevron Glass

Clare Valley Waste

Corporation of The City of Adelaide

D'arenberg

Downer

Ecoplas Australia

Electronic Recycling Australia

Fleurieu Regional Waste Authority

Foamex

Gabalu

Hallett

Infrabuild Recycling

Intercast & Forge

IWS

JBS Australia - Bordertown

Jeffries Garden Soils

Marine Stores

Mobius Farms

Northern Adelaide Waste Management Authority

Nyrstar

Opal Packaging Australia

Orora

Peats Soil

Re.Group

Recycling Plastics Australia

Remondis Australia

ResourceCo

SA Composters

Shred-x

Sims Metal

South Australian Water Corporation

Transmutation

Urban Renewal Authority

Van Schaik's Bio Gro

Veolia-ResourceCo Alternative Fuels

Visy Recycling Australia

YCA Recycling

# Summary

## Introduction

Each year, Green Industries SA measures recovery and disposal activity in South Australia (SA) to assess how the State is performing on waste management and resource recovery. The findings are used to track progress against SA's waste targets. This report presents the results for the 2023-24 financial year.

## Summary of 2023-24 results

SA's recovery rate in 2023-24 was an estimated 83.2%, which is slightly higher than recent years. SA recovered about 4.47 million tonnes of material in 2023-24 which is a 5% increase compared to 2022-23; and disposed about 903 kilotonnes (kt, or thousands of tonnes) of waste to landfill in 2023-24. Disposal decreased by 1% compared to 2022-23. Overall waste generation was approximately 5.38 million tonnes – a 4% increase from the previous year.

Headline statistics for resource recovery, landfill disposal and waste generation are provided in Table S1. This includes:

- Standard reporting materials, comprising masonry, metals, organics, cardboard and paper, plastics, glass, foundry sands, leather and textiles, and tyres and other rubber.
- Separately reported materials, comprising clay, fines, rubble, soil and fly ash. These materials are reported separately because they can fluctuate significantly across years and between jurisdictions.

**Table S1** Summary of resource recovery, landfill disposal and waste generation, SA, 2023-24

| | Standard reporting materials | Separately reported materials | Total |
|---|---|---|---|
| Resource recovery (million tonnes) | 3.39 | 1.08 | **4.47** |
| Landfill disposal (million tonnes) | 0.87 | 0.03 | **0.90** |
| Waste generation (million tonnes) | 4.26 | 1.11 | **5.38** |
| Recovery rate (%) | 79% | 97% | **83%** |

# Recovery by material

When comparing 2023-24 resource recovery data to the previous year:

- **Masonry** recovery was lower at 1.18 million tonnes, a decrease from 1.23 million tonnes in 2022-23. This was mainly driven by a reduction in concrete recovery. Reported recovery of bricks increased from 2022-23, returning to the higher levels seen in previous years. From the previous year, asphalt recycling increased by about 18%, plasterboard fell more significantly, returning to levels seen in 2021-22.
- **Metals** recovery decreased by about 14% overall to 437 kt from the 2022-23 reported recovery of 507 kt. This was mostly due to a decrease in steel recovery, but reported recovery of the smaller non-ferrous metals fraction declined by half.
- **Organics** recovery was about 1.40 million tonnes in 2023-24, an increase from the 1.10 million tonnes recovered in 2022-23. The assumptions used for analysing timber recovery were revised this year, thus the reported increase may be partly due to improved accuracy.
- **Cardboard** and paper recovery increased slightly by 4% from 2022-23 to 223 kt.
- **Plastics** recovery increased by about 40% overall. Improved insights on scrap plastic generated in SA and reprocessed interstate and plastic recovered for energy contributed to this increase.
- **Glass** recovery remained steady at 74 kt, although a higher proportion of recovered glass was from non-food and beverage glass.
- Recovery of **other materials** including, foundry sands, leather and textiles, and tyres and other rubber was about 37 kt. In 2022-23 it was about 26 kt. The increase is mostly attributable to higher reported recovery of tyres.
- Recovery of **separately reported materials** including clay, fines, rubble and soil and fly ash remained steady, with a 2% increase on 2022-23 levels to 1,085 kt. No fly ash was recovered.

Figure S1 summarises the material composition and destination of recovered materials in SA in 2023-24.

## Performance against state waste targets

In 2020, Green Industries SA released *South Australia's Waste Strategy 2020-25*. The strategy sets waste recovery[1] 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 2023-24 data is provided in Table S2. The 2025 recovery target for metropolitan C&D has been exceeded by one percentage point but MSW and C&I are still lagging their targets.

**Table S2** Summary of state waste targets and progress on them

| Topic | Target | Progress |
|---|---|---|
| Landfill diversion | Zero avoidable waste to landfill by 2030 | SA disposed about 903 kt of waste to landfill in 2023-24 a decrease from 914 kt in 2022-23 |
| Waste generation | 5% reduction in waste generation per capita from a 2020 baseline | Waste generation per capita showed 4% increase in 2023-24 compared to 2019-20. |
| Metropolitan recovery | Recovery rates by 2025:<br>- MSW 75%<br>- C&I 90%<br>- C&D 95% | Recovery rates achieved by metropolitan SA in 2023-24:<br>- MSW 67%<br>- C&I 78%<br>- C&D 96% |

## Local government kerbside diversion

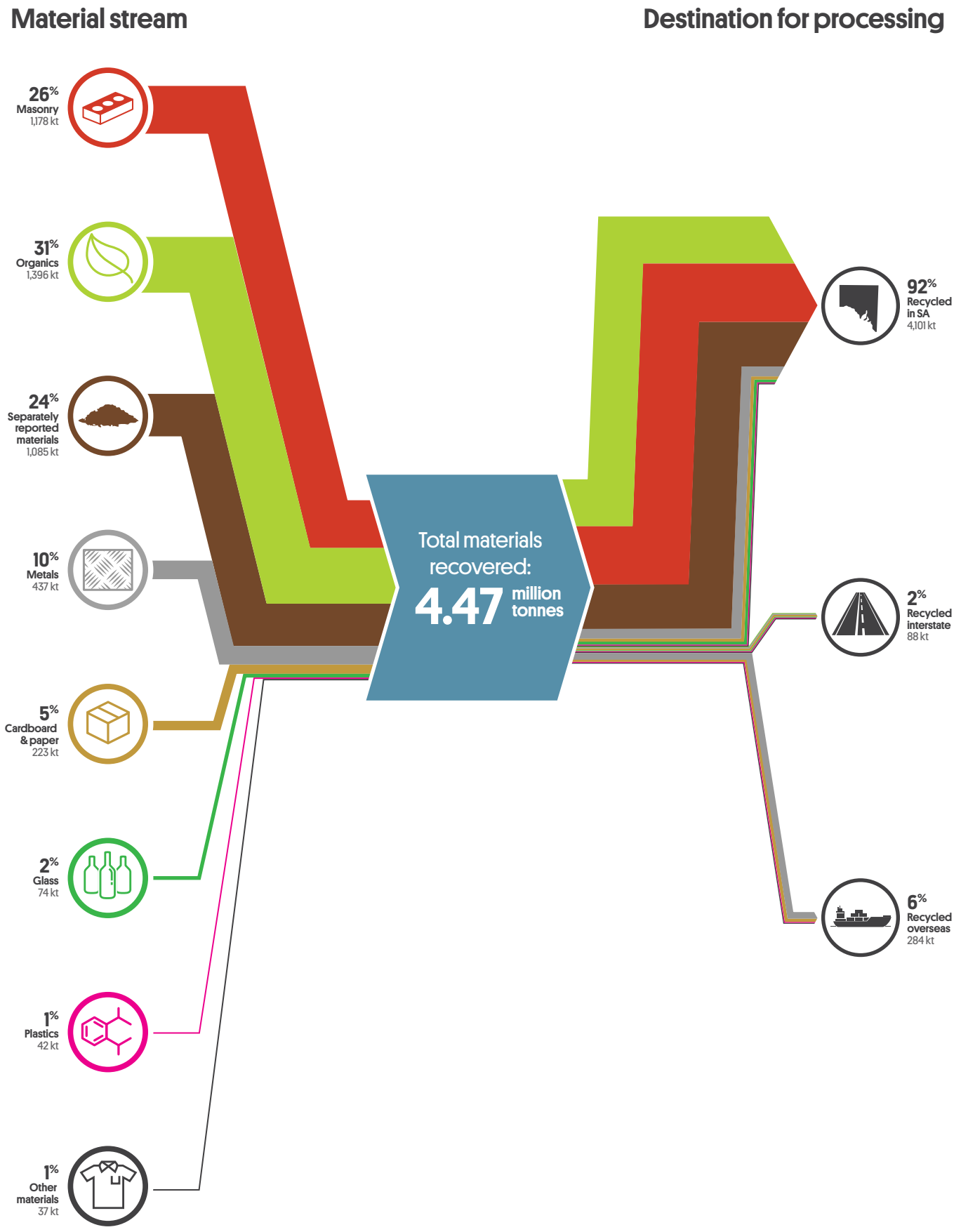
About 693 kt of waste materials were collected at kerbside in SA, including 530 kt from metropolitan councils and 163 kt from regional councils. About 50% of kerbside waste was diverted from landfill in SA in 2023-24, slightly lower than the 2022-23 rate of 51%. Diversion was higher for metropolitan councils (52%) than regional councils (41%).

## Material flow analyses

Material flow analyses were conducted for 2023-24. Section 4 of this report contains summaries for flows of metals, cardboard and paper, plastics, glass, textiles and tyres for SA in 2023-24, covering consumption, waste generation and recovery and a Sankey chart, in which material flows are represented using arrows proportional to the scale of the calculated material flow.

1 *South Australia's Waste Strategy 2020-25* refers to 'diversion' targets used synonymously with 'recovery'. In the CERRR, this is consistently referred to as 'recovery' to mean waste materials sorted, separated or processed for reuse, recycling or energy recovery, while 'diversion' refers to material to sending material to an alternative facility to landfill.

**Figure S1** Resource recovery, including energy recovery, SA, 2023-24, by material and destination, not including e-waste



# 1 Introduction

- The *Circular Economy Resource Recovery Report 2023-24* presents the findings of a survey of SA's resource recovery sector for the 2023-24 financial year.
- It shows data on SA's waste generation, landfill disposal and resource recovery, including progress against targets set in *South Australia's Waste Strategy 2020-2025*.

A circular economy utilises resources to their fullest potential. Waste avoidance, reuse and recycling are maximised while raw material extraction and landfilling are minimised. This is illustrated in Figure 1.

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 targets set out in *South Australia's Waste Strategy 2020-25* (Green Industries SA 2020), which defines targets for waste reduction and waste recovery[2] from landfill to 2025. Table 1 (overleaf) summarises SA's waste targets.

This report is the fourth edition of the *Circular Economy Resource Recovery Report* (CERRR). The CERRRs are a new iteration of Green Industries SA's previous *Recycling Activity Survey Reports*. The CERRR 2023-24 builds on the findings of previous years and is mostly consistent with the *Australian standard for waste and resource recovery data and reporting, second edition* (DCCEEW 2024) with some differences in reporting of some hazardous wastes.

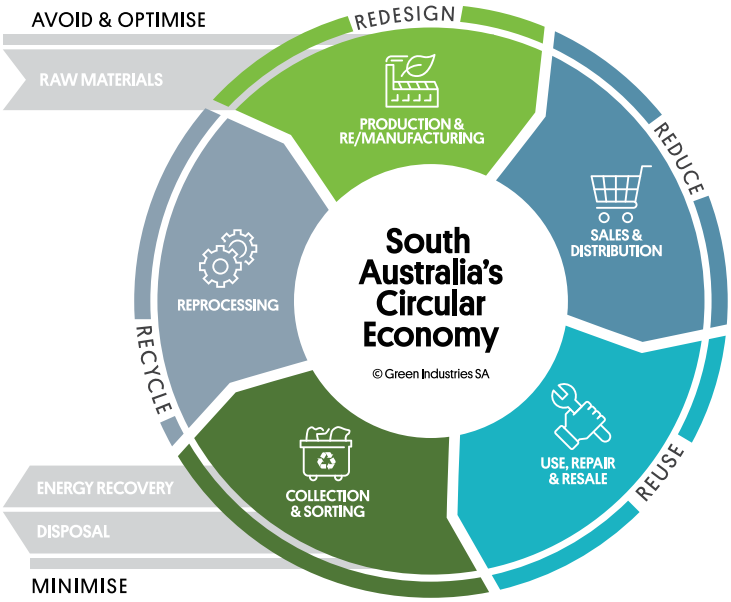



**Figure 1** South Australia's circular economy

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

2 *South Australia's Waste Strategy 2020-25* refers to 'diversion' targets used synonymously with 'recovery'. In the CERRR, this is consistently referred to as 'recovery' to mean waste materials sorted, separated or processed for reuse, recycling or energy recovery, while 'diversion' refers to material to sending material to an alternative facility to landfill.

**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 | % recovery all MSW[3] | % recovery C&I | % recovery C&D |
| 2023 | 60% | 65% | 85% | 90% |
| 2025 | 70% | 75% | 90% | 95% |
| **Non-metropolitan waste targets (all source streams)** | | | | |
| 2020 | Maximise recovery 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 recovery targets | | | |

The *Circular Economy Resource Recovery Survey 2023-24* (the survey) asked recyclers, reprocessors, the reuse sector and the energy recovery industry in SA about their operations in 2023-24. 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.

Survey participants were also asked about the status of resource recovery, barriers to their operations and employee figures.

Starting in financial year 2021-22, the South Australian Environment Protection Authority's (SA EPA) has required mass balance reporting from waste depots that receive over 20,000 tonnes of solid waste per annum. This data was used to validate and supplement the survey results.

While significant effort has been taken to verify the survey responses, it is acknowledged that some quantities are based on estimates with significant margins of error, or reliant on data collected in previous years. This is further discussed in Appendix A. The estimated error margin in the total tonnage was 1.9%. Approximately, 67% of the tonnes reported were measured by a weighbridge. Overall, the authors believe the data reliably supports the key messages presented in this report.

As part of developing the CERRR 2023-24, material flow analyses (MFAs) were conducted for several materials. Section 4 of this report contains summaries for flows of metals, cardboard and paper, plastics, glass, textiles and tyres for SA in 2023-24, covering consumption, waste generation and recovery. Each is represented by a Sankey chart, in which material flows are represented using arrows proportional to the scale of the calculated material flow. The MFAs for glass and metals are examined in particular detail, including a review of opportunities for increasing recovery.

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

This section summarises the results of the *Circular Economy Resource Recovery Survey 2023-24*, including:

- resource recovery and landfill disposal
- SA's performance against state targets for waste management
- local government recovery
- SA's transition towards a circular economy.

## 2.1 Resource recovery and landfill disposal

### Overview

SA recovered about 4.47 million tonnes of material in 2023-24, a 5% increase compared to 2022-23. Disposal to landfill decreased this year; about 903 kilotonnes (kt, or thousands of tonnes) of waste was landfilled in 2023-24 compared to 914 kt in 2022-23. Overall waste generation was 5.38 million tonnes, an increase from 5.16 million tonnes in the previous year. SA achieved a recovery rate of 83.2% in the 2023-24 financial year, slightly higher than the 2022-23 rate of 82.3%.

Table 2 (overleaf) summarises the key statistics for resource recovery and landfill disposal in SA in 2023-24, including records from the past five years and from 2003-04 (the first year SA conducted a recycling activity survey). Data are considered in two groups:

1. Standard reporting materials, which comprise masonry, metals, organics, cardboard and paper, plastics, glass, foundry sands, leather and textiles, and tyres and other rubber.

2. Separately reported materials, which comprise clay, fines, rubble, soil and fly ash. These materials are reported separately because they can fluctuate significantly across years as they are strongly influenced by large infrastructure projects.

Table 2 shows that the reported tonnes recovery of standard reporting materials has increased by 7% from 2022-23 and the recovery of separately reported materials remained steady, with a minimal increase of 2%.

Waste generation increased by about 4% in absolute terms and 3% on a per capita basis (2.86 tonnes per person in 2023-24 compared with the previous 2.79 tonnes per person).

The recovery rate increased by about one percentage point.


The data source for several reporters in 2023-24 was from mandatory mass balance reporting to SA EPA rather than a voluntary response to the *Circular Economy Resource Recovery Survey 2023-24*. The assumptions used to map the reported materials to the categories reported here could lead to some variation in the reporting of recovery.

It is noted that in previous editions of the CERRR, the scope has included materials 'reused'. The scope for the CERRR 2023-24 was adjusted slightly. The scope includes clays, fines, rubbles and soils reported as 'reused' but excluded other materials to the fate waste reuse, as they may be better measured in other systems.

Most values in this report are rounded to three significant figures to avoid misleading the reader about the level of accuracy in the data.

**Table 2** Annual SA resource recovery and landfill diversion performance for 2023-24 and previous years

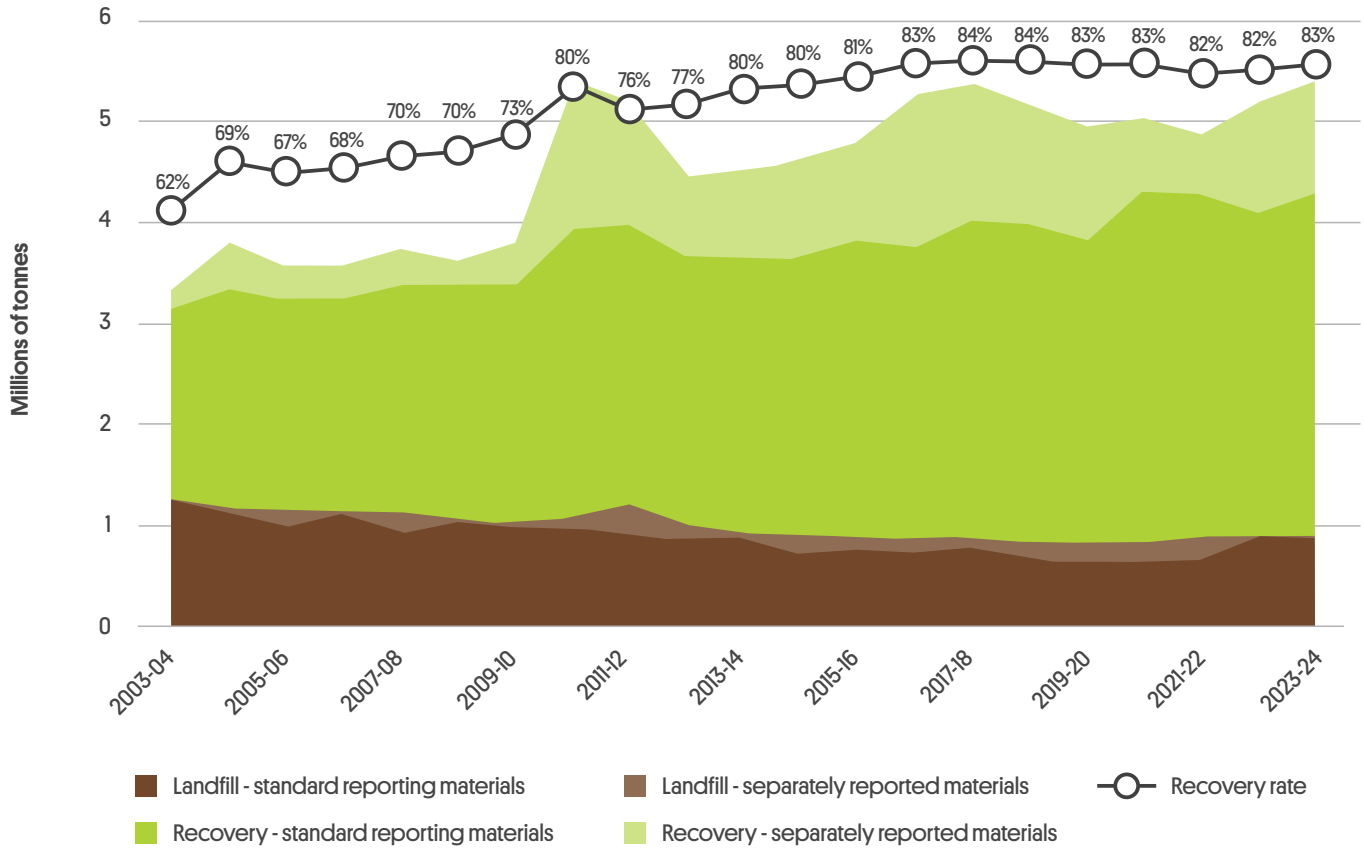
| | | | | | | | Change | |
|---|---|---|---|---|---|---|---|---|
| | 2003-04 | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | 22-23 to 23-24 | 03-04 to 23-24 |
| **Resource recovery (kt)** | | | | | | | | |
| Standard reporting materials | 1,880 | 2,990 | 3,470 | 3,390 | 3,180 | 3,390 | 7% | 80% |
| Separately reported materials | 162 | 1,140 | 730 | 600 | 1,060 | 1,080 | 2% | 570% |
| **Total** | **2,040** | **4,130** | **4,200** | **3,990** | **4,240** | **4,470** | **5%** | **119%** |
| **Landfill disposal (kt)** | | | | | | | | |
| Standard reporting materials | 1,258 | 631 | 641 | 676 | 886 | 875 | -1% | -30% |
| Separately reported materials | 20.0 | 196 | 199 | 209 | 28.0 | 28.0 | 0% | 40% |
| **Total** | **1,280** | **827** | **840** | **885** | **914** | **903** | **-1%** | **-29%** |
| **Waste generation (kt)** | | | | | | | | |
| Standard reporting materials | 3,140 | 3,630 | 4,110 | 4,070 | 4,070 | 4,260 | 5% | 36% |
| Separately reported materials | 182 | 1,140 | 928 | 813 | 1,090 | 1,110 | 2% | 512% |
| **Total** | **3,320** | **4,960** | **5,040** | **4,880** | **5,160** | **5,380** | **4%** | **62%** |
| **Recovery rate (%)** | | | | | | | | |
| Standard reporting materials | 59.9% | 82.6% | 84.4% | 83.4% | 78.2% | 79.5% | 1% | 20% |
| **Total** | **61.5%** | **83.3%** | **83.3%** | **81.9%** | **82.3%** | **83.2%** | **1%** | **22%** |
| **SA population (persons)** | **1,530,000** | **1,770,000** | **1,770,000** | **1,820,000** | **1,850,000** | **1,880,000** | **1%** | **21%** |
| **Per capita recovery (kg/person/yr)** | | | | | | | | |
| Standard reporting materials | 1.23 | 1.69 | 1.96 | 1.86 | 1.72 | 1.80 | 5% | 47% |
| **Total** | **1.33** | **2.34** | **2.37** | **2.19** | **2.29** | **2.38** | **4%** | **79%** |
| **Per capita disposal (kg/person/yr)** | | | | | | | | |
| Standard reporting materials | 0.82 | 0.36 | 0.36 | 0.37 | 0.48 | 0.47 | -2% | -43% |
| **Total** | **0.83** | **0.47** | **0.47** | **0.49** | **0.49** | **0.48** | **-2%** | **-42%** |
| **Per capita waste generation (kg/person/yr)** | | | | | | | | |
| Standard reporting materials | 2.05 | 2.05 | 2.32 | 2.23 | 2.20 | 2.27 | 3% | 11% |
| **Total** | **2.16** | **2.80** | **2.84** | **2.68** | **2.79** | **2.86** | **3%** | **33%** |
| **SA Gross State Product (GSP) ($ millions)** | **$91,000** | **$117,000** | **$122,000** | **$129,000** | **$134,000** | **$142,000** | **6%** | **56%** |
| **Performance metrics per GSP (kt/$ million GSP)** | | | | | | | | |
| Total recovery | 22.4 | 35.4 | 34.3 | 30.9 | 31.6 | 31.5 | -1% | 40% |
| Total disposal | 14.0 | 7.08 | 6.86 | 6.85 | 6.81 | 6.35 | -7% | -55% |
| **Total waste generation** | **36.5** | **42.5** | **41.2** | **37.7** | **38.4** | **37.8** | **-2%** | **4%** |

*Note: The change in recovery rates over time shows change in percentage points, rather than a rate of change.*

## Progress since the first survey year (2003-04)

Figure 2 presents the trend for resource recovery and landfill disposal in SA since 2003-04, the first survey year. 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




## Recovery by material type

A summary of trends in recovery by material type is shown in Figure 3 and Table 3. A more detailed breakdown is provided in Section 3. When comparing 2023-24 to the previous year, reported:

- **Masonry** recovery was lower at 1.18 million tonnes, a decrease from 1.23 million tonnes in 2022-23. This was mainly driven by a reduction in concrete recovery. Reported recovery of bricks increased from 2022-23, returning to the higher levels seen in previous years. From the previous year, asphalt recycling increased by about 18%, plasterboard fell more significantly, returning to levels seen in 2021-22.
- **Metals** recovery decreased by about 14% overall to 437 kt from the 2022-23 reported recovery of 507 kt. This was mostly due to a decrease in steel recovery, but reported recovery of the smaller non-ferrous metals fraction declined by half.

- **Organics** recovery was about 1.40 million tonnes in 2023-24, an increase from the 1.10 million tonnes recovered in 2022-23. The assumptions used for analysing timber recovery were revised this year, thus the reported increase may be partly due to improved accuracy.
- **Cardboard and paper** recovery increased slightly by 4% from 2022-23 to 223 kt.
- **Plastics** recovery increased by about 40% overall. Improved insights on scrap plastic generated in SA and reprocessed interstate and plastic recovered for energy contributed to this increase.
- **Glass** recovery remained steady at 74 kt, although a higher proportion of recovered glass was from non-food and beverage glass.
- Recovery of **other materials** including, foundry sands, leather and textiles, and tyres and other rubber was about 37 kt. In 2022-23 it was about 26 kt. The increase is mostly attributable to higher reported recovery of tyres.
- Recovery of **separately reported materials** including clay, fines, rubble and soil and fly ash remained steady, with a 2% increase on 2022-23 levels to 1,085 kt. No fly ash was recovered.

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

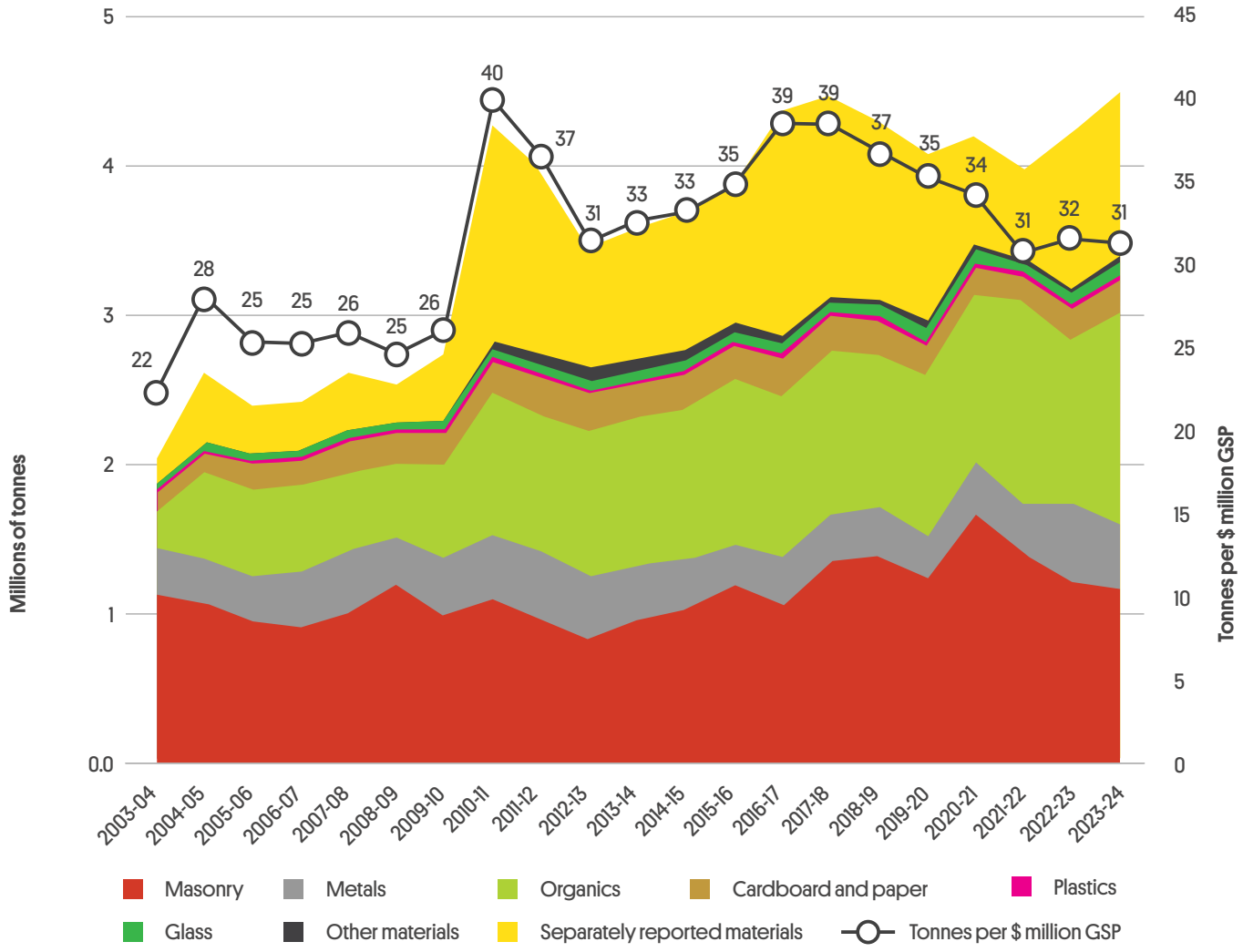


**Table 3** Summary of SA resource recovery by material type in kilotonnes

| | Recovery (kt) | | | | | | Change (%) |
|---|---|---|---|---|---|---|---|
| **Material type** | **2003-04** | **2019-20** | **2020-21** | **2021-22** | **2023-23** | **2023-24** | **22-23 to 23-24** |
| **Standard reporting materials** | | | | | | | |
| **Masonry** | | | | | | | |
| Asphalt | 100 | 238 | 339 | 284 | 208 | 245 | 18% |
| Bricks | 165 | 41.0 | 43.6 | 26.9 | 15.5 | 35.3 | 128% |
| Concrete | 877 | 975 | 1,283 | 1,114 | 1,005 | 898 | -11% |
| Plasterboard | 0 | 1.00 | 0.89 | 0.25 | 1.75 | 0.34 | -81% |
| **Subtotal** | **1,142** | **1,260** | **1,670** | **1,430** | **1,230** | **1,180** | **-4%** |
| **Metals** | | | | | | | |
| Iron and steel | 264 | 248 | 327 | 281 | 433 | 379 | -13% |
| Aluminium | 19.0 | 11.0 | 12.2 | 28.6 | 40.8 | 42.0 | 3% |
| Non-ferrous metals | 13.0 | 19.0 | 11.4 | 19.5 | 32.6 | 15.8 | -52% |
| **Subtotal** | **296** | **278** | **351** | **329** | **507** | **437** | **-14%** |
| **Organics** | | | | | | | |
| Food organics | 0 | 13.4 | 15.8 | 29.8 | 47.2 | 89.1 | 89% |
| Garden organics | 130 | 250 | 277 | 290 | 332 | 357 | 8% |
| Timber | 117 | 315 | 202 | 238 | 68 | 294 | 333% |
| Other organics | 0 | 528 | 634 | 794 | 651 | 656 | 1% |
| **Subtotal** | **247** | **1,110** | **1,130** | **1,350** | **1,100** | **1,400** | **27%** |
| **Cardboard and paper** | | | | | | | |
| Cardboard | 91.0 | 134 | 138 | 60.2 | 106 | 140 | 33% |
| Liquid paperboard | 0 | 0.60 | 0.80 | 0.16 | 0.49 | 1.12 | 130% |
| Magazines and newsprint | 32.7 | 47.4 | 31.5 | 70.4 | 74.8 | 55.5 | -26% |
| Printing and writing paper | 12.3 | 12.0 | 11.6 | 32.9 | 34.7 | 26.7 | -23% |
| **Subtotal** | **136** | **194** | **181** | **164** | **216** | **223** | **4%** |
| **Plastics** | | | | | | | |
| Polyethylene terephthalate | 0 | 4.70 | 8.90 | 9.23 | 9.13 | 3.85 | -58% |
| High density polyethylene | 0 | 6.00 | 12.0 | 11.7 | 12.0 | 8.71 | -28% |
| Polyvinyl chloride | 0 | 0.10 | 0.02 | 0.00 | 0.01 | 0.29 | 2674% |
| Low density polyethylene | 0 | 3.00 | 4.51 | 6.73 | 2.41 | 13.57 | 464% |
| Polypropylene | 0 | 1.10 | 4.91 | 5.48 | 5.08 | 4.86 | -4% |
| Polystyrene | 0 | 0.60 | 0.40 | 0.13 | 0.54 | 2.01 | 270% |
| Mixed and/or other plastics | 8.61 | 14.2 | 1.65 | 0.20 | 1.02 | 8.94 | 780% |
| **Subtotal** | **8.61** | **29.7** | **32.4** | **33.5** | **30.2** | **42.2** | **40%** |
| **Glass** | | | | | | | |
| Glass | 45.6 | 87.0 | 84.2 | 53.6 | 73.6 | 74.4 | 1% |
| **Subtotal** | **45.6** | **87.0** | **84.2** | **53.6** | **73.6** | **74.4** | **1%** |

| Material type | Recovery (kt) | | | | | | Change (%) |
|---|---|---|---|---|---|---|---|
| | 2003-04 | 2019-20 | 2020-21 | 2021-22 | 2023-23 | 2023-24 | 22-23 to 23-24 |
| **Other materials** | | | | | | | |
| Foundry sands | 0 | 24.0 | 8.22 | 4.22 | 2.42 | 0.98 | -59% |
| Leather and textiles | 4.08 | 0.90 | 1.56 | 4.89 | 2.76 | 6.15 | 122% |
| Tyres and other rubber | 0.09 | 19.0 | 19.1 | 24.7 | 20.5 | 29.6 | 44% |
| **Subtotal** | **4.17** | **43.9** | **28.9** | **33.8** | **25.7** | **36.7** | **43%** |
| **Total standard reporting materials** | **1,880** | **2,990** | **3,470** | **3,390** | **3,180** | **3,390** | **7%** |
| **Separately reported materials** | | | | | | | |
| Fly ash | 0 | 0 | 0 | 0 | 0 | 0 | |
| Clay, fines, rubble and soil – clean fill | 162 | 874 | 659 | 551 | 1,050 | 1,022 | -3% |
| Clay, fines, rubble and soil – intermediate waste soil | - | 266 | 70.4 | 52.9 | 14.1 | 63.4 | 350% |
| **Total separately reported materials** | **162** | **1,140** | **729** | **604** | **1,064** | **1,085** | **2%** |
| **Grand total** | **2,040** | **4,130** | **4,200** | **3,990** | **4,240** | **4,470** | **5%** |

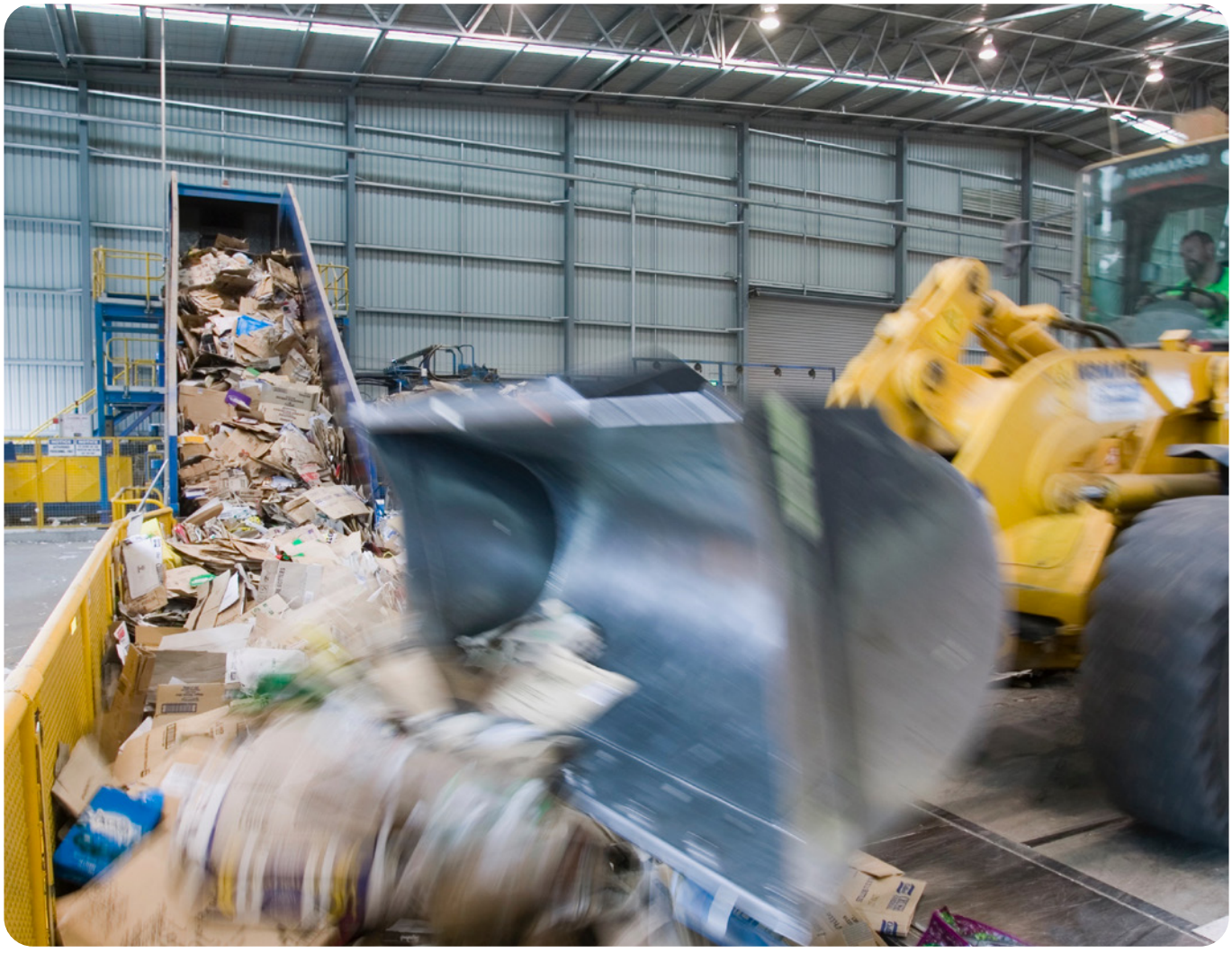
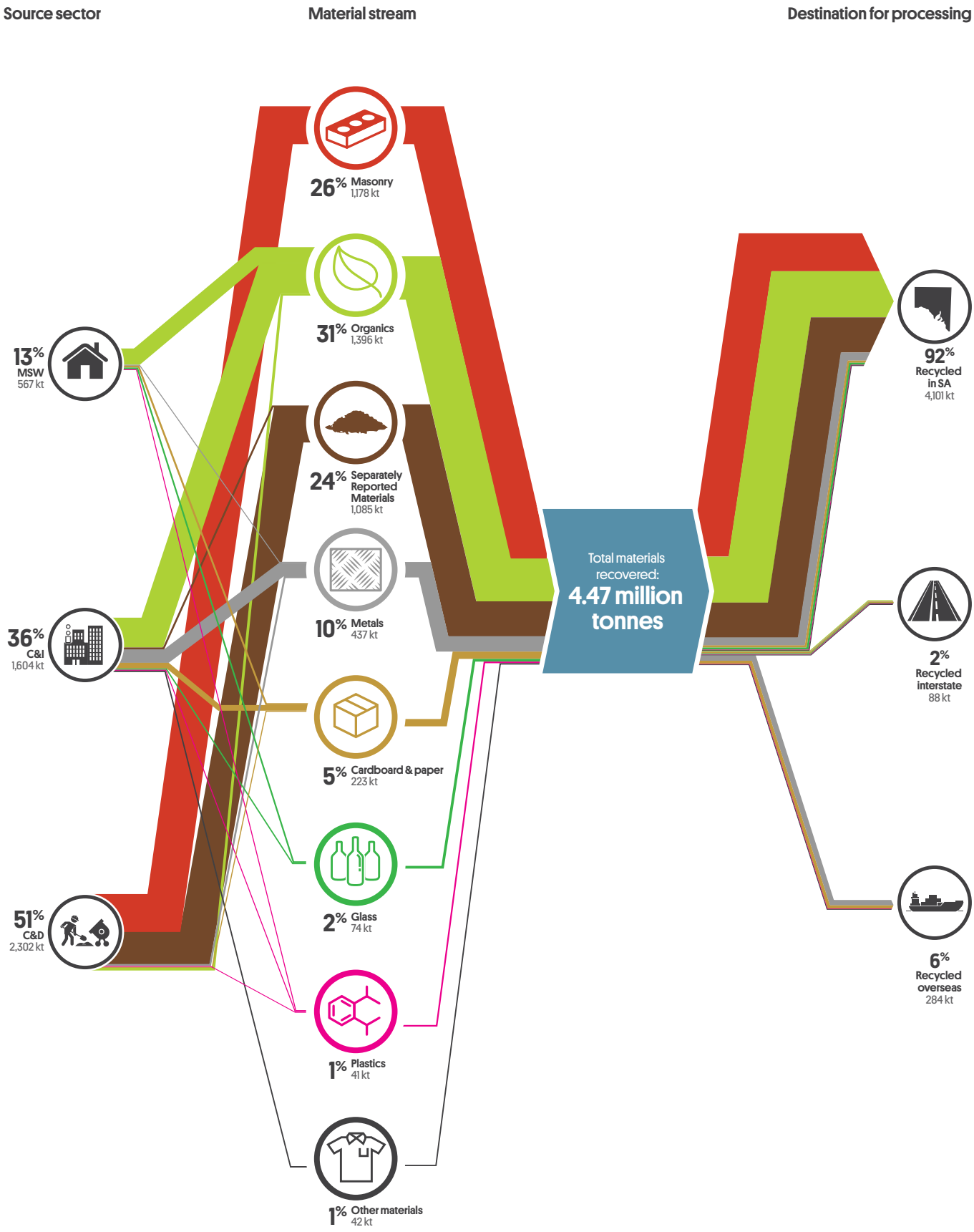


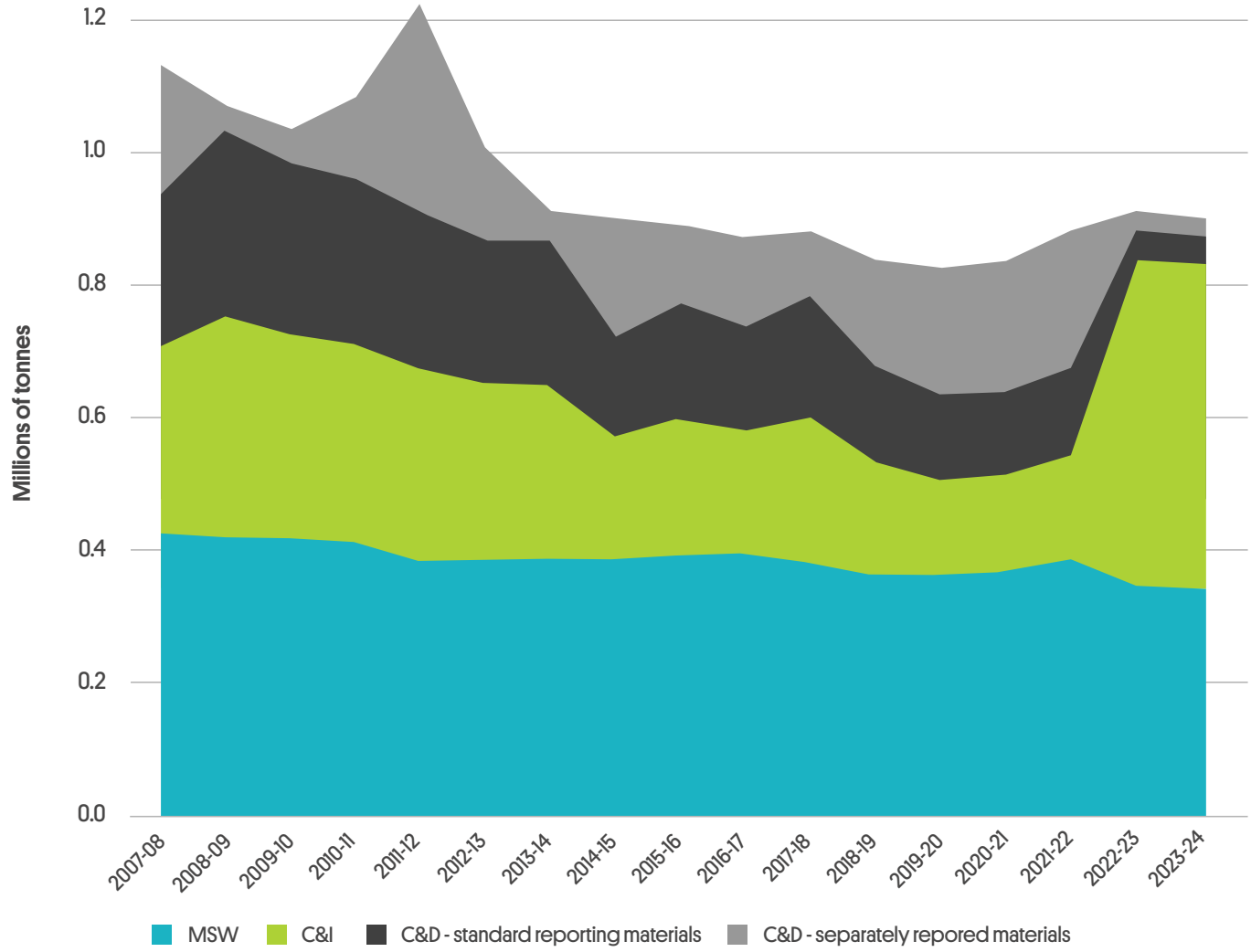
**Figure 4** Resource recovery, including energy recovery, SA, 2023-24, by material, source stream and destination, not including e-waste



## Landfill disposal

SA disposed about 903 kt of waste to landfill in 2023-24, a decrease from the 914 kt landfilled in 2022-23. No deduction is made for cover materials.[4] Figure 5 displays trends for disposal by source stream[5], and shows that most landfill waste is from the C&I stream.

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




4 In accordance with Schedule 4 of the Environment Protection Regulations 2009, SA EPA provides for a discount levy rate for daily cover at landfills required to use cover in their licence. The discount applies to 10% of the leviable tonnes received. The Australian Standard for Waste and Resource Recovery Data and Reporting states that 'the quantity of waste allocated to the fate 'disposal' includes waste used for landfill cover and capping'. As the default 10% deduction does not clarify the proportion of non-waste used as cover, this analysis includes all material reported by SA EPA as being sent to landfill in 2023-24 as waste.

5 The partitioning method for source streams of waste to landfill was changed in 2022-23 based on an audit of several C&I transfer station in 2022 and SA EPA mass balance reporting data.

## Source streams

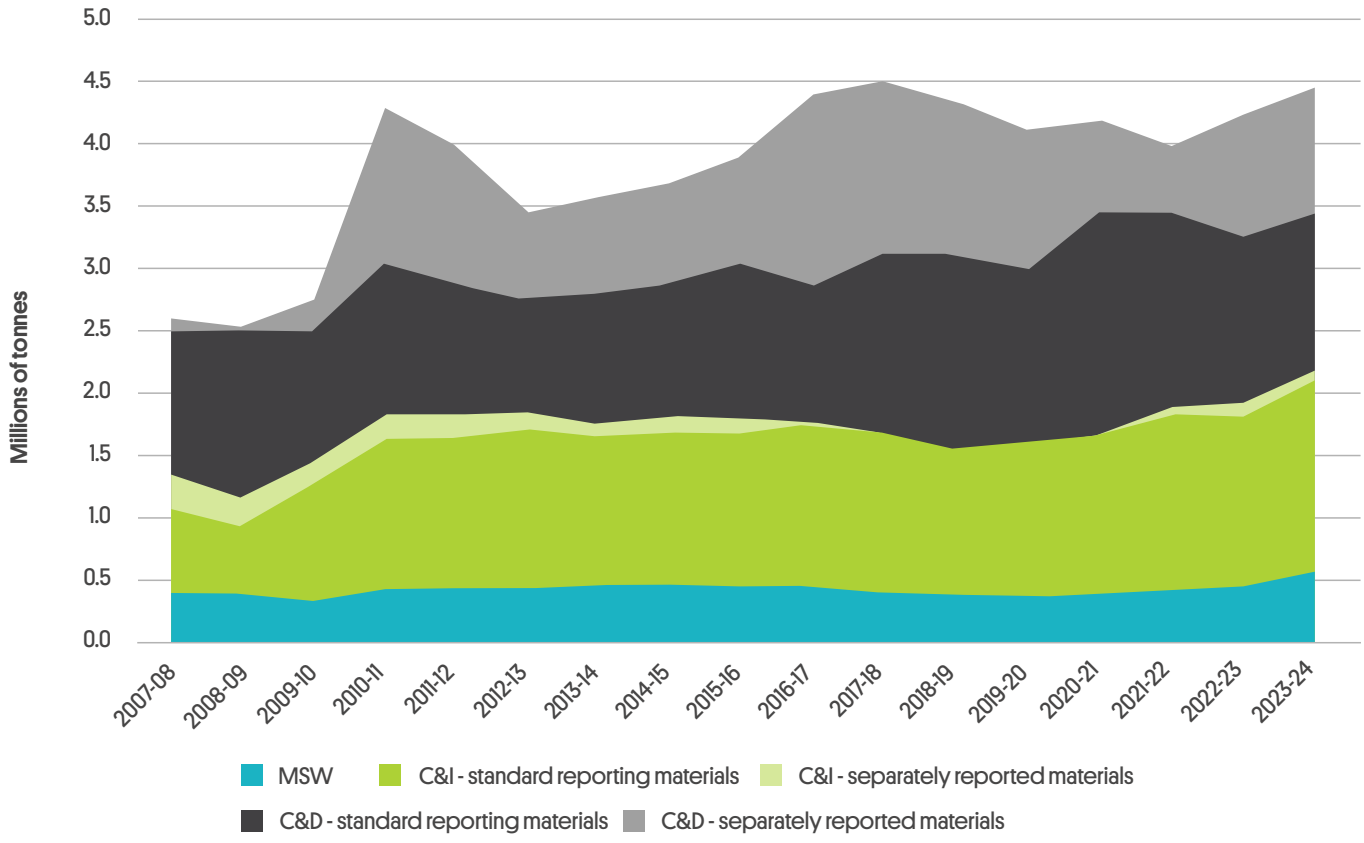
The source stream origin for SA waste and recovered materials in 2023-24 is shown in Table 4, Figure 6 and Figure 7. Like previous years, the biggest portion of recovered materials was C&D waste (51%), followed by C&I (36%) and MSW (13%).

The estimated recovery rate for C&D was the highest in 2023-24 at 97%, followed by C&I at 77% then MSW at 62%. This is largely consistent with 2022-23 although MSW recovery is higher.

**Table 4** South Australia recovery and landfill disposal by source stream in 2023-24[6]

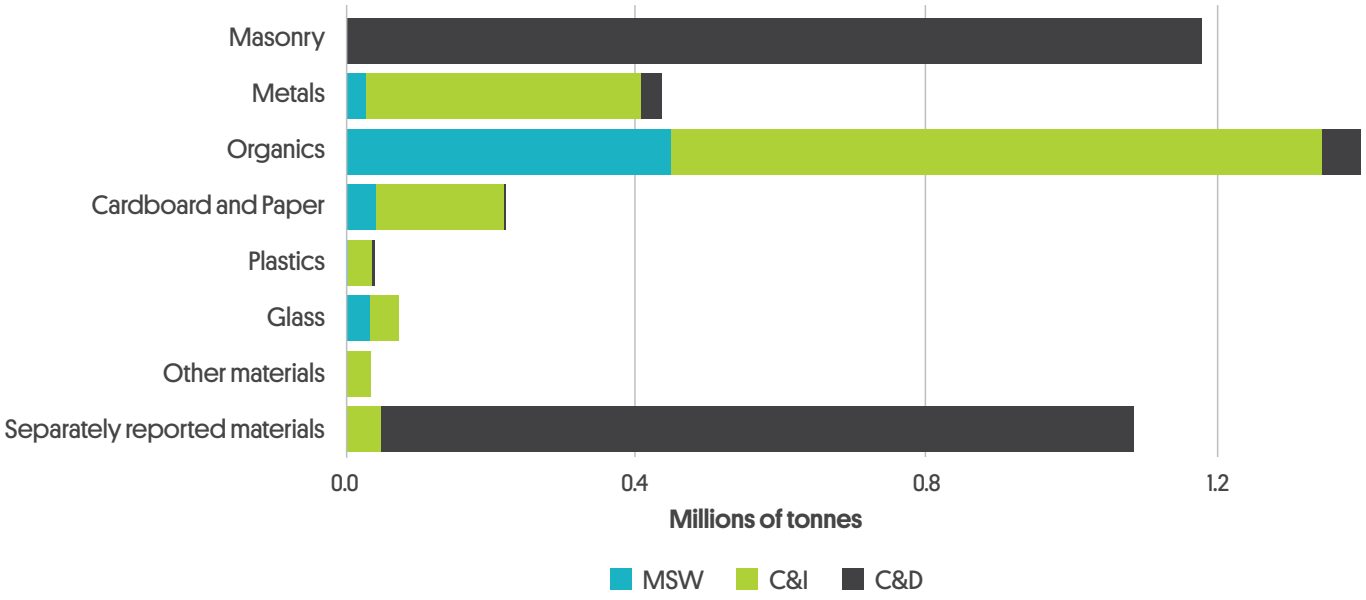
| | Recovery | | Landfill disposal | | Recovery rate |
|---|---|---|---|---|---|
| Sector | kt | % of total | kt | % of total | |
| MSW | 567 | 13% | 343 | 38% | 62% |
| C&I | 1,604 | 36% | 488 | 54% | 77% |
| C&D | 2,300 | 51% | 72.2 | 8% | 97% |
| **Total** | **4,470** | | **903** | | **83%** |

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




6 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 S2 and Table 12.

**Figure 7** Source stream of recovered materials by material category, SA, 2023-24




## Geographical origin

Metro SA contributed about 3,830 kt (86%) of the state's total recovered materials in 2023-24, and 636 kt (70%) of total disposed waste. About 86% of waste generated in metropolitan SA was recovered.

Reported material recovery from regional SA contributed 645 kt (14%) of total recovered materials in the 2023-24 financial year. Landfills in regional SA received about 267 kt (30% of all SA disposal) of waste to landfill, representing a regional recovery rate of 71%.

When comparing 2023-24 to 2022-23:

- Metropolitan recovery grew from 3,420 kt to 3,830 kt and disposal tonnes fell slightly from 656 kt to 636 kt, which resulted in an overall increase in the recovery rate from 84% to 86%.
- Regional recovery fell to 645 kt from 820 kt and regional disposal rose slightly from 260 kt to 267 kt, resulting in a decrease in the regional recovery rate from 76% to 71%. A significant portion of this decrease is due to less waste fill recovered from regional areas in 2023-24.

**Table 5** SA recovery and landfill disposal by geographical origin in 2023-24

| | Recovery | | Landfill disposal | | Recovery rate |
|---|---|---|---|---|---|
| Sector | kt | % of total | kt | % of total | |
| Metro | 3,830 | 86% | 636 | 70% | 86% |
| Regional | 645 | 14% | 267 | 30% | 71% |
| **Total** | **4,470** | | **903** | | **83%** |

The locations of SA's recycling and reprocessing facilities are shown overleaf in Figure 8 and Figure 9.

**Figure 8** Approximate geographical location of main sites of recyclers and reprocessors in SA

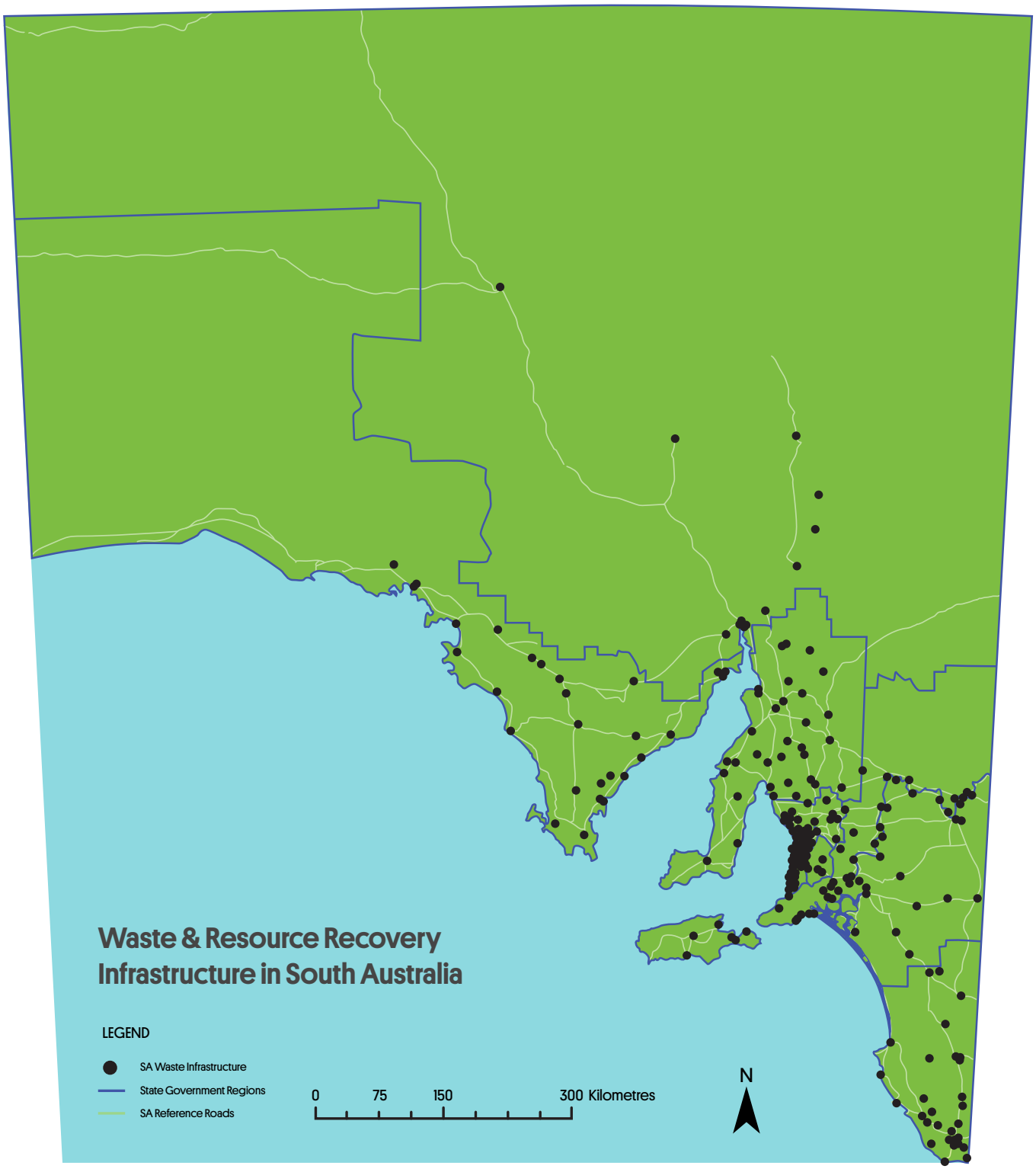
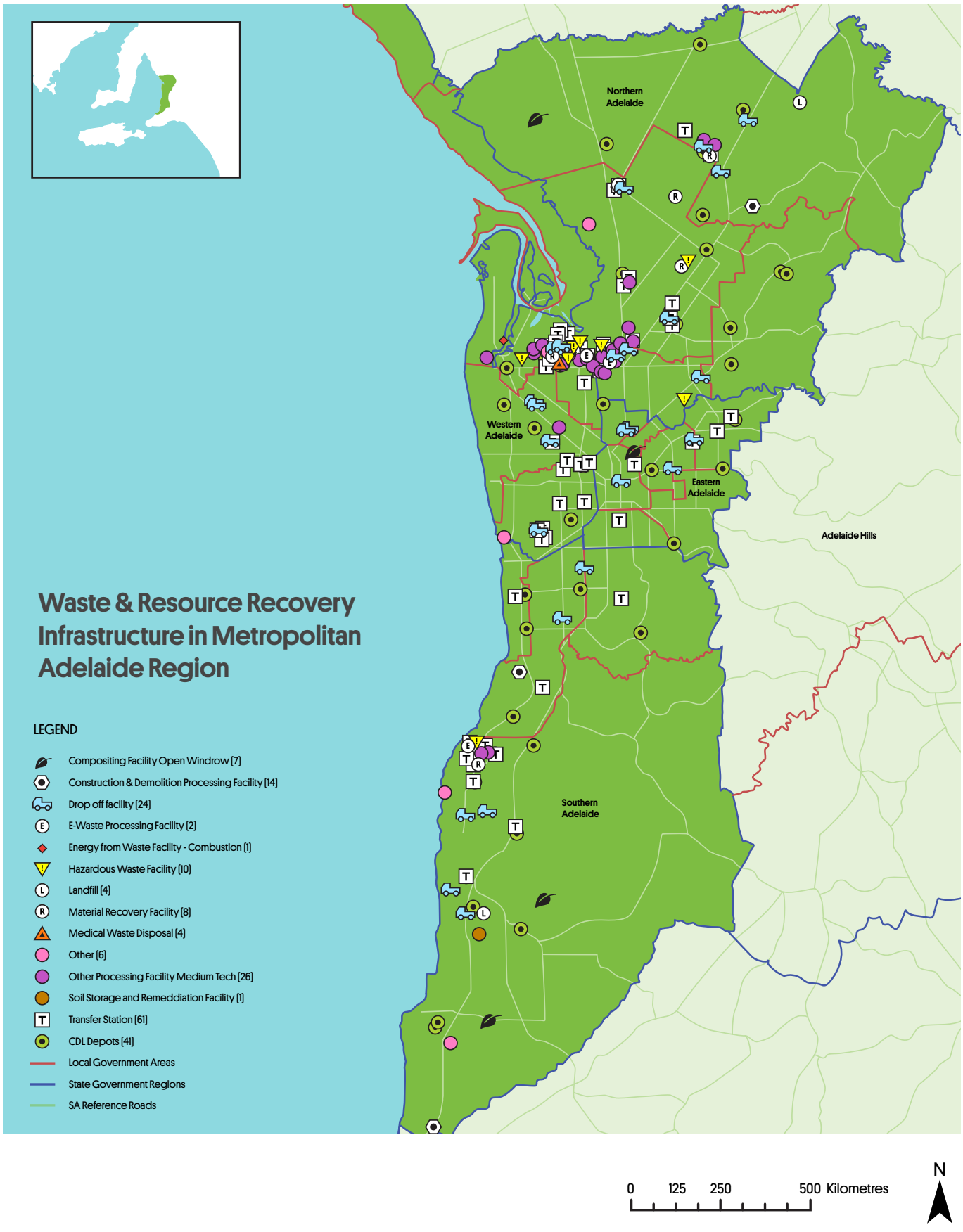


**Figure 9** The locations of main sites of recyclers and reprocessors in Adelaide



## Destination for recovered materials

Most materials recovered in South Australia are reprocessed within the state (92%). In 2023-24, about 2% of materials were reported as reprocessed interstate and 6% reprocessed overseas. In comparison, in 2022-23, about 3% was sent interstate and 5% sent overseas. Table 6 summarises recovery of SA materials by reprocessing destination and Table 7 provides a more detailed breakdown by material category.

Survey data was supplemented by data on exports of waste-derived materials from the Australian Bureau of Statistics. These materials were counted as recovered as they were assumed to be sent overseas for recycling. In the recent past, waste-derived materials exported for recycling were often poorly-sorted and contaminated with 'off-spec' materials. Contamination of exported waste-derived paper and plastic is now greatly reduced due to Australian Government regulation of these flows and investment by Australian recyclers in generating products that more closely meet the export specifications. MRF operators have responded to this with investment in new sorting technology.

**Table 6** Destination of SA sourced materials in 2023-24

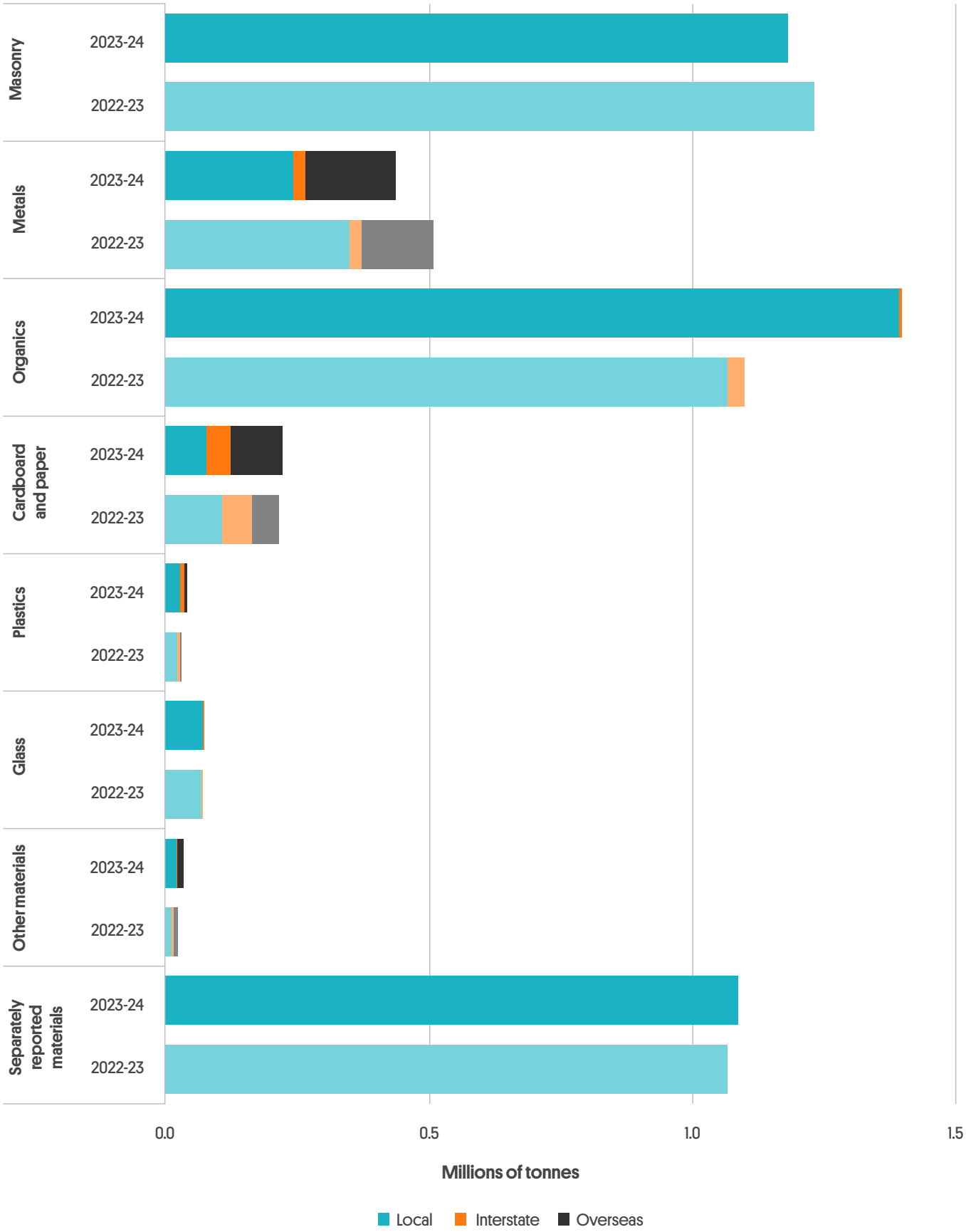
| | Recovery | |
|---|---|---|
| **Destination** | **kt** | **% of total** |
| SA | 4,100 | 92% |
| Interstate | 87.6 | 2% |
| Overseas | 284 | 6% |
| **Total** | **4,470** | |

All recovered masonry, organics and separately reported materials (clay, fines, rubble and soil) and a high proportion of glass (97%) were reprocessed locally in SA in 2023-24. Most scrap plastic was reprocessed in SA (69%), with 20% sent interstate and 11% sent overseas. Approximately 61% of 'other materials' was reported as reprocessed in SA, while 9% was sent interstate and 30% sent overseas for reprocessing. About half of scrap metal was reported as reprocessed in SA, 6% interstate and 39% overseas. Most cardboard and paper generated was processed overseas (44%), 36% within SA and the remainder was sent interstate (21%).

**Table 7** Destination of SA sourced materials in 2023-24 by material category

| | Percent of material recovered (%) | | |
|---|---|---|---|
| **Material category** | **SA** | **Interstate** | **Overseas** |
| Masonry | 100% | 0% | 0% |
| Metals | 56% | 6% | 39% |
| Organics | 100% | 0% | 0% |
| Cardboard and paper | 36% | 20% | 44% |
| Plastics | 69% | 20% | 11% |
| Glass | 97% | 3% | 0% |
| Other materials | 61% | 9% | 30% |
| Separately reported materials | 100% | 0% | 0% |
| **Total** | **92%** | **2%** | **6%** |

**Figure 10** Destination of SA sourced materials by material category in 2022-23 and 2023-24



## Energy recovery

Table 8 shows total resource recovery of SA materials in 2023-24, split between waste reuse, 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. Waste reuse is the reuse without processing of a product or material that has entered a waste and resource recovery facility. The tonnages allocated to this fate are all waste soils.

About 159 kt of SA materials were estimated as recovered for their energy value in 2023-24, compared to 194 kt in the previous year.

**Table 8** Material and energy recovery, SA, 2023-24

| Recovery type | kt | Contribution to recovery rate (%) |
|---|---|---|
| Material recovery | 4,120 | 92% |
| Energy recovery | 159 | 4% |
| Waste reuse | 192 | 4% |
| **Total (resource recovery)** | **4,470** | |

## Imports

The survey covered reporting of waste and recovered materials imported from interstate or overseas for information purposes but these do not count towards SA's recycling performance. Reported imports of waste and recovered materials into SA in 2023-24 are shown in Table 9.

**Table 9** Materials reported as imported to SA for resource recovery in 2023-24, tonnes

| | Imported tonnes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Material category** | **ACT** | **NSW** | **NT** | **Qld** | **Tas** | **Vic** | **WA** | **Overseas** | **Total** |
| Masonry | - | - | - | - | - | - | - | - | - |
| Metals | - | - | - | - | - | - | - | - | - |
| Organics | - | - | - | - | - | 38,000 | - | - | 38,000 |
| Cardboard and paper | - | - | - | - | - | 110 | - | - | 110 |
| Plastics | - | 3,160 | 70 | 3,160 | - | 3,240 | 3,220 | - | 12,900 |
| Glass | - | 21,000 | 2,000 | 3,000 | - | 18,000 | - | - | 44,000 |
| Other materials | - | - | - | - | - | - | - | 50 | 50 |
| **Total** | **-** | **24,200** | **2,100** | **6,160** | **-** | **59,400** | **3,220** | **50** | **95,100** |

Imports of scrap material from other states was well reported for 2023-24 compared to 2022-23. The uptake of container deposit schemes in other states around Australia may have contributed to the increase in glass and plastics imported to SA for reprocessing in 2023-24. NSW and Vic were the most significant sources of imported scrap.

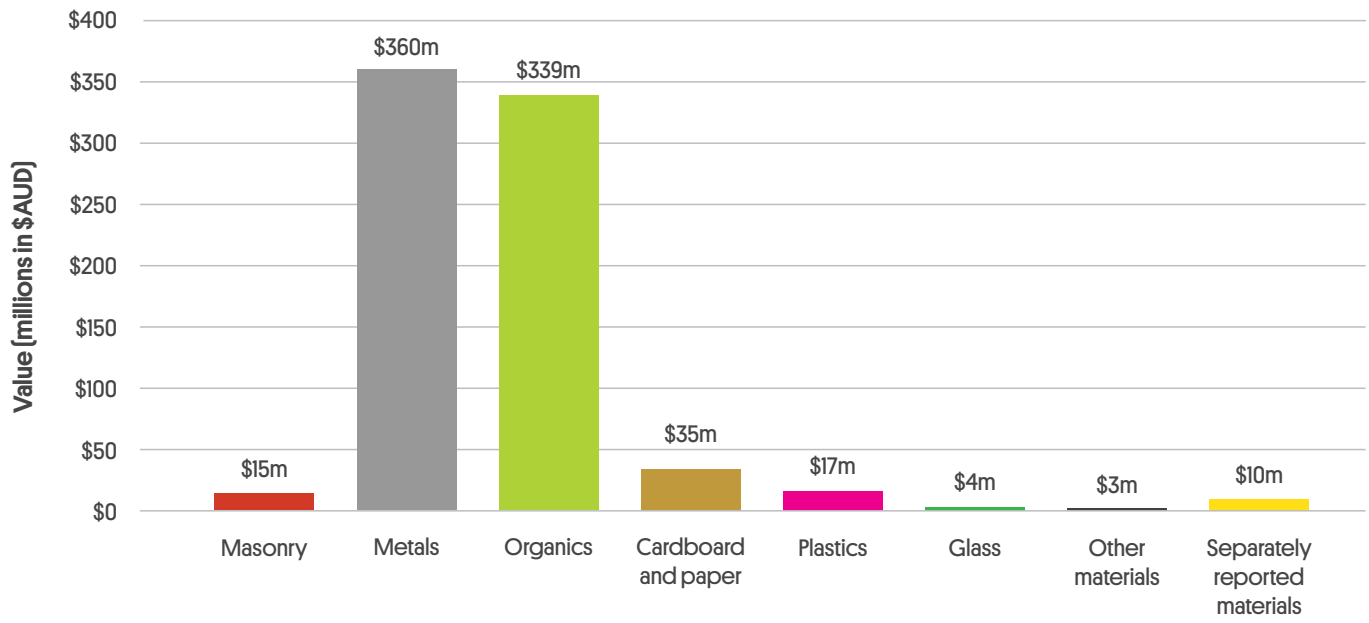
## Market value of resource recovery

Survey participants were asked about the average value for their products, and these were used to estimate the total market value of resource recovery in SA. Table 10 lists the estimated on-sale price per tonne for different recovered materials. The values in Table 10, coupled with recovered tonnes, were used to estimate the total market value of resource recovered materials seen in Figure 11. A more detailed breakdown of the value of resource recovery in SA is provided in Section 7.

**Table 10** Assumed values for recovered materials in SA in 2023-24 based on survey responses

| Material category or type | Estimated on-sale price ($/t) |
|---|---|
| Masonry | $13 |
| Metals – steel | $524 |
| Metals – non-ferrous including aluminium | $2,800 |
| Organics – meat rendering | $2,000 |
| Organics – garden organics, food organics and timber | $164 |
| Other organics | Variable |
| Cardboard and paper | $155 |
| Plastics | $393 |
| Glass | $54 |
| Textiles and leather | $178 |
| Tyres and other rubber | $60 |
| Separately reported materials and clean fill | $9 |

**Figure 11** Estimated market value of resource recovered material in SA during 2023-24



Metals represent the largest share of the market value amongst recovered materials in 2023–24 at $360 million. This is a decrease on the previous years at $465 million. Higher prices for scrap metal results in drawdown of stockpiles, while lower prices are associated with growth in stockpiles.

Organics were the next largest share at $339 million. Recovered organics, particularly meat rendering products such as tallow, have a high value per tonne. The higher volumes of timber reported as recovered in 2023-24 compared with previous years also contribute to the higher estimated value of organics in 2023-24.

The value of scrap cardboard and paper was about $35 million, higher than the $23 million estimated for 2022-23 but still not as high as 2020-21 ($44 million). Scrap plastics had a market share of $17 million. The average reported values of plastics ranged from HDPE, which had the highest at about $900 per tonne, down to mixed plastics, which had the lowest at $112 per tonne.

Recovered masonry materials contributed about $15 million in 2023-24. The value of masonry has remained relatively steady across the previous two years. Separately reported materials, mostly clay, fines, rubble and soil, were valued at about $10 million. This is slightly higher than in 2022-23.

Recovered glass contributed $4 million. Although the overall volumes were consistent with 2022-23, a lower proportion of the recovered glass was reportedly from food and beverage containers which have higher value, bringing the total value of recovered glass down from $8.5 million in 2022-23.

Other recovered materials (including foundry sands, leather and textiles, and tyres and other rubber) were worth about $3 million.

In total, the estimated value of SA's resource recovery in 2023-24 was about $783 million. This is lower than 2022-23 when the total value was approximately $811 million.

## Disaster waste

The State Government waived the landfill levy for about 7,880 tonnes sent to landfill in 2023-24. This was to assist communities with the cost of waste disposal after natural disasters and severe weather. The 2022-23 River Murray region flood event waste cleanup began in early 2023 with the program concluding in March 2025.

Approximately 33.7 kt of flood-affected materials were removed from the River Murray region (Green Industries SA, 2024) including:

- 2.9 kt of green waste and sandbags sent for composting or to be used as cover material
- 16.6 kt of additional material diverted from landfill for recycling
- 14.2 kt sent to landfill.

## 2.2 Performance against state targets

In 2020, Green Industries SA released *South Australia's Waste Strategy 2020-25*. The strategy defines waste recovery and reduction targets to 2025, which are guided by an overall target of zero avoidable waste to landfill by 2030.[7] This section details SA's progress in achieving these targets.

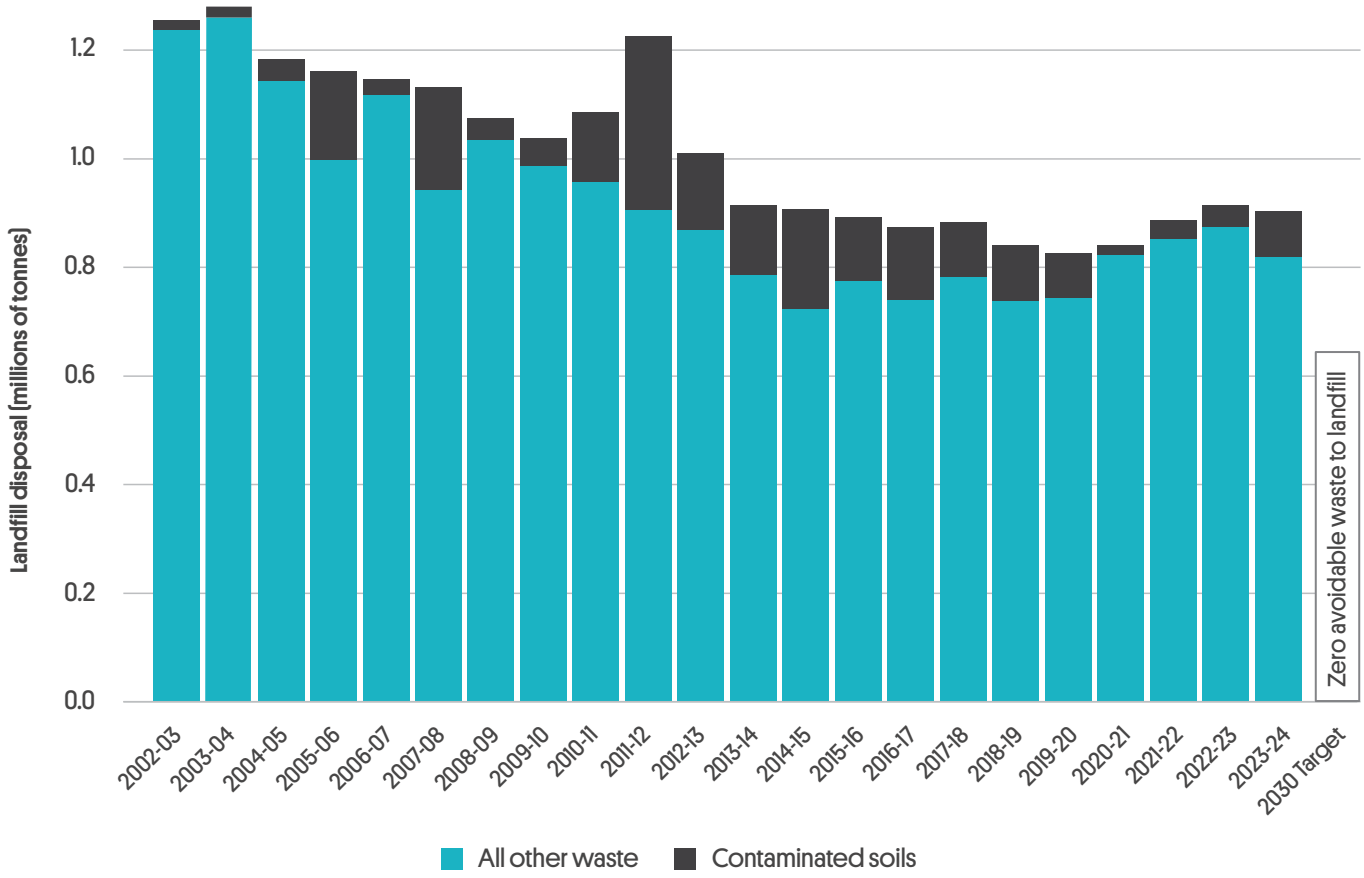
### Landfill diversion target

*South Australia's Waste Strategy 2020-25* sets out a goal for zero avoidable waste to landfill by 20307. The State disposed of about 902 kt of waste to landfill in 2023-24, a decrease from 914 kt of in 2022-23, 885 kt in 2021-22, 840 kt in 2020-21 and 827 kt 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 2023-24 are equivalent to a reduction of 29% against the 2002-03 levels.

**Figure 12** Landfill disposal trend since 2002-03, including state target for 2030




7 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.

## Waste generation target

*South Australia's Waste Strategy 2020-25* sets a target for a 5% reduction in waste generation per capita from a 2019-20 baseline by 2025. Table 11 summarises a five-year trend in waste generation per capita for all reported materials. Waste generation per capita rose by 70 kilograms (2.5%) in 2023-24 compared to 2022-23 and was 2.2% higher than 2019-20. Waste generation per capita has been increasing since 2021-22.

**Table 11** Waste generation per capita since 2019-20, including the state target for 2025

| | | | | | | Change (%) | Target |
|---|---|---|---|---|---|---|---|
| Recovery type | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | 22-23 to 23-24 | 2025 |
| Waste generation per capita (kg/person/yr) | 2,800 | 2,840 | 2,680 | 2,790 | 2,860 | 2.5% | 5% reduction from 2020 baseline |

## Metropolitan recovery target

SA has established targets for waste recovery from landfill from its metropolitan region by source stream. The State goal for 2025 is 75% recovery for MSW, 90% recovery for C&I, and 95% recovery for C&D. Table 12 presents the recovery rate achieved in metropolitan SA in 2023-24, together with State targets for 2023 and 2025.

In 2023-24, the metropolitan C&D recovery rate was 96%, C&I source stream recovery rate was 78%, and the MSW recovery rate was 66%. Similarly, in 2022-23, the C&I recovery rate was 75.6%, the C&D recovery rate was 97.4%, and the MSW recovery rate was 61.7%.

**Table 12** Metropolitan recovery rate for standard reporting materials in SA, 2023-24, including state targets to 2025

| | | Metropolitan recovery target | |
|---|---|---|---|
| Source sector | 2023-24 recovery rate | 2023 | 2025 |
| MSW | 67% | 65% | 75% |
| C&I | 78% | 85% | 90% |
| C&D | 96% | 90% | 95% |


## 2.3 Local government diversion

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.

Table 13 shows data on materials collected in household residual, recycling and organics bins at kerbside in SA in 2023-24. About 693 kt of kerbside materials were collected, of which 530 kt were from the metro region and 163 kt were from regional areas. This was very similar to the past two years. Most kerbside waste was collected in residual bins (349 kt), followed by organics bins (214 kt), and recycling bins (129 kt).

SA's recovery rate for kerbside waste in 2023-24 was an estimated 49.6%, a decrease from the previous year's rate of 51.2%. Recovery was higher for metropolitan councils (52.2%) than regional councils (41.3%), both of which were slightly lower than in 2022-23.

**Table 13** Materials collected from households at kerbside in SA in 2023-24

| Region | Collected at kerbside (kt) | | | | Recovery rate (%) |
|---|---|---|---|---|---|
| | Residual | Recycling | Organics | Total | |
| Metro | 254 | 99 | 178 | 530 | 52.2% |
| Regional | 96 | 31 | 37 | 163 | 41.3% |
| SA | 349 | 129 | 214 | 693 | 49.6% |

The household hazardous waste collection program offers free drop-off for hazardous waste items in SA. This prevents hazardous substances from ending up in landfill. Table 14 summarises the material collected through the program.

**Table 14** Household hazardous waste collection, 2023-24

| Hazardous waste | Tonnes |
|---|---|
| Aerosol Cans | 4.6 |
| Batteries | 7.6 |
| Corrosives | 2.9 |
| Fertilisers | 1.4 |
| Fire Extinguishers | 6.5 |
| Flammables | 31.3 |
| Fumigants | <0.1 |
| Gas Bottles | 27.1 |
| Heavy Metals and Compounds | <0.1 |
| Inert Liquids | 62.2 |
| Isocyanates | <0.1 |
| Lead Based Compound | <0.1 |
| Light Tubes | 4.6 |
| Oils | 81.0 |
| Oxidisers | 1.2 |
| Paint | 4.1 |
| Pesticides | 2.6 |
| Pharmaceuticals | <0.1 |
| Poisons | <0.1 |
| Preservatives | 9.7 |
| Smoke Detectors | 0.1 |

## Recovery by region

Table 15 shows population and kerbside data for 2023-24 at the sub-region level, including kilograms of kerbside waste per capita. Within metropolitan SA, the Central Eastern and Southern sub-regions achieved the highest overall recovery rates at 55%, followed by the Western (52%) and then Northern (48%) sub-regions. The Central Eastern region generated the least waste per capita (361 kg per person) followed by the Northern region and then the Western region.

Regional SA generated 379 kg of kerbside waste per capita and had the lowest recovery rate at 41%, which is slightly less than 2022-23 (44%).

**Table 15** Population and kerbside data statistics by region

| Region or sub-region | Population | Kerbside waste collected (kt) | Kerbside waste per capita (kg/capita) | Recovery rate |
|---|---|---|---|---|
| Metro | 1,390,000 | 530 | 381 | 52% |
| Central Eastern | 285,000 | 103 | 361 | 55% |
| Northern | 387,000 | 144 | 373 | 48% |
| Southern | 349,000 | 142 | 407 | 55% |
| Western | 369,000 | 141 | 381 | 52% |
| Regional | 430,000 | 163 | 379 | 41% |
| **SA** | **1,821,000** | **693** | **381** | **50%** |

## Coverage

Nearly all households in SA are provided a kerbside service. According to the *National waste and resource recovery report 2024* (Blue Environment 2024), about 91% of SA's population are provided with a residual waste service, 90% have a recycling service and 87% have an organics service.[8]

8 *The National Waste Report 2022*, used as the source data for this section of previous Circular Economy Resource Recovery Reports, reported access to kerbside services using a third-party database. That data showed the proportion of the population residing in local government areas where particular services are offered. This was incorrectly reported as the proportion of the population with actual access to each service type. The proportions shown in that report were consequently inflated and are superseded by the values shown here, which are the proportions of the population who have each type of service at their property.

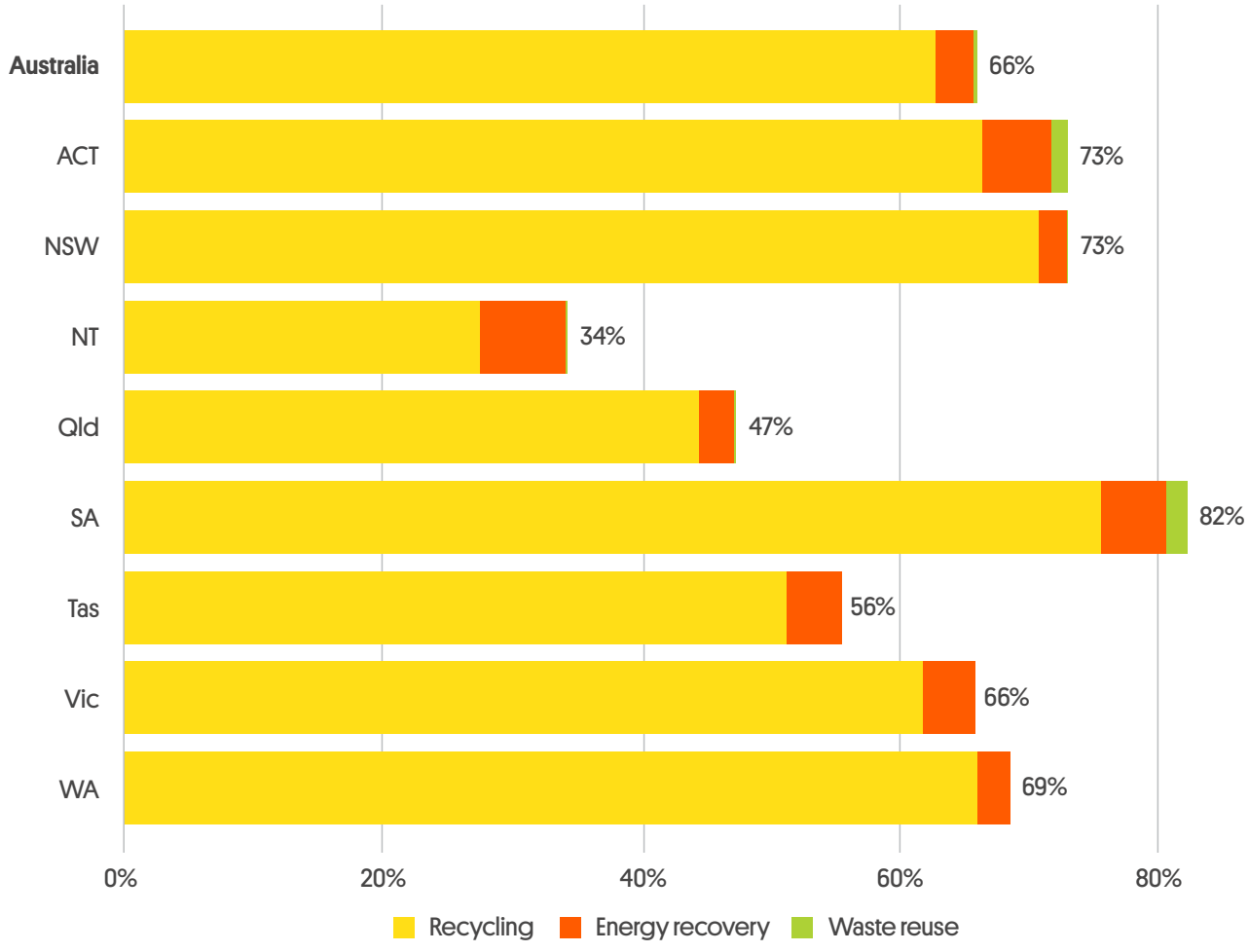
## 2.4 Comparative performance with other jurisdictions

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 and resource recovery report 2024* (Blue Environment 2024), released by the Department of Climate Change, Energy, the Environment and Water, adjusts these methods to present a consistent as possible comparison of recovery rates across states and territories.

Figure 13 is taken from the *National Waste and Resource Recovery Report 2024* and shows recycling, waste reuse and energy recovery and overall recovery rates for each Australian jurisdiction in 2022-23. SA had the highest recovery rate of 82%.[9] The next highest rate was 73%, achieved by ACT and NSW. Overall, Australia achieved a recovery rate of 66% in 2022-23.

**Figure 13** Resource recovery and recycling rates by jurisdiction, 2022-23




*Source: National Waste and Resource Recovery Report 2024 [Blue Environment 2024]*

9 This differs from the value reported in the CERRR 2022-23 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 survey asked SA recyclers about their workforce and employment details, and Table 16 and Table 17 summarise the results. 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 16 shows the number of reported full-time equivalent employees in SA's resource recovery sector over the last few years. In 2023-24, 1,575 equivalent full-time employees were reported across recycling businesses that processed about 71% of total recovered materials. The true number of people employed in the resource recovery sector may be significantly higher. Some companies making large contributions to resource recovery in SA did not respond to this question.

**Table 16** Reported full-time equivalent employees in SA's resource recovery sector survey results

| Employment category | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 |
|---|---|---|---|---|---|
| Total full time equivalent employees | 2,098 | 2,108 | 1,957 | 1,701 | 1,575 |

The survey asked respondents to breakdown their reported workforce by employment classification. The results are shown in Table 17 with results of previous years. Machinery operators were the most reported employee classification, followed by employees engaged in sorting, then drivers and administrators. There has been little variation in the proportions since 2019-20.

**Table 17** Full time equivalent employees in SA's resource recovery sector by employee type

| Employment type | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 |
|---|---|---|---|---|---|
| Administration | 15% | 13% | 14% | 13% | 13% |
| Construction /design | 0.5% | 0.2% | 0.0% | 0.1% | 5% |
| Driver | 17% | 18% | 14% | 13% | 16% |
| Machinery operator | 26% | 31% | 37% | 28% | 31% |
| Other | 7% | 6% | 3% | 11% | 5% |
| Sales/ marketing | 4% | 5% | 3% | 5% | 9% |
| Sorting | 4% | 3% | 8% | 14% | 6% |
| Supervisor | 5% | 7% | 5% | 5% | 4% |
| Technical support | 4% | 8% | 11% | 9% | 3% |
| Unskilled | 17% | 9% | 4% | 3% | 7% |


## 2.6 The circular economy

### Industry engagement with the circular economy concept

The survey asked companies and organisations to nominate which factors were of the highest priority, in a circular economy, for selecting the end destination of the materials they receive. The results to this question are shown in Table 18. Not all survey participants provided a response to this question, but based on available data, the desire to recover materials was as important as financial reasons.

**Table 18** Responses to the question "which of the following factors is your highest priority when identifying the reprocessing destination for sourced goods and materials in a circular economy?"

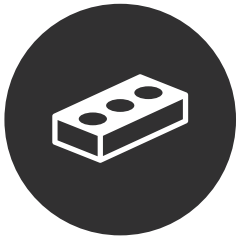
| Circular economy factor | Proportion of responses |
|---|---|
| Financial | 11% |
| Avoiding landfill | 13% |
| Goods or material can be recycled | 16% |
| Made their own response | 19% |
| No response | 40% |


VEOLIA
ENVIRONMENTAL
SERVICES

# 3 Material resource recovery reports

This section presents the key findings from analysis of 2023-24 survey data by material category and type. The materials covered in this section are:

- masonry – asphalt, bricks, concrete, plasterboard
- metals – steel, aluminium, and non-ferrous metals
- organics – food organics, garden organics, timber, and other organics
- cardboard and paper – cardboard, liquid paperboard, magazines and newsprint, and printing and writing paper
- plastics – polyethylene terephthalate (PET), high density polyethylene (HDPE), polyvinyl chloride (PVC), low density polyethylene (LDPE), polypropylene (PP), polystyrene (PS), mixed and other plastics
- glass – glass from food and beverage containers, and other glass
- other materials – foundry sands, leather and textiles, and tyres and other rubber
- non-standard materials - fly ash and clay, fines, rubble and soil



## 3.1 Masonry

About 1.18 million tonnes of masonry was recovered in SA in 2023-24 which is a slight decrease from 2022-23 (1.23 million tonnes).

Concrete contributed the greatest proportion of reported masonry materials (76%), asphalt (21%), bricks (3%) and plasterboard (<1%). Concrete recovery was approximately 10% lower than in 2022-23. This may be due to reduced major demolition and construction activity in the period – recyclers commented that while demand for material is high, it is difficult to obtain material. Reported recovery of bricks increased to be closer to the recovery rates reported prior to 2020.

Clays, fines, rubble and soil were previously reported in this sub-section but for the 2023-24 CERRR can be found in sub-section 3.8.

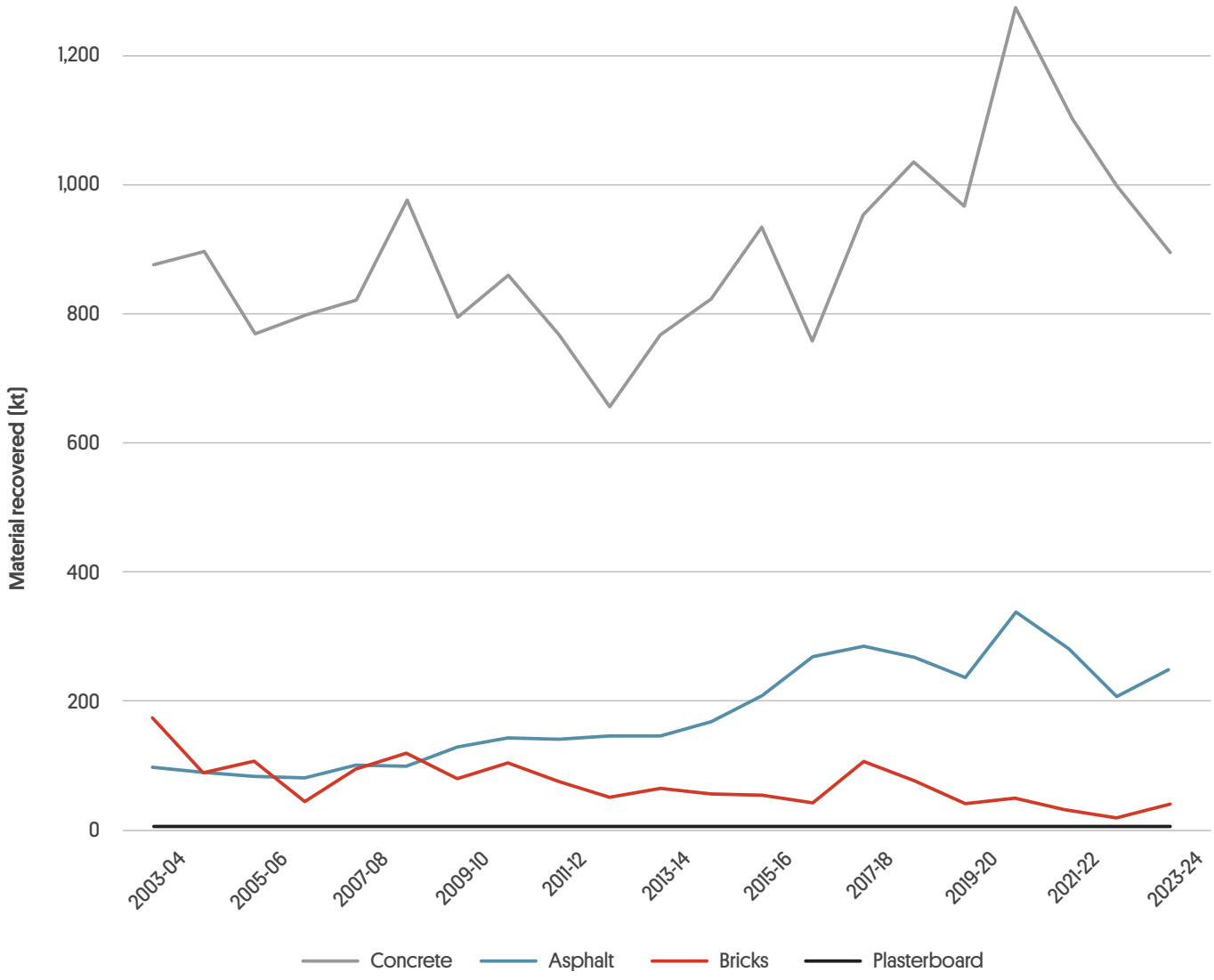
Table 19 summarises masonry recovery in 2023-24.

**Table 19** Masonry recovered, SA, 2023-24

| Material type | Net recovery (kt) |
|---|---|
| Asphalt | 245 |
| Bricks | 35.3 |
| Concrete | 898 |
| Plasterboard | 0.34 |
| **Total** | **1,180** |

Figure 14 and Figure 15 show trends in masonry materials types over time, while Figure 15 compares the reported composition of masonry materials in 2022-23 and 2023-24.

**Figure 14** Masonry recovered since 2003-04




960

**Figure 15** Reported percent composition of masonry recovered in 2022-23 and 2023-24

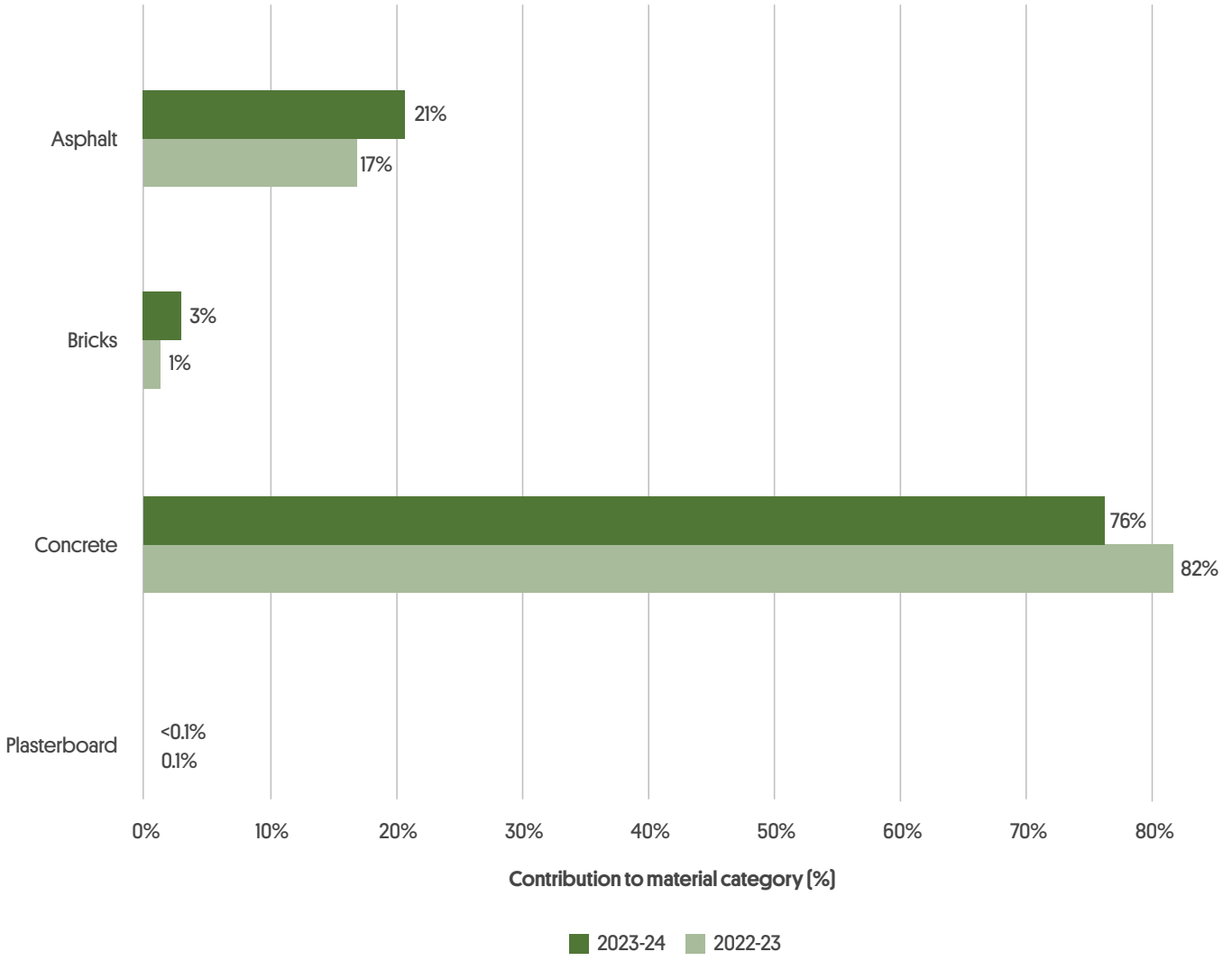



Table 20 presents the source stream, geographical origin and reprocessing location for recovered masonry materials in SA in 2023-24. Masonry is mostly from infrastructure projects in the metropolitan region, and all recovered masonry is reprocessed locally in the State.

**Table 20** Masonry recovered in 2023-24 by source stream, geographical origin and reprocessing location

| | Source stream (%) | | | Geographical origin (%) | | Reprocessing location (%) | | |
|---|---|---|---|---|---|---|---|---|
| **Material type** | **MSW** | **C&I** | **C&D** | **Metro** | **Regional** | **SA** | **Interstate** | **Overseas** |
| Asphalt | 0% | 0% | 100% | 96% | 4% | 100% | 0% | 0% |
| Bricks | 0% | 0% | 100% | 84% | 16% | 100% | 0% | 0% |
| Concrete | 0% | 0% | 100% | 89% | 11% | 100% | 0% | 0% |
| Plasterboard | 0% | 0% | 100% | 89% | 11% | 100% | 0% | 0% |
| **Total** | **0%** | **0%** | **100%** | **90%** | **10%** | **100%** | **0%** | **0%** |

## 3.2 Metals

Recovery of scrap metals declined in the 2023-24 financial year to about 437 kt, compared to the previous year's 507 kt. Recovered metals were mostly steel (379 kt), followed by aluminium (42.0 kt), non-ferrous metals (excluding aluminium) (15.8 kt). Table 21 summarises metals recovery in SA in 2023-24.

**Table 21** Metals recovered, SA, 2023-24

| Material type | Net recovery (kt) |
|---|---|
| Steel | 379 |
| Aluminium | 42.0 |
| Non-ferrous metals (ex. aluminium) | 15.8 |
| **Total** | **437** |

Figure 16 and Figure 17 show metals recovery trends since 2003-04. The percent composition that steel, aluminium and other non-ferrous metals contribute to overall metals recovery is presented in Figure 18.

**Figure 16** Metals recovered since 2003-04 – steel

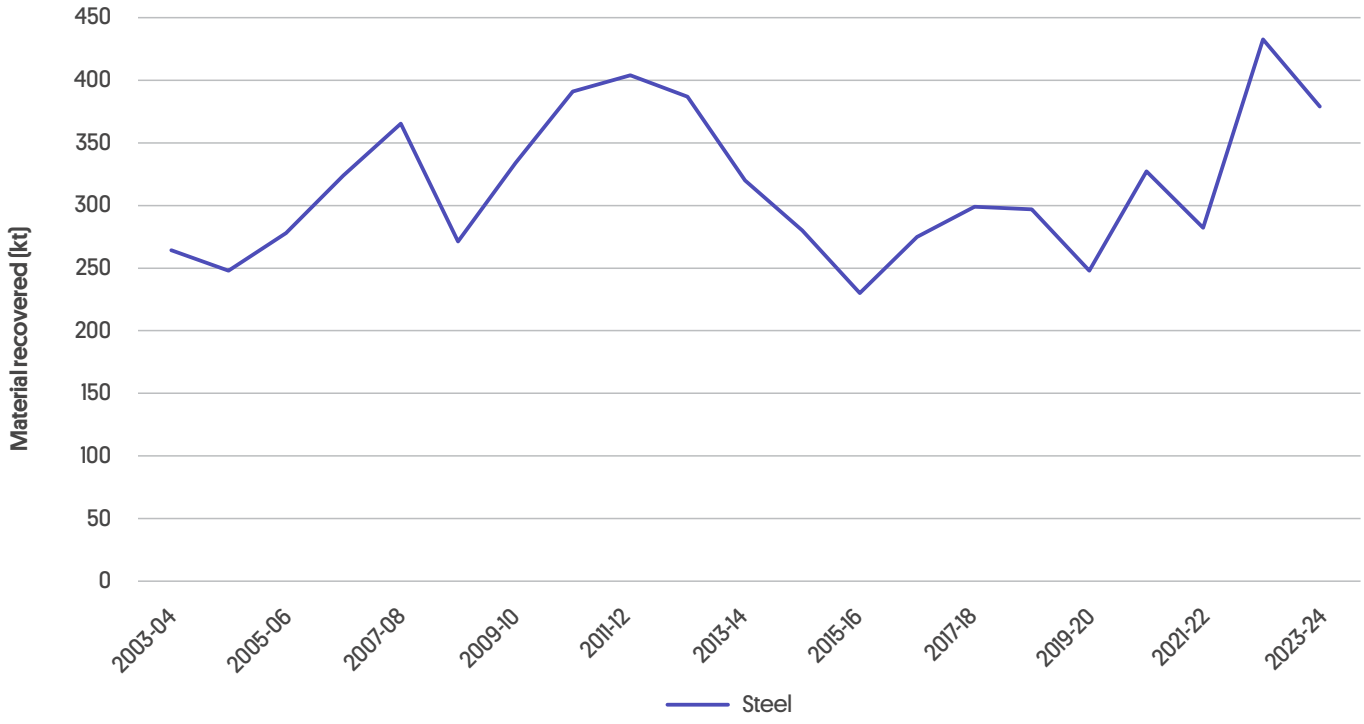



**Figure 17** Metals recovered since 2003-04 – aluminium and other non-ferrous metals

**Figure 18** Reported percent composition of metals recovered in 2022-23 and 2023-24

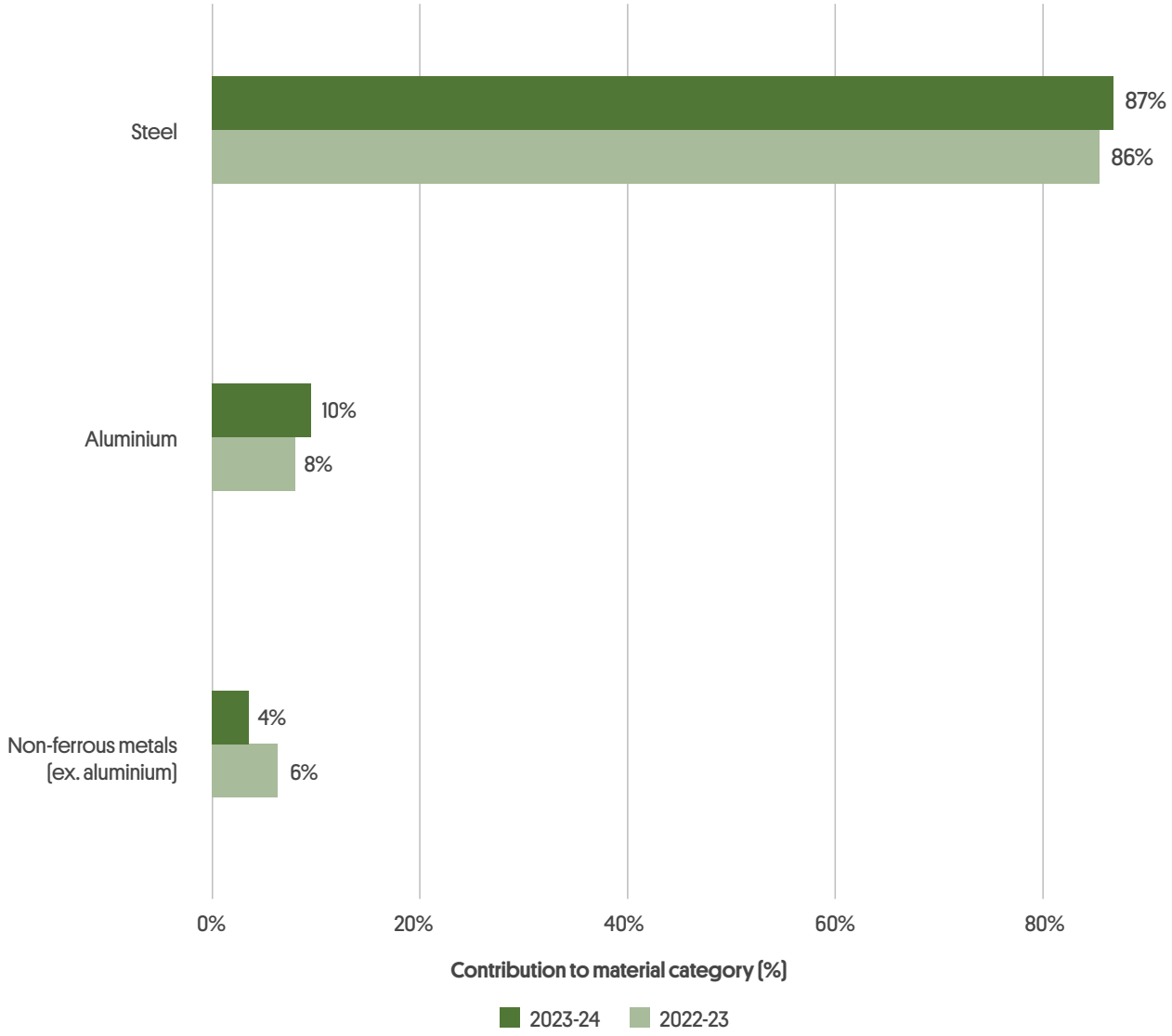



Table 22 shows metals recovered by type, source stream, geographical origin and reprocessing location. Recovered metals were reported as mostly from C&I sources but C&D and MSW each contributed about 7%.

**Table 22** Metals recovered in 2023-24 by source stream, geographical origin and reprocessing location

| | Source stream (%) | | | Geographical origin (%) | | Reprocessing location (%) | | |
|---|---|---|---|---|---|---|---|---|
| **Material type** | **MSW** | **C&I** | **C&D** | **Metro** | **Regional** | **SA** | **Interstate** | **Overseas** |
| Steel | 4% | 89% | 7% | 78% | 22% | 60% | 6% | 34% |
| Aluminium | 36% | 62% | 2% | 74% | 26% | 18% | 0% | 82% |
| Non-ferrous metals (ex. aluminium) | 1% | 93% | 6% | 93% | 7% | 59% | 0% | 41% |
| **Total** | **7%** | **86%** | **7%** | **78%** | **22%** | **56%** | **6%** | **39%** |

## 3.3 Organics

Organics recovery remained strong in 2023-24, with almost 1.40 million tonnes of organic materials recovered. Table 23 summarises the recovery of food organics, garden organics, timber and other organics in SA in 2023-24.

As in previous years, the group of 'other' organics, which includes meat rendering, waste grease and fat, waste sludge and biosolids and miscellaneous organics, contributed about half of overall organics recovery, at 47%, accounting for 656 kt recovered.

Most recovered garden and food organics is from municipal combined food organics and garden organics (FOGO), of which 303 kt was recovered. This material is reported in the following tables and charts within the food organics and garden organics categories, having been split into these components using the assumed ratio 17% food organics and 83% garden organics based on measurements in other jurisdictions. In 2023-24 about 357 kt of garden organics were recovered in SA, contributing about 26% towards overall organics recovery. Reported food organics recovery increased to 89.1 kt, continuing a significant increase since 2021-22. About 4% of the recovered food, all from C&I sources, was used for energy recovery.

Reported timber recovery improved in 2023-24 to 294 kt. Timber comprised 21% of total organics recovery in 2023-24, compared with only 6% in 2022-23. Revised assumptions of recovery of timber have likely improved the accuracy of this report compared with previous years.

**Table 23** Organics recovered, SA, 2023-24

| Material type | Net recovery (kt) |
|---|---|
| Food organics | 89.1 |
| Garden organics | 357 |
| Timber | 294 |
| Other organics | 656 |
| Meat rendering | 219 |
| Waste grease and fat | 84.4 |
| Waste sludge and biosolids | 130 |
| Organics (other) | 223 |
| **Total** | **1,396** |

**Figure 19** Organics recovered since 2003-04

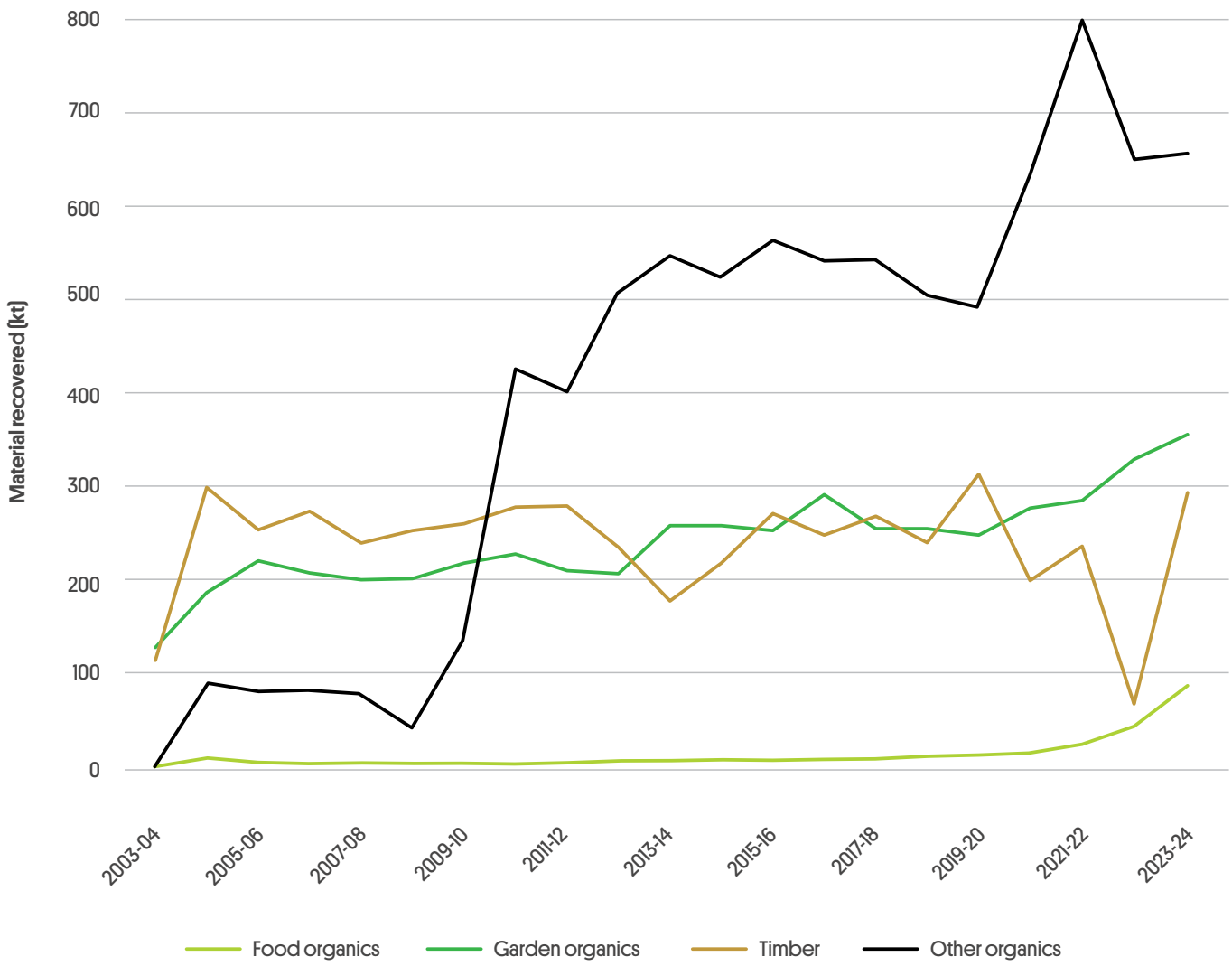


**Figure 20** Other organics recovered since 2009-10

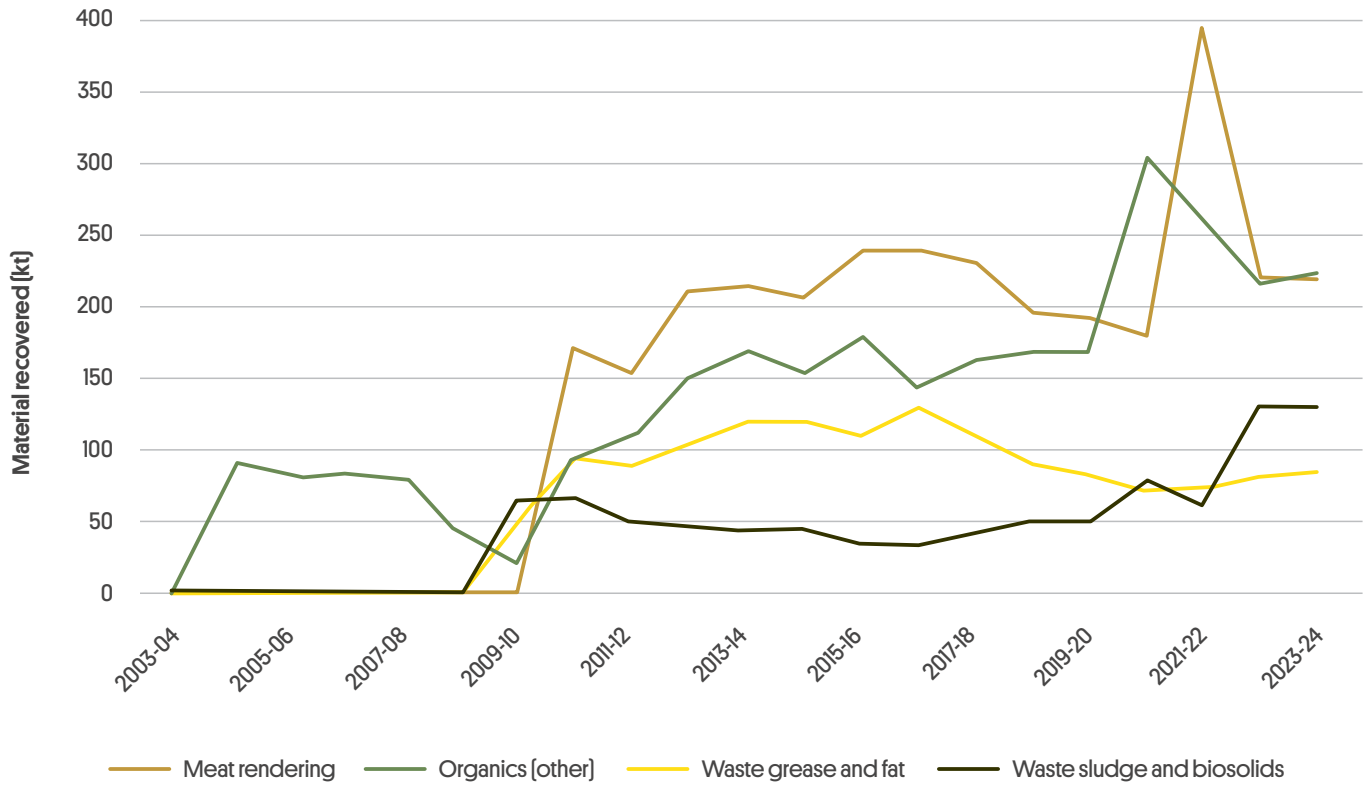



**Figure 21** Reported percent composition of organics recovered in 2022-23 and 2023-24

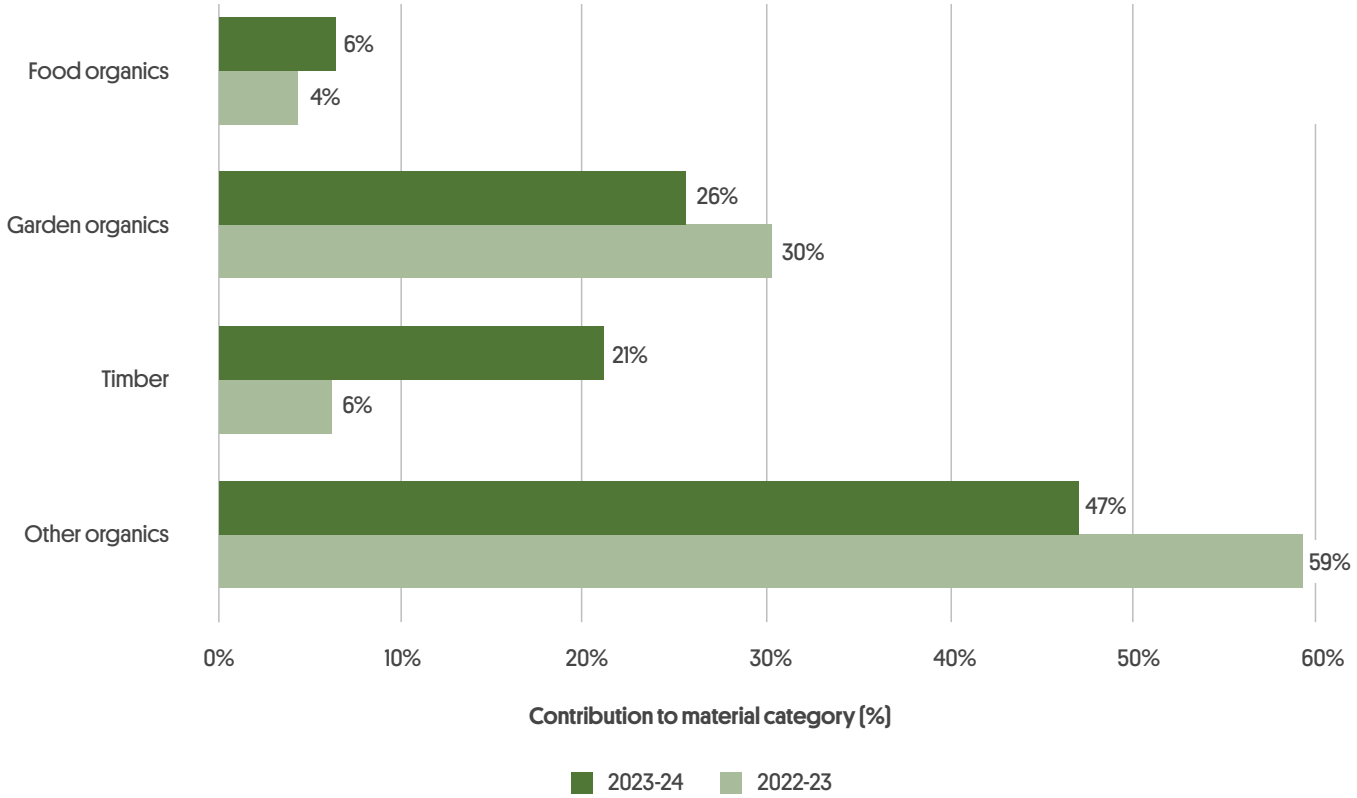


Table 24 provides detail of organics recovery in SA in 2023-24, including information of source stream, geographical origin and reprocessing location. Most organics came from SA's C&I stream (64%), followed by the MSW stream (32%), with a small proportion, mostly timber, being C&D waste (4%). Almost all organics generated in SA (99.7%) were recycled in SA. Metropolitan SA generated more organics (77%) than regional SA.

**Table 24** Organics recovered in 2023-24 by source stream, geographical origin and reprocessing location

| | Source stream (%) | | | Geographical origin (%) | | Reprocessing location (%) | | |
|---|---|---|---|---|---|---|---|---|
| **Material type** | **MSW** | **C&I** | **C&D** | **Metro** | **Regional** | **SA** | **Interstate** | **Overseas** |
| Food organics | 61% | 39% | 0% | 90% | 10% | 100% | 0% | 0% |
| Garden organics | 83% | 11% | 5% | 90% | 10% | 100% | 0% | 0% |
| Timber | 0% | 89% | 11% | 90% | 10% | 100% | 0% | 0% |
| Other organics | 15% | 85% | 0% | 63% | 37% | 99% | 1% | 0% |
| **Total** | **32%** | **64%** | **4%** | **77%** | **23%** | **99.7%** | **0.3%** | **0%** |

*Note: Some values are presented to one decimal place to avoid misrepresentation due to rounding*

## 3.4 Cardboard and paper

Recovery of scrap cardboard and paper was similar in 2023-24 to the previous year, with about 223 kt of cardboard and paper recovered in SA, compared to 216 kt in 2022-23. Cardboard was the largest portion of the category with 140 kt reported as recovered in 2023-24. Recovery of magazines and newsprint accounted for about 55.6 kt and printing and writing paper totalled 26.8 kt. A small amount of liquid paperboard was recovered (1.12 kt). Reported mixed paper and cardboard were apportioned into the sub-categories of cardboard, magazines and newsprint, and printing and writing paper. The method for apportioning was updated from previous years to reflect national surveys of mixed paper and cardboard composition.

**Table 25** Cardboard and paper recovered, SA, 2023-24

| Material type | Net recovery (kt) |
|---|---|
| Cardboard and waxed cardboard | 140 |
| Liquid paperboard | 1.12 |
| Magazines and newsprint | 55.5 |
| Printing and writing paper | 26.7 |
| **Total** | **223** |

Figure 22 and Figure 23 show trends in cardboard and paper recovery over time with mixed paper and cardboard apportioned into other material types, while Figure 24 compares the percent composition for different cardboard and paper types in 2023-24 and 2022-23. Consumption of paper and cardboard – and particularly newsprint and magazines – continues to decline due to digitisation.

**Figure 22** Cardboard and paper recovered since 2003-04 – cardboard, magazines and newsprint and printing and writing paper

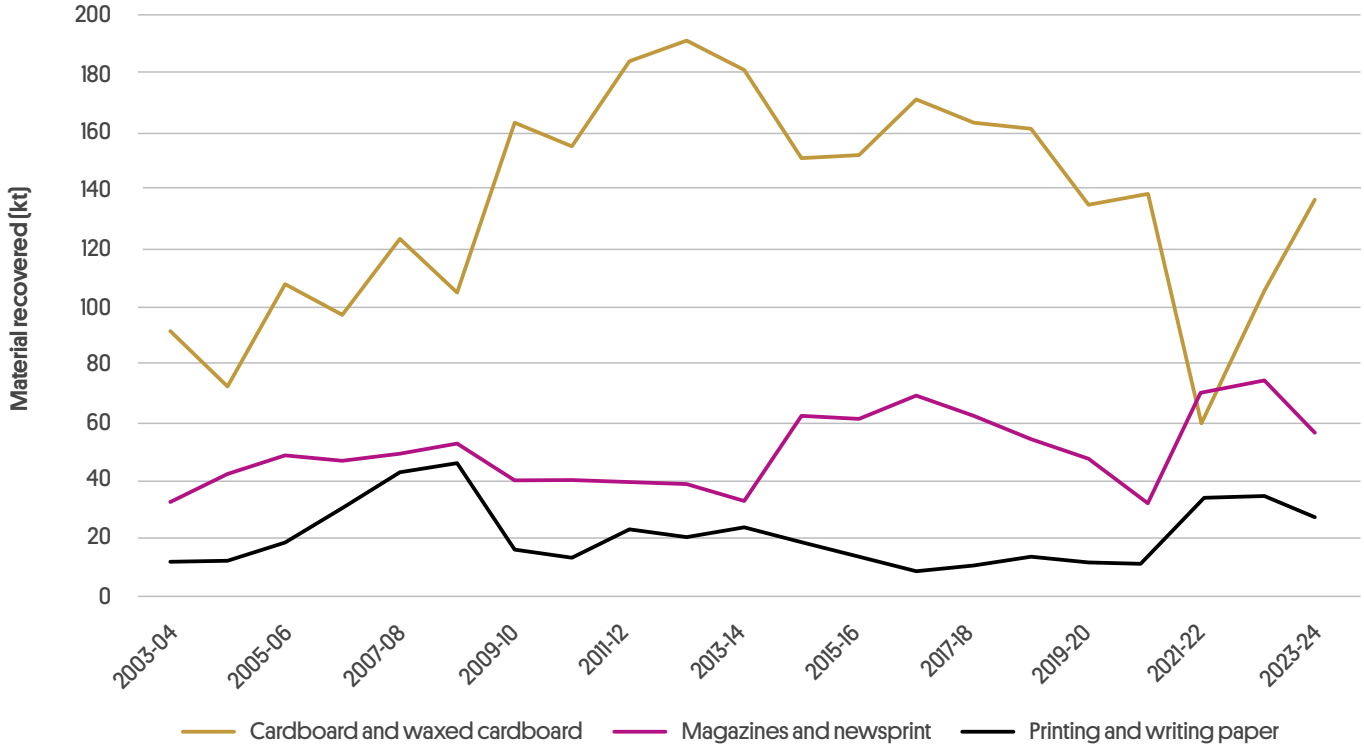



**Figure 23** Cardboard and paper recovered since 2003-04 – liquid paperboard

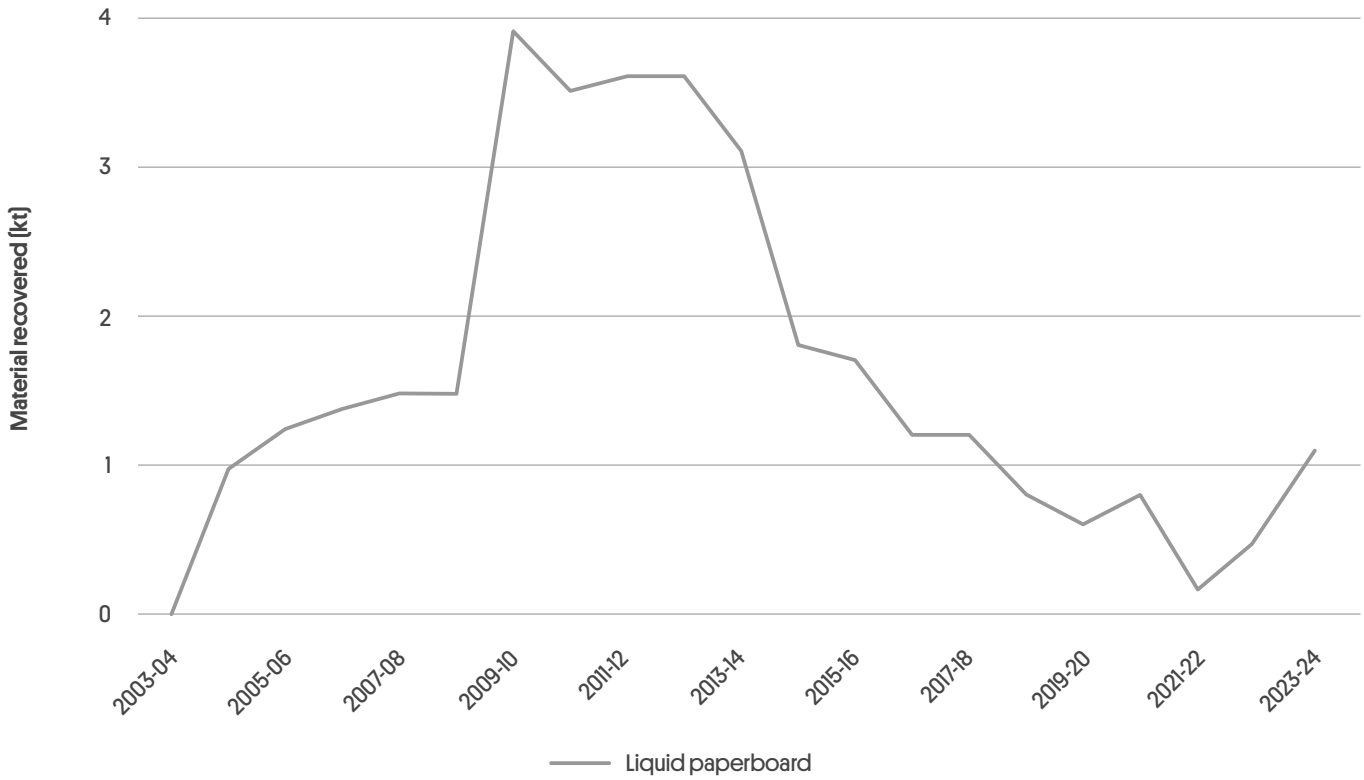


**Figure 24** Reported percent composition of cardboard and paper recovered in 2022-23 and 2023-24

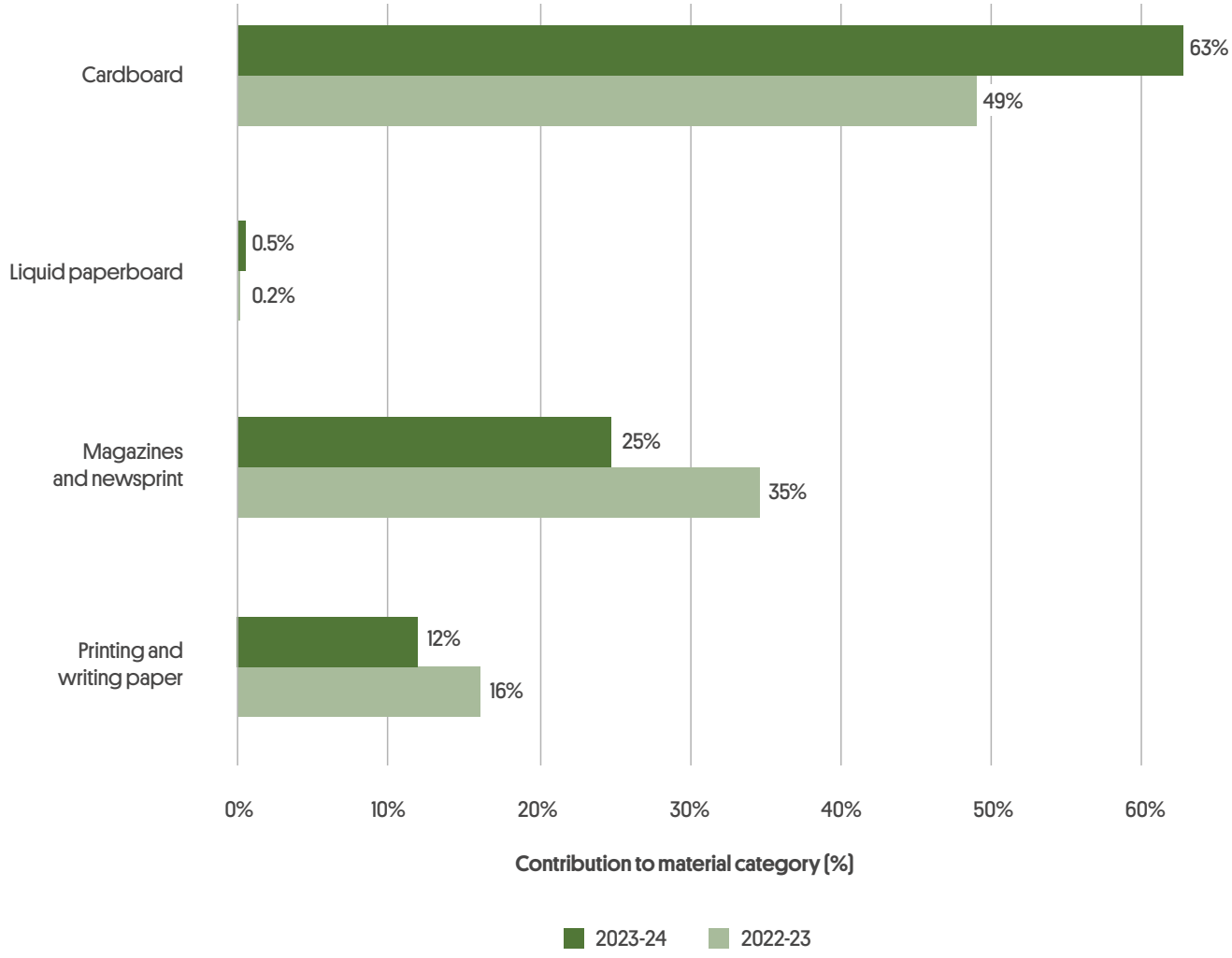



Table 26 presents the source stream, geographical origin and reprocessing location for recovered cardboard and paper in SA in 2023-24. Cardboard and paper were mostly recovered from the C&I stream (78%) and reprocessing was mostly undertaken overseas (44.3%). Most was from metropolitan SA (89%).

**Table 26** Cardboard and paper recovered in 2023-24 by source stream, geographical origin and reprocessing location

| | Source stream (%) | | | Geographical origin (%) | | Reprocessing location (%) | | |
|---|---|---|---|---|---|---|---|---|
| **Material type** | **MSW** | **C&I** | **C&D** | **Metro** | **Regional** | **SA** | **Interstate** | **Overseas** |
| Cardboard | 18% | 80% | 2% | 88% | 12% | 30% | 18% | 52% |
| Liquid paperboard | 0% | 100% | 0% | 94% | 6% | 0% | 58% | 42% |
| Magazines and newsprint | 26% | 72% | 3% | 89% | 11% | 44% | 25% | 31% |
| Printing and writing paper | 24% | 74% | 2% | 90% | 10% | 45% | 23% | 31% |
| **Total** | **20%** | **78%** | **2%** | **89%** | **11%** | **35.4%** | **20.3%** | **44.3%** |

## 3.5 Plastics

SA recovered 42.2 kt of plastics in 2023-24. This reflects improved insights about plastics in mixed waste streams and about scrap plastic generated in SA that is reprocessed outside of SA. Table 27 summarises 2023-24 plastics recovery and Figure 25, Figure 26 and Figure 27 show plastics recovery trends since 2003-04.

Survey data at the polymer level is sometimes not available, so trends at the polymer level are more uncertain than trends about overall recovery of scrap plastics. The authors expect this data to improve over time.

Low density polyethylene (LDPE) was the highest contributor to plastics recovery, accounting for a reported 32% of plastics recovered. The reported LDPE recovery is higher than previous years. This is in part due to a revised method for analysing plastics recovered for energy. The higher quantities are also reflective of stockpiled RedCycle plastics being recovered for energy and the introduction of trials of bag-in-bin kerbside soft plastics recycling in SA. Of the LDPE recovery reported in Table 27, about 42% was recycled and the rest used for its energy value. While overall recovery of LDPE was high, some waste collectors noted fewer opportunities for clean LDPE and linked this difficulty to the waste export restrictions established by the Australian Government.

High density polyethylene (HDPE) and mixed and other plastics each accounted for 21% of recovered plastics. Mixed and 'other' plastics, which includes #7 polymers are reported together here. Most of the tonnes reported here are likely to be 'other' plastics such as polycarbonate, bioplastics or plastics recovered from e-waste. This material grouping accounted for about 21% of all plastics recovered from SA.

Polystyrene recovery has been well-documented in the previous few years, as shown in Figure 26. Expanded polystyrene is often placed in rubbish bins but effort is being made by industry to offer the public opportunities to recycle their EPS. As with LDPE, the revised method for analysing plastics recovered for energy increases the apparent change in polystyrene recovery in 2023-24.

**Table 27** Plastics recovered, including energy recovery, SA, 2023-24

| Material type | Net recovery (kt) |
|---|---|
| Polyethylene terephthalate | 3.9 |
| High density polyethylene | 8.7 |
| Polyvinyl chloride | 0.3 |
| Low density polyethylene | 13.6 |
| Polypropylene | 4.9 |
| Polystyrene | 2.0 |
| Mixed and/or other plastics | 8.9 |
| **Total** | **42.2** |

**Figure 25** Plastics recovered since 2003-04 – PET, HDPE, LDPE, PP and mixed and other plastics

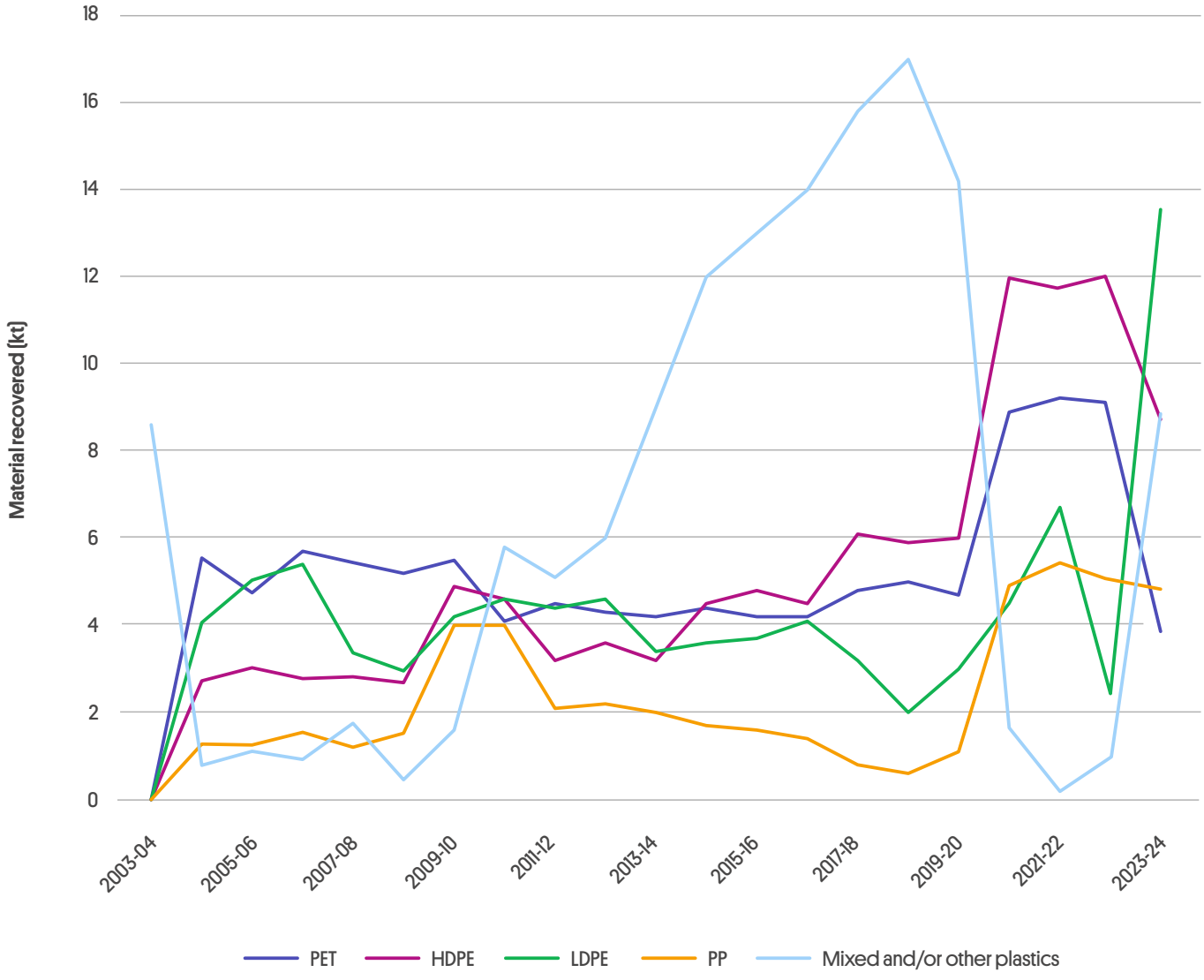


**Figure 26** Plastics recovered since 2003-04 – PVC and PS

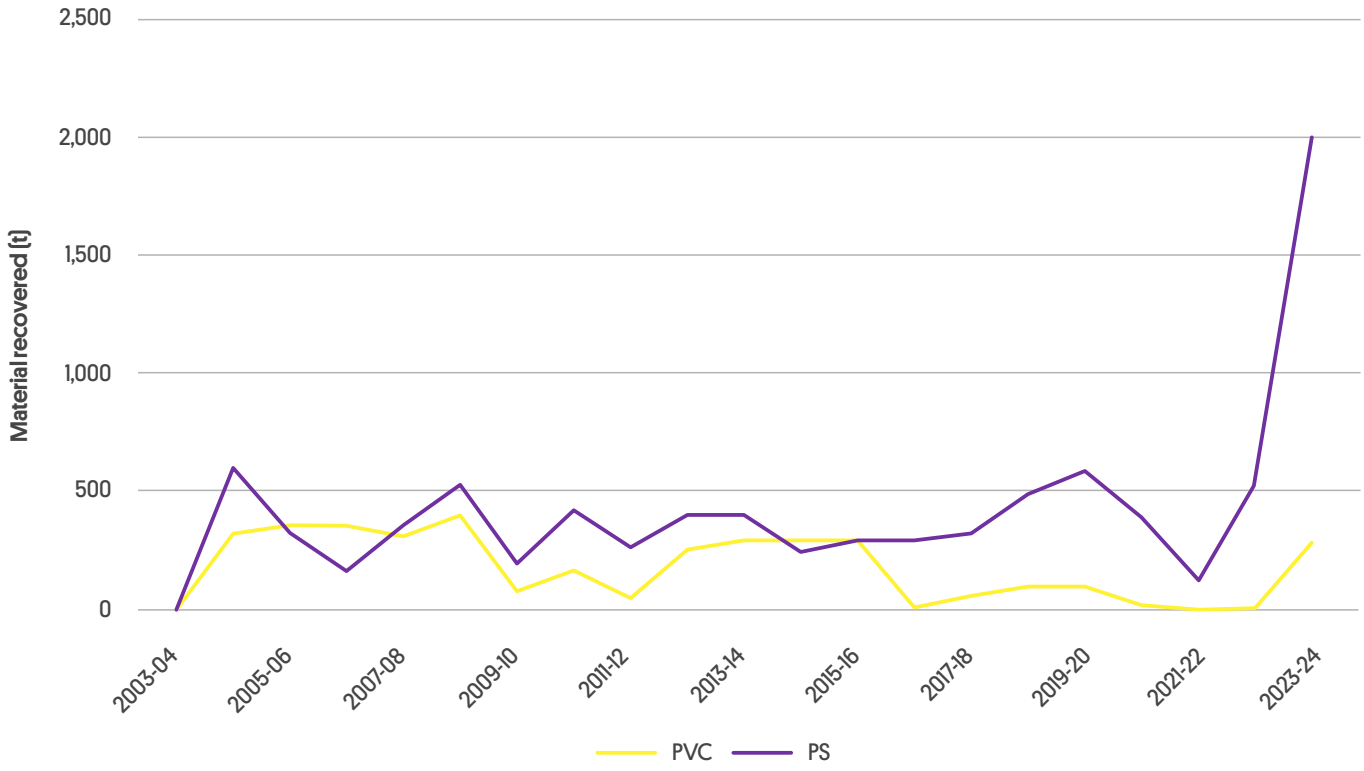



**Figure 27** Plastics recovered since 2003-04 – all plastics

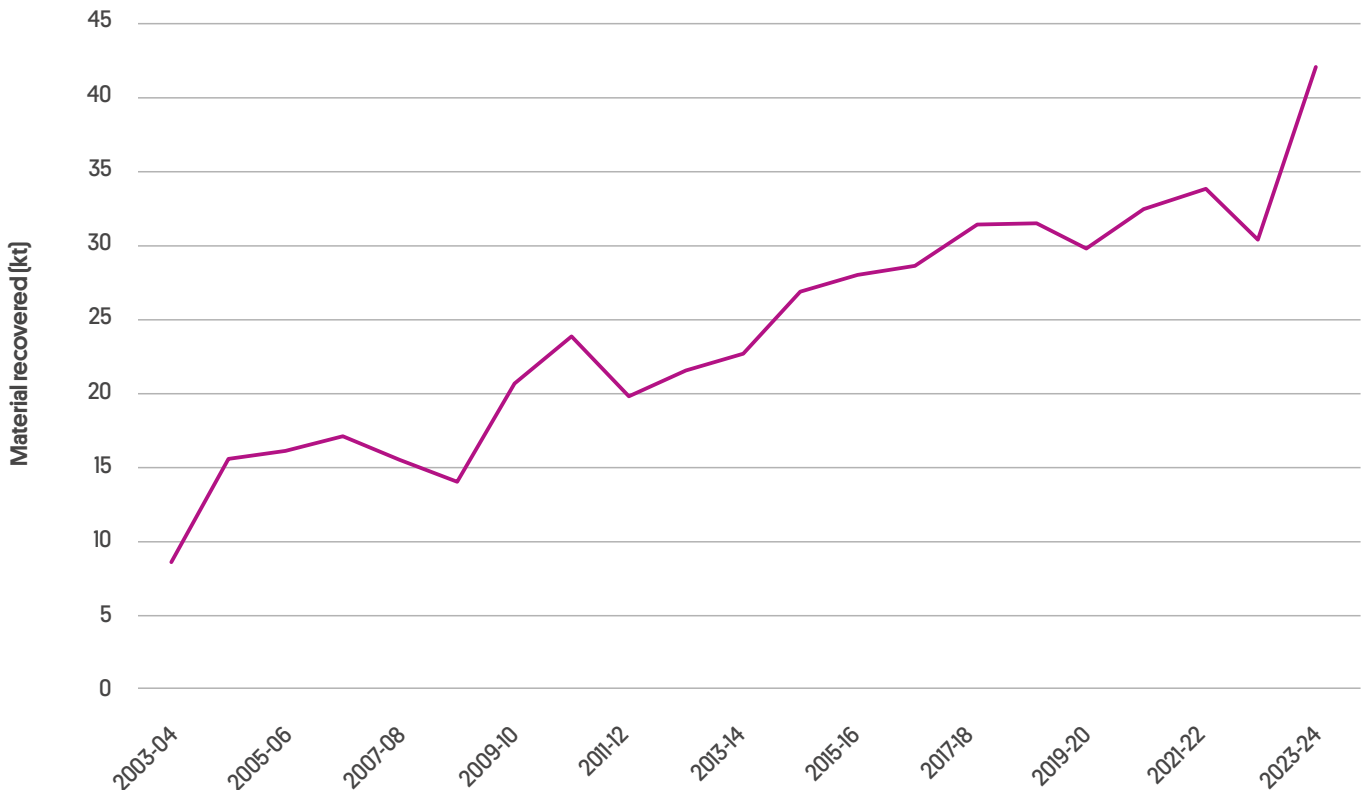
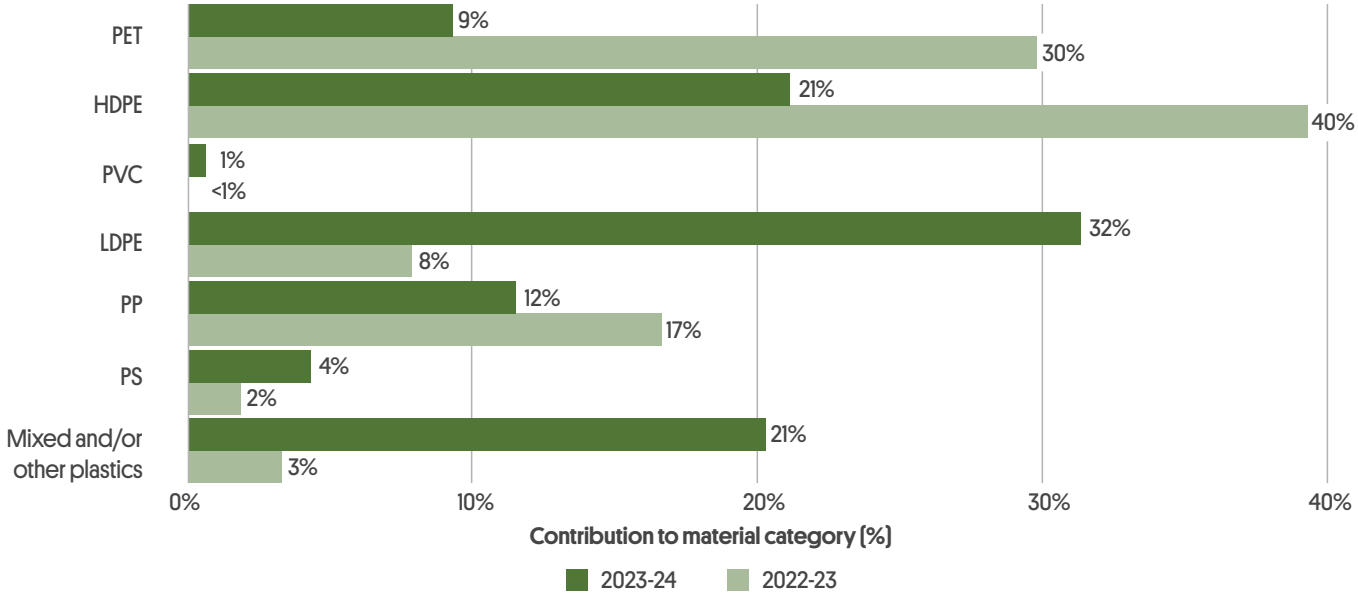


**Figure 28** Reported percent composition of plastics recovered in 2022-23 and 2023-24




*Note: Figure 28 contains minor corrections to the composition of plastics recovery for 2022-23 published in the CERRR 2022-23.*

Plastics recovery in 2023-24 by plastics type, source stream, geographical origin and reprocessing location is shown in Table 28. About 82% of recovered plastics were reported as coming from the C&I stream, with most of the remainder from MSW sources (12%). About 7% overall was recovered from the C&D source stream, mostly polystyrene from waffle pod products and mixed plastics as well as PVC.

About 69% of total recovered plastics were reprocessed locally in SA. About 11% plastics were exported, which is higher than the 3% reported in 2022-23. This reflects waste export licences granted by the Australian Government following the export restrictions for plastics in 2022. Under the export restrictions organisations must have a licence to export waste plastics if they have not been sorted and processed so as to be ready for remanufacture without further processing in accordance with the specifications of the Department of Climate Change, Energy, the Environment and Water. 'Processed' generally refers to plastics that have been sorted, washed, cleaned and transformed, for example, into hot washed flakes or single resin pellets. It does not refer to plastic that is simply shredded.

**Table 28** Plastics recovered in 2023-24 by source stream, geographical origin and reprocessing location

| | Source stream (%) | | | Geographical origin (%) | | Reprocessing location (%) | | |
|---|---|---|---|---|---|---|---|---|
| **Material type** | **MSW** | **C&I** | **C&D** | **Metro** | **Regional** | **SA** | **Interstate** | **Overseas** |
| Polyethylene terephthalate | 28% | 72% | 0% | 94% | 6% | 46% | 43% | 11% |
| High density polyethylene | 30% | 67% | 3% | 94% | 6% | 49% | 27% | 24% |
| Polyvinyl chloride | 0% | 79% | 21% | 93% | 7% | 71% | 29% | 0% |
| Low density polyethylene | 2% | 98% | 0% | 90% | 10% | 69% | 18% | 14% |
| Polypropylene | 17% | 83% | 1% | 87% | 13% | 78% | 22% | 0% |
| Polystyrene | 3% | 76% | 21% | 88% | 12% | 95% | 3% | 2% |
| Mixed and other plastics | 1% | 76% | 23% | 90% | 10% | 90% | 10% | 0% |
| **Total** | **12%** | **82%** | **7%** | **91%** | **9%** | **69%** | **20%** | **11%** |

## 3.6 Glass

SA recovered about 74 kt of scrap glass in 2023-24, which is stead with the from 74 kt reported recovered in 2022-23. Recovered glass was mostly containers; 69% of overall volumes in 2023-24 was glass from food and beverage containers and 31% other glass. Demand for high quality glass remains strong and glass reprocessors are importing clean cullet from interstate markets.

**Table 29** Glass recovered, SA, 2023-24

| Material type | Net recovery (kt) |
|---|---|
| Glass from food and beverage containers | 51 |
| Other glass | 23 |
| **Total** | **74** |

Glass recovery trends since 2003-04 are shown in Figure 29. The proportions of glass from food and beverage containers and other glass recovered in 2023-24 are shown in Figure 30.

**Figure 29** Glass recovered since 2003-04

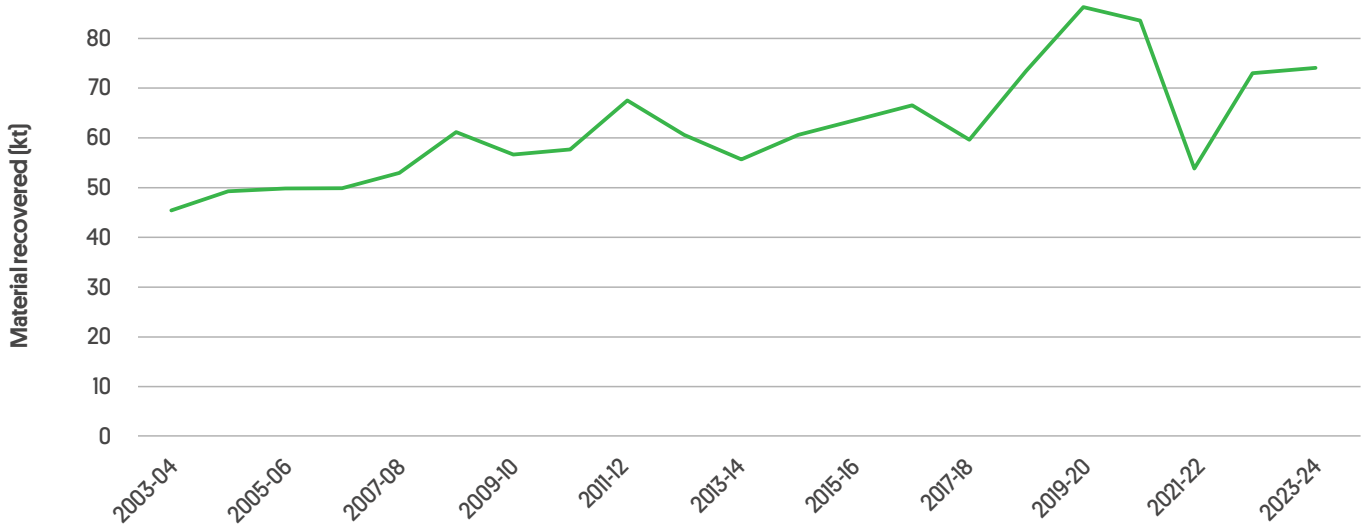



**Figure 30** Reported percent composition of glass recovered in 2023-24

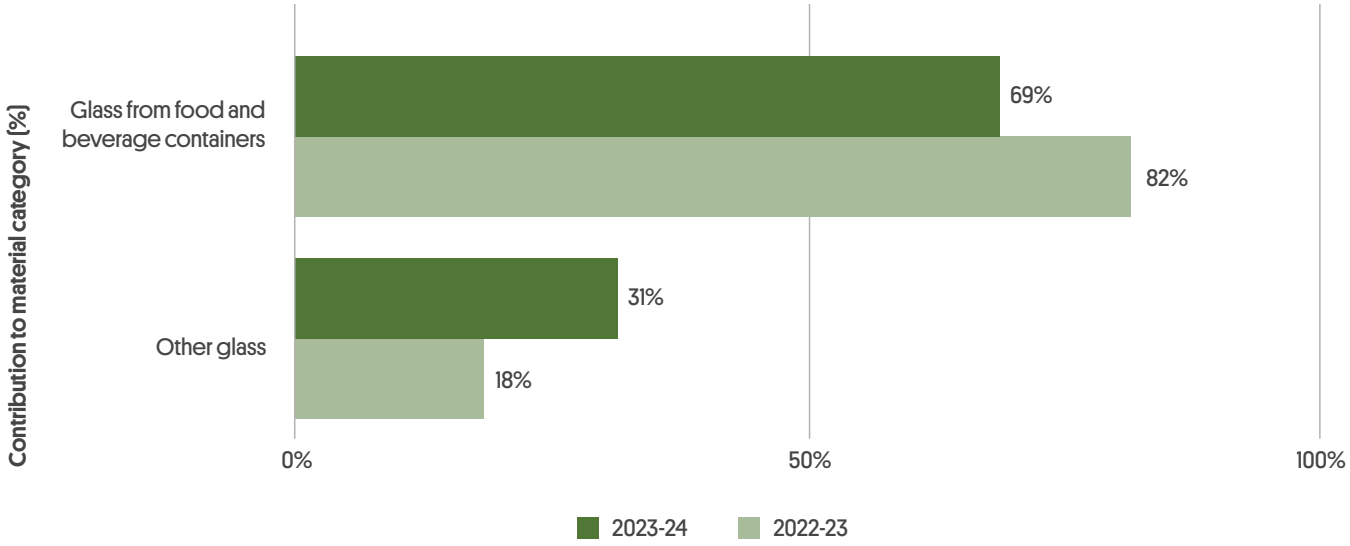



Table 30 presents the source stream, geographical origin and reprocessing location for recovered glass in SA in 2023-24. The MSW and C&I streams were equally split. Half of glass waste was generated from each stream. Most glass was from the metropolitan region (84%), and almost all reprocessing occurred in SA (97%).

**Table 30** Glass recovered in 2023-24 by source stream, geographical origin and reprocessing location

| | Source stream (%) | | | Geographical origin (%) | | Reprocessing location (%) | | |
|---|---|---|---|---|---|---|---|---|
| Material type | MSW | C&I | C&D | Metro | Regional | SA | Interstate | Overseas |
| Glass | 50% | 50% | 0% | 84% | 16% | 97% | 3% | 0% |

## 3.7 Other materials

The 'other materials' category includes foundry sands, leather and textiles, and tyres and other rubber. The combined recovery of these materials in 2023-24 was about 37 kt. This was slightly more than the 26 kt recovered in 2022-23. Minimal quantities of foundry sands have been recovered since 2019-20. A major processor of foundry sands stopped accepting the material in 2020-21, and it has since been beneficial reused in agricultural applications or sent to landfill. A small amount is used in composting. Tyres and other rubber contributed the most to overall recovery in this category (81%). Leather and textiles recovery rose slightly to 6 kt in 2023-24 from 3 kt in 2022-23 and 5 kt 2021-22.

**Table 31** Other materials recovered, SA, 2023-24

| Material type | Net recovery (kt) |
|---|---|
| Foundry sands | 1 |
| Leather and textiles | 6 |
| Tyres and other rubber | 30 |
| **Total** | **37** |

Figure 31 and Figure 32 show trends in the recovery of other materials by type. Figure 32 compares the contribution for different other material types toward total recovery from 2023-24 and 2022-23.

**Figure 31** Other materials recovered since 2003-04 – foundry sands, leather and textiles and tyres and other rubber

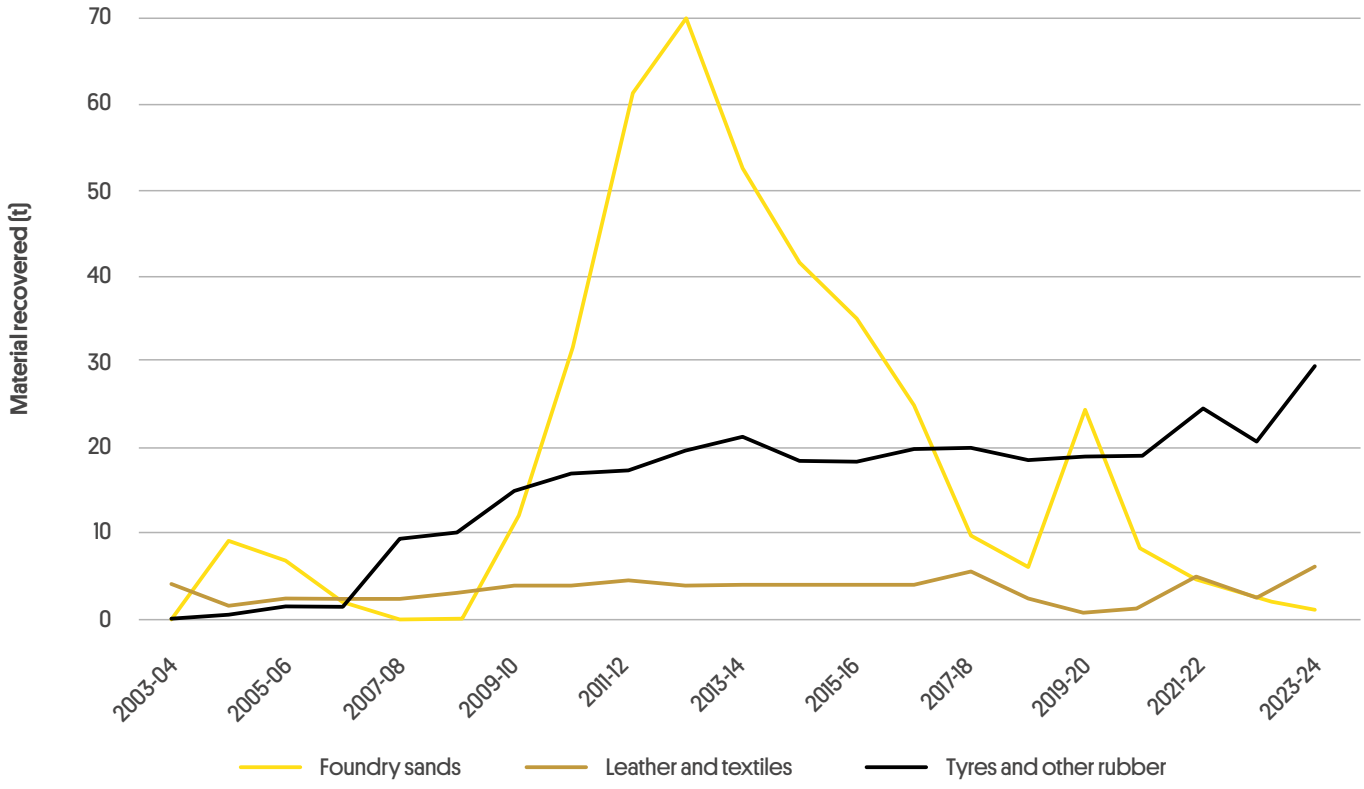



**Figure 32** Reported percent composition of other materials recovered in 2022-23 and 2023-24

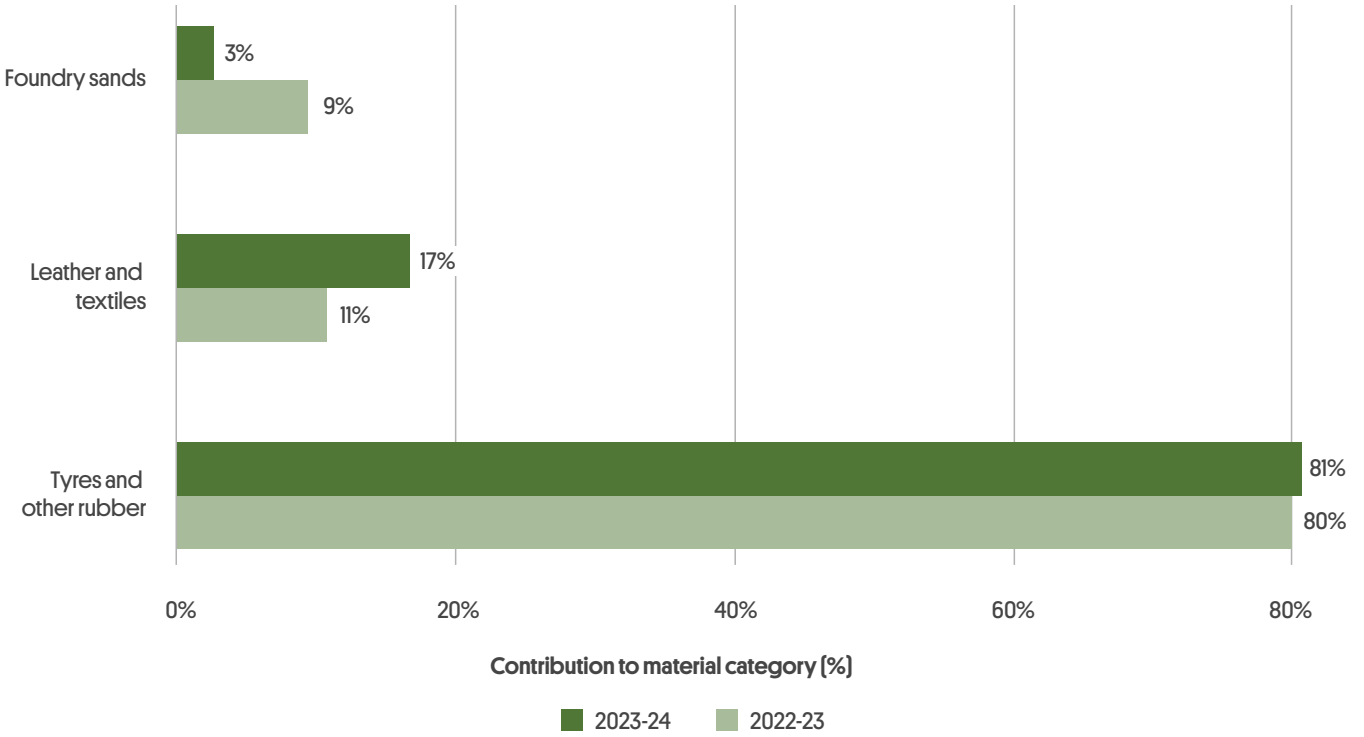


Table 32 presents the source stream, geographical origin and reprocessing destination for material types within the 'other materials' category. All materials in this category were from C&I sources. About 96% of were from metropolitan SA. Most other materials were reprocessed locally (61%) or was exported overseas (30%) with only a small amount sent interstate (9%).

**Table 32** Other materials recovered in 2023-24 by source stream, geographical origin and reprocessing location

| | Source stream (%) | | | Geographical origin (%) | | Reprocessing location (%) | | |
|---|---|---|---|---|---|---|---|---|
| **Material type** | **MSW** | **C&I** | **C&D** | **Metro** | **Regional** | **SA** | **Interstate** | **Overseas** |
| Foundry sands | 0% | 100% | 0% | 70% | 30% | 100% | 0% | 0% |
| Leather and textiles | 0% | 100% | 0% | 95% | 5% | 51% | 1% | 48% |
| Tyres and other rubber | 0% | 100% | 0% | 97% | 3% | 62% | 11% | 27% |
| **Total** | **0%** | **100%** | **0%** | **96%** | **4%** | **61%** | **9%** | **30%** |

## 3.8 Separately reported materials

Separately reported materials include fly ash and clay, fines, rubble and soil. These are reported separately as significant variation between years can strongly impact the trends in recovery rate for other material categories. It is noted that SA has not recovered any fly ash since the closure of the Port Augusta Power Station. Clean fill contributed the majority of recovery in this category, accounting for 1,020 kt of recovery in 2023-24. This is shown in Table 33.

**Table 33** Separately reported materials recovered, SA, 2023-24

| Material type | Net recovery (kt) |
|---|---|
| Clay, fines, rubble and soil – clean fill | 1,020 |
| Clay, fines, rubble and soil – intermediate waste soil | 63.4 |
| Fly ash | 0 |
| **Total** | **1,080** |

Table 34 presents the source stream, geographical origin and reprocessing destination for material types within the separately reported materials category. Most materials were sourced from the C&D stream (95%). The majority was from metro SA (93%) and all was recovered in SA.

**Table 34** Separately reported materials recovered in 2023-24 by source stream, geographical origin and reprocessing location

| Material type | Source stream (%) | | | Geographical origin (%) | | Reprocessing location (%) | | |
|---|---|---|---|---|---|---|---|---|
| | MSW | C&I | C&D | Metro | Regional | SA | Interstate | Overseas |
| Clay, fines, rubble and soil – clean fill | 0% | 3% | 97% | 92% | 8% | 100% | 0% | 0% |
| Clay, fines, rubble and soil – intermediate waste soil | 0% | 31% | 69% | 100% | 0% | 100% | 0% | 0% |
| Fly ash | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **Total** | **0%** | **5%** | **95%** | **93%** | **7%** | **100%** | **0%** | **0%** |

Figure 33 and Figure 34 show trends in the recovery of separately reported materials by type. Figure 34 compares the contribution for different other material types toward total recovery from 2023-24 and 2022-23.

**Figure 33** Separately reported materials recovered since 2003-04 – Clay, fines, rubble and soils and fly ash

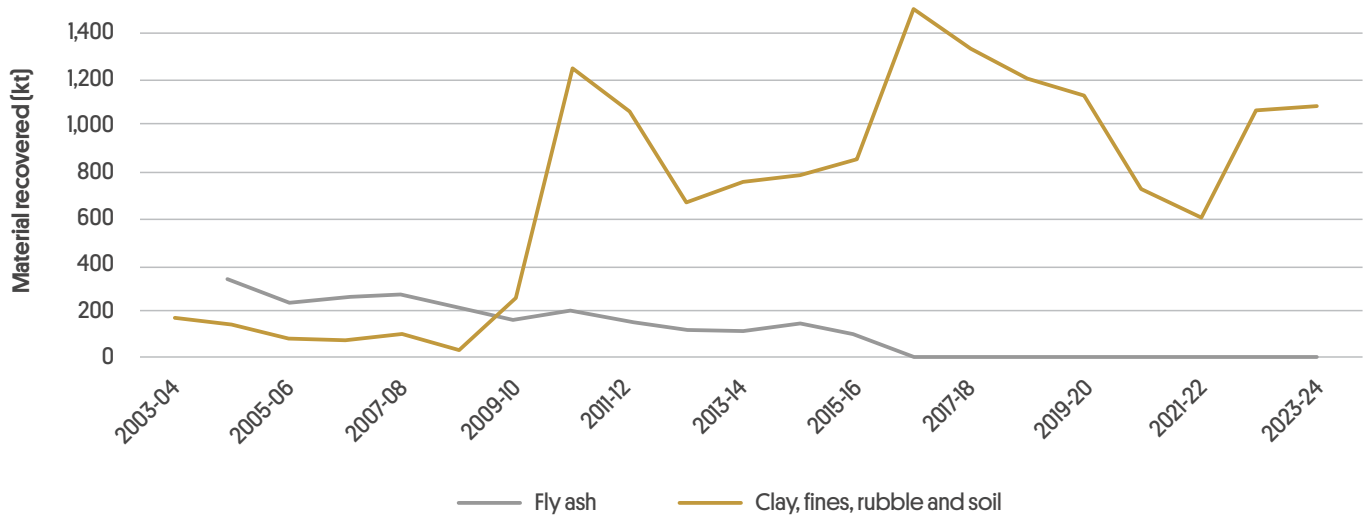
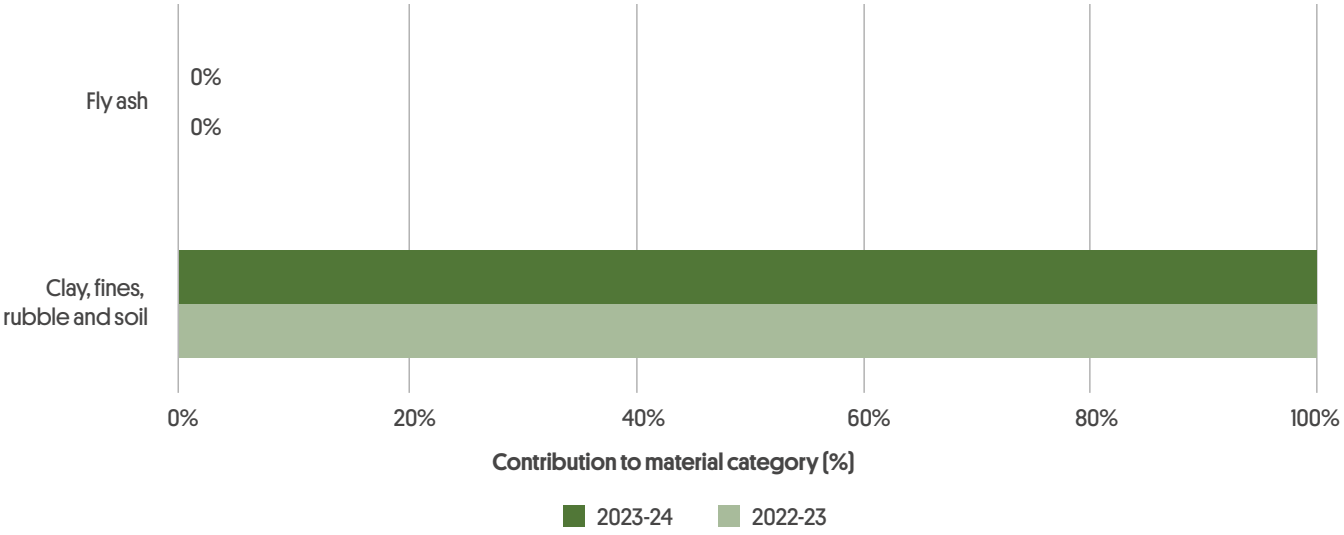



**Figure 34** Reported percent composition of separately reported materials recovered in 2022-23 and 2023-24




Rose Spray
ADMIL PTY. LTD.

# 4 Material flow analyses

This section will present the results of material flow analyses (MFAs) of SA materials in the 2023-24 financial year. The materials covered in this section are:

- metals – steel, aluminium, and non-ferrous metals
- cardboard and paper – cardboard, liquid paperboard, magazines and newsprint, and printing and writing paper
- plastics – PET, HDPE, PVC, LDPE, PP, PS, and mixed and/or other plastics
- glass – glass from food and beverage containers, and other glass
- textiles
- tyres.

Across the 2023-24 to 2025-26 reports, in-depth analysis will be presented for two materials to provide further insight into the MFA process and modelled indicators, and highlight material-specific opportunities for improving circularity. The two detailed material categories this year are **metals** and **glass**.

## 4.1 Introduction to material flow analysis

A general definition of MFA is provided by the UN Environment Programme International Resource Panel (UNEP 2020):

> *Material flow analysis comprises a group of methods to analyse the physical flows of materials into, through and out of a given system. It can be applied at different levels of scale, i.e. products, firms, sectors, regions, and whole economies. The analysis may be targeted to individual substance or material flows, or to aggregated flows, e.g. of resource groups (fossil fuels, metals, minerals).*

MFAs follow the principle of conservation of mass, tracing material flows by balancing inputs and outputs and drawing on the following concepts described in Table 35.

**Table 35** Key concepts and terminology in MFA modelling

| Term | Definition |
|---|---|
| System | The object of an MFA investigation. |
| Material | An umbrella term for both substances (homogenous materials) and goods (materials or products made up of one or more substances). |
| Process | The transformation, transport or storage of materials. |
| Flow | The mass of material into or out of a process per unit time (e.g. year). |
| Stock | The quantity of materials stored within a process. Any process can potentially contain stocks. Input flows into a process equals the output flows plus the change in stocks. |
| Residence time | The time period for which a material remains in a stock process. |
| Transfer coeffi-cient | Quantities that partition materials leaving a process to downstream processes. |
| Final sink | A process where materials have very long residence times (>1,000 years). |

MFA and the scientific field developing around it support the analysis of anthropogenic and natural material flows through manufacturing, use, disposal and recovery. This is useful for measuring and monitoring the transition to a circular economy, identifying opportunities for maximising recovery, and improving environmental outcomes generally.

The MFAs assess materials flowing to and from processes within a system. A list of these processes is provided in Table 36.

**Table 36** Material flow analysis processes

| Process | Definition |
|---|---|
| Australian virgin | The upstream process of incoming system materials from Australian virgin sources. |
| Overseas virgin | The upstream process of incoming system materials from overseas imported virgin sources. |
| Overseas recy-cled | The upstream process of incoming system materials from overseas imported recycled sources. |
| Manufacturing | All processes that transform materials into saleable products. |
| Use | Use phase of the products containing the materials. Includes stocks of materials that are in use. |
| Sorting | Post-use processes that separate products into discrete material streams prior to repro-cessing. |
| Reprocessing | Post-sorting processes that physically transform materials and products that are then (typical-ly) input-ready for the manufacture of new products. |
| Energy recovery | The process of recovering energy that is embodied in solid waste. |
| Export | The downstream process of post-consumption materials going to export. |
| Environment | Dispersal to the open environment, and could also be termed 'leakage'. Examples include 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 envi-ronment that are subsequently cleaned up are modelled as going directly to another fate ra-ther than the 'Environment' process. |
| Landfill | Disposal of all materials to landfill. Includes onsite disposal. |

MFAs can help to measure material circularity and assess the performance of the waste and resource recovery sector by identifying strengths and inefficiencies at different stages of recovery. A set of circular economy indicators were selected for this work:

- **Recycled content:** Performance of the manufacturing system in utilising recycled materials. Low recycled content means consumed products comprise little or no recycled materials, e.g., owing to poor product design and/or reprocessing technology limitations.
- **Collection efficiency:** Performance of the collection system. Low collection efficiency means a high proportion of material is not separated from material flows at the household or business and is directed to landfill, e.g., owing to limited source separation and/or poor disposal practices.
- **Sorting efficiency:** Performance of the system in separating materials designated for specific recovery pathways. Low sorting efficiency highlights opportunities to reduce contamination of collected materials received and/or improve sorting processes at the sorting facilities.
- **Reprocessing efficiency:** Performance of the system in reprocessing materials to be ready for specific remanufacturing or energy recovery pathways. Low reprocessing efficiency highlights opportunities to reduce contamination of sorted materials received, improve product design, and/or improve processes at the reprocessing facilities.
- **Recycling rate:** Performance of the system in recycling end-of-life materials.
- **Energy recovery rate:** Performance of the system in diverting end-of-life materials to energy recovery.
- **Recovery rate:** Performance of the system in diverting end-of-life materials to recycling and energy recovery.
- **Local material utilisation rate:** Performance of the system in on-shore remanufacturing, relative to the amount of material that is potentially available.

A more thorough description of the MFA method is given in Appendix A4. It includes more detail on how the circular economy indicators were derived.

The results of the MFA modelling are summarised in the following sections by material category (metals, cardboard and paper, plastics and glass) or material type (textiles and tyres). The results include a table for each material that summarise flows for SA in 2023-24, covering quantities for consumption, waste generation and recovery and the calculated MFA indicators. They also include a Sankey chart, in which material flows are illustrated using arrows proportional to the scale of the calculated material flow.

Note that the recovery quantities calculated via MFA may differ slightly from those presented elsewhere in this report. This is because they use a different method that draws on estimates of material consumption and lifespans. Additionally, waste generation and waste to landfill at the material level are not measured in this report, so there is uncertainty associated with the recovery rates presented in this section.

## 4.2 Metals

The MFA results for metals are summarised in Figure 35 and Table 37. It is estimated 651 kt of metals were consumed in SA in 2023-24, with 482 kt of metals waste generated. Recovery is estimated at 437 kt, or 91% of waste generation.

**Figure 35** Metals material flow diagram, SA 2023-24

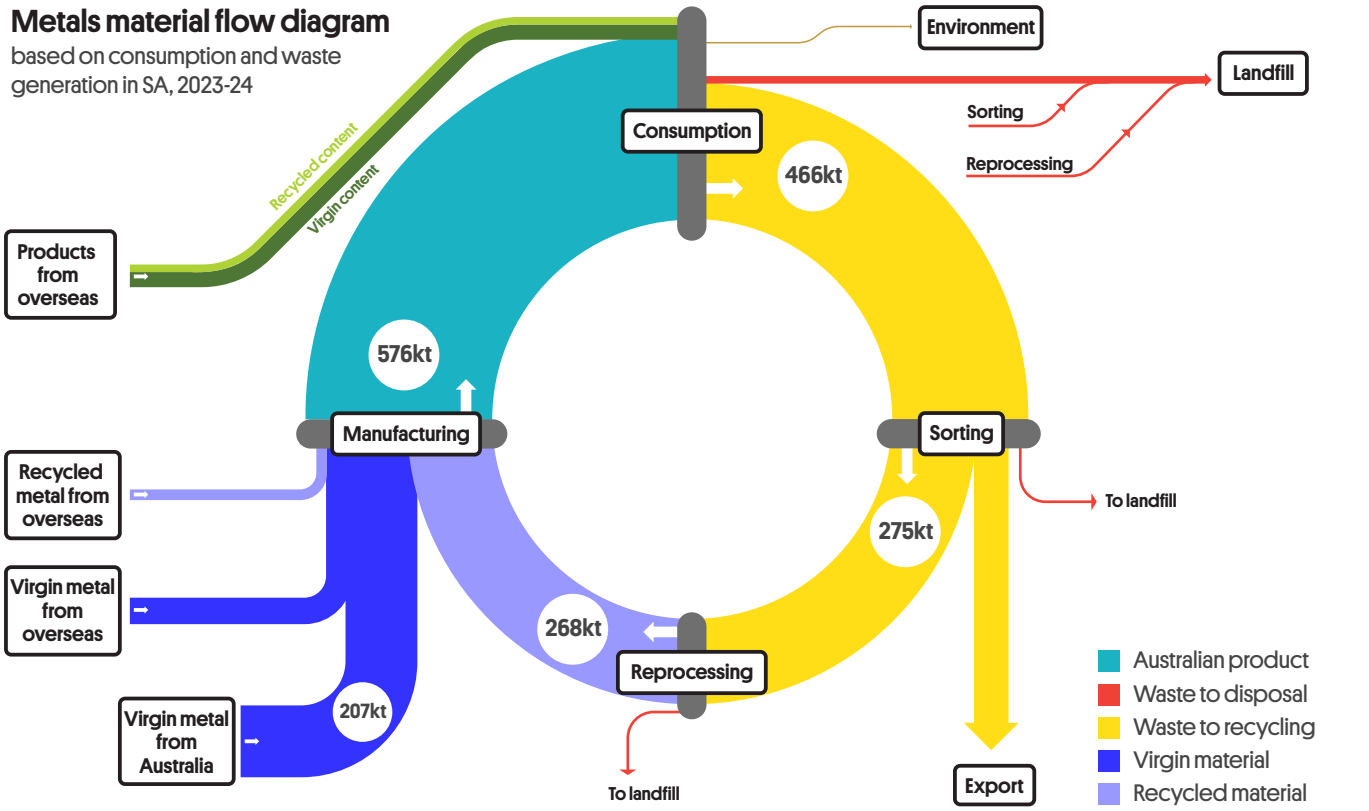



**Table 37** Metals MFA indicators, SA 2023-24

| Indicator | Unit | Value |
|---|---|---|
| Consumption | kt | 651 |
| Waste generation | kt | 482 |
| Recovery | kt | 437 |
| Recycled content | % | 50% |
| Collection efficiency | % | 97% |
| Sorting efficiency | % | 95% |
| Reprocessing efficiency | % | 98% |
| Recycling rate | % | 91% |
| Energy recovery rate | % | 0% |
| Recovery rate | % | 91% |
| Local material utilisation rate | % | 56% |

## Detailed material flows analysis – Metals

Metals are highly recyclable as they are easy to sort, maintain their quality after reprocessing and benefit from high commodity values. They are not overly affected by contamination because impurities can be removed in production or managed by sorting and dilution (World Steel Association, 2021). The MFA estimates a recovery rate for SA metals in 2023-24 of 91%.

Recycled content is highly integrated into global metal markets. All steel plants use steel scrap as a raw material (World Steel Association, 2021). The recycled content of steel varies by production process; electric arc furnaces can produce steel with up to 100% recycled content while basic oxygen furnaces produce steel with up to approximately 30% recycled content (World Steel Association, 2023). In 2023, about 70% of Australian steel production was in basic oxygen furnaces and about 30% from electric arc furnaces, which approximately matched the global steel production profile (World Steel Association, 2024).

Almost all Australian scrap aluminium is exported as domestic smelters do not have the capability to accept post-consumer waste, although small quantities of pre-consumer scrap can be processed onshore (APCO, 2024). The MFA estimates an overall recycled content of 50% for metals consumed in SA in 2023-24. This includes recycled content in products imported from overseas.

Recycled metals enjoy strong end markets, including applications in the built environment and packaging. Exports are a major component of metals flows, and end markets and tightly linked to international metal exchange prices. About 39% of SA's recovered metals were exported in 2023-24.

Recycling metals emits significantly lower greenhouse gas emissions compared to extracting and processing virgin metals. For example, it is estimated that in SA each tonne of aluminium recycled prevents the release of 16.7 t of carbon dioxide equivalent (see Appendix A3.5

*Opportunities for improving circularity*

The MFAs estimate high (>95%) efficiencies for end-of-life metals across collection, sorting and reprocessing, demonstrating strong recovery systems across the chain. Possible opportunities for improvements include strengthening local metals manufacturing and maximising diversion of shredder floc metals from landfill.

Shredder floc is a by-product of recovering large metal products like cars, refrigerators and washing machines. These bulky items are dismantled and shredded at recovery facilities; the majority of metals are separated and recycled, but about 30% of the product turns into a residual fraction – known as shredder floc – consisting of mangled plastics, rubber, metals, textiles and various other fines (Sustainability Victoria, 2014). Shredder floc is difficult to recover and generally disposed of, with about 50 kt landfilled in SA each year. The Environment Protection Authority allows a 25% waste levy reduction for landfilling shredder floc (SA EPA, 2025). Because some of it is high in calorific value (e.g. plastics), shredder floc could be diverted to thermal energy recovery facilities in the future.

There may be an opportunity to improve recovery of metals by encouraging recycling of small metals items such as nails and fixing. These are generally not accepted in kerbside recycling bins because are difficult to sort in materials recovery facilities, where they tend to fall through conveyor belts and potentially get trapped in moving parts.

The Commonwealth Government regulates the export of waste glass, plastics, tyres and paper and cardboard to prevent environmental harm posed by Australian waste to overseas nations. A similar logic could be applied to metals – recycling in Australia would prevent potentially substandard management of shredder floc in developing countries (e.g. burning or dumping). There may be an opportunity to improve metals circularity by applying similar regulations to metals (NWRIC, 2023).

# 4.3 Cardboard and paper

The MFA results for cardboard and paper are shown in Figure 36 and Table 38. It is estimated about 343 kt of cardboard and paper was consumed in SA in 2023-24. Waste generation is estimated at 354 kt, which is slightly higher than consumption due to pre-consumer scrap from manufacturing. About 223 kt of cardboard and paper was recovered in 2023-24, or an estimated 63% of waste generated. This included about 37 kt to energy recovery.

**Figure 36** Cardboard and paper material flow diagram, SA 2023-24

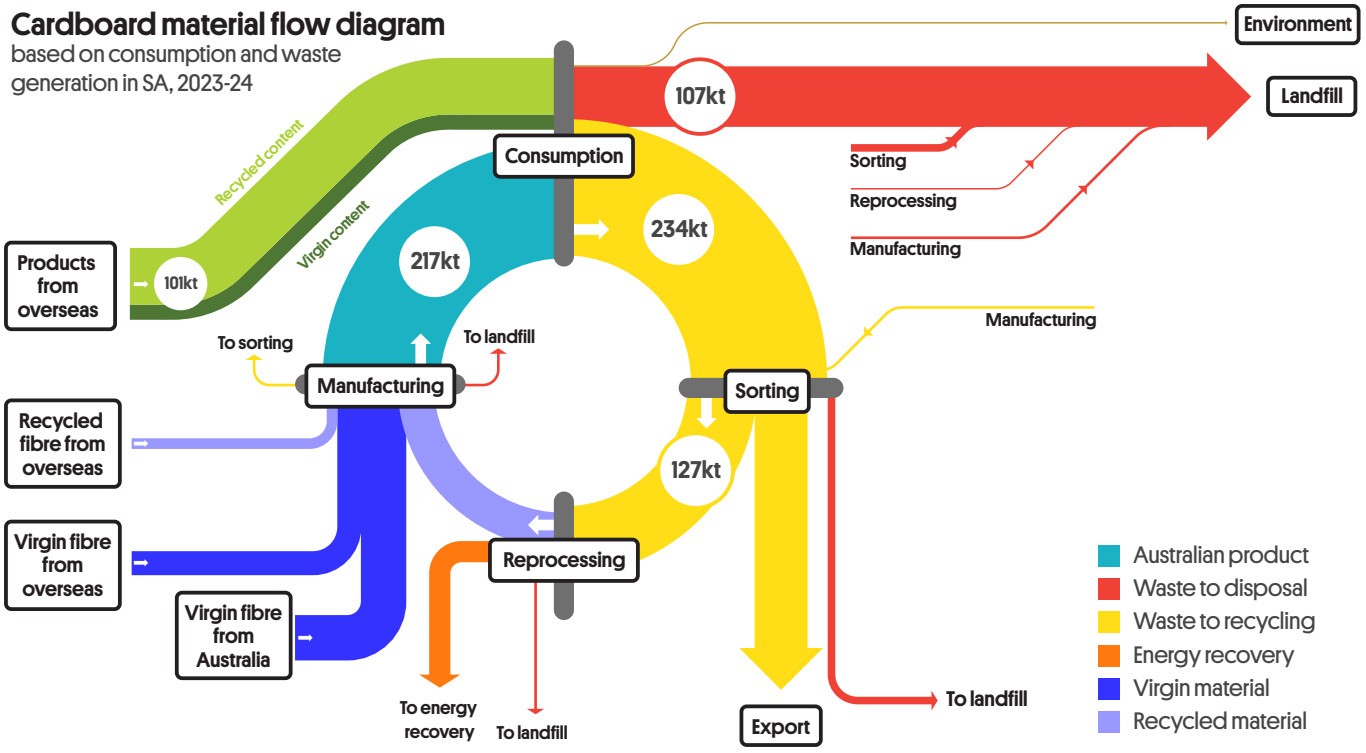



**Table 38** Cardboard and paper MFA indicators, SA 2023-24

| Indicator | Unit | Value |
|---|---|---|
| Consumption | kt | 343 |
| Waste generation | kt | 354 |
| Recovery | kt | 223 |
| Recycled content | % | 61% |
| Collection efficiency | % | 68% |
| Sorting efficiency | % | 94% |
| Reprocessing efficiency | % | 98% |
| Recycling rate | % | 52% |
| Energy recovery rate | % | 10% |
| Recovery rate | % | 63% |
| Local material utilisation rate | % | 25% |

# 4.4 Plastics

The MFA results for plastics are shown in Figure 37 and Table 39. The MFA estimates about 206 kt of plastics were consumed in SA in 2023-24, with 175 kt of plastics waste generated. Recovery is estimated at 42 kt, which equated to an estimated recovery rate of 24%, split approximately equally between energy recovery and recycling.

**Figure 37** Plastics material flow diagram, SA 2023-24

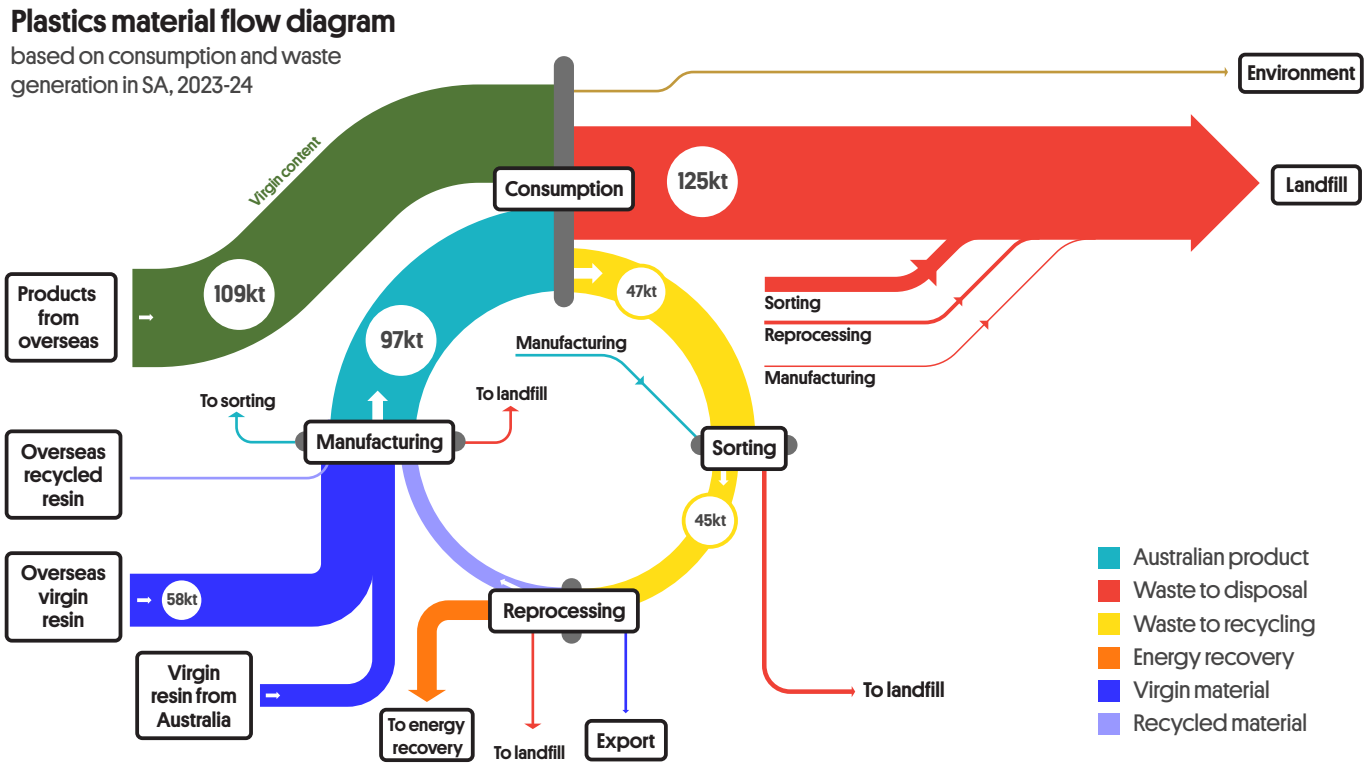



**Table 39** Plastics MFA indicators, SA 2023-24

| Indicator | Unit | Value |
|---|---|---|
| Consumption | kt | 206 |
| Waste generation | kt | 175 |
| Recovery | kt | 42 |
| Recycled content | % | 8% |
| Collection efficiency | % | 28% |
| Sorting efficiency | % | 92% |
| Reprocessing efficiency | % | 93% |
| Recycling rate | % | 12% |
| Energy recovery rate | % | 12% |
| Recovery rate | % | 24% |
| Local material utilisation rate | % | 10% |

# 4.5 Glass

The MFA results for glass are summarised in Figure 38 and Table 40. Glass consumption in SA in 2023-24 is estimated at 113 kt, and waste generation at 102 kt. About 74 kt of SA's glass waste was recovered in 2023-24. The estimated recovery rate is 73%.

**Figure 38** Glass material flow diagram, SA 2023-24

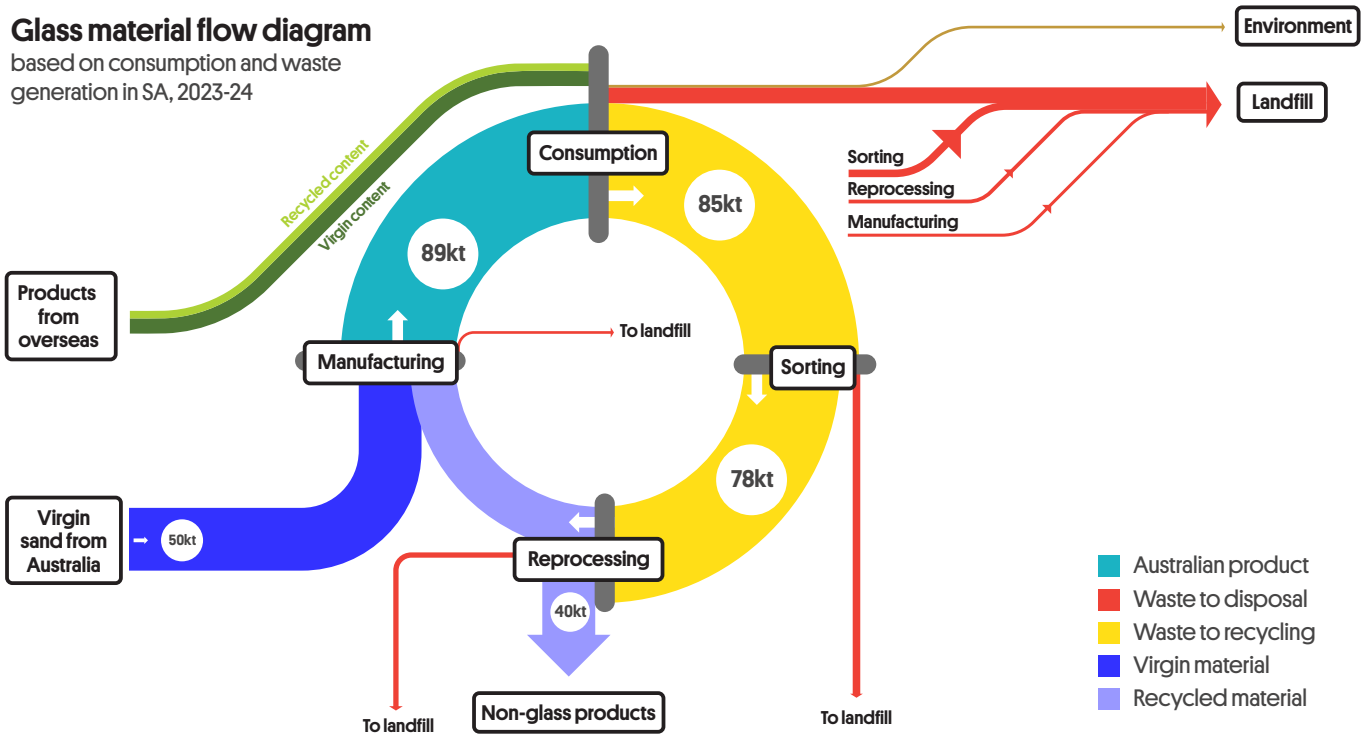



**Table 40** Glass MFA indicators, SA 2023-24

| Indicator | Unit | Value |
|---|---|---|
| Consumption | kt | 113 |
| Waste generation | kt | 102 |
| Recovery | kt | 74 |
| Recycled content | % | 36% |
| Collection efficiency | % | 83% |
| Sorting efficiency | % | 92% |
| Reprocessing efficiency | % | 95% |
| Recycling rate | % | 73% |
| Energy recovery rate | % | 0% |
| Recovery rate | % | 73% |
| Local material utilisation rate | % | 73% |

## Detailed material flows analysis – Glass

Glass is highly recyclable but suffers from breakages during collection and sorting. Source separation of glass is key to preventing losses of fines to landfill, which SA has supported since the introduction of container deposit legislation in 1977.

Markets for recycled glass are strong, consisting primarily of food and beverage packaging and crushed glass to civil construction. The circular recycling of glass back into glass packaging is environmentally preferred over crushed glass applications. Streams of clean and colour-sorted glass, as collected through container deposit schemes, are sought after because they are low in contamination and suitable for glass-to-glass manufacturing. Victoria is currently in the process of rolling out glass bins to households, in addition to its container deposit legislation.

Australia's glass manufacturers, including a major facility in SA, are actively increasing the recycled content of their product. The MFA estimates the overall recycled content of glass consumed in SA in 2023-24 at 36%; however, the rate for glass packaging was considerably higher and in the order of 50–60%.

About 74 kt of SA glass was recycled in 2023-24, of which 46% went back into glass packaging and 54% into non-glass applications like recycled sand into road base. The recovery rate is estimated at 73%. Export of glass has been regulated since January 2021 and no glass waste was reported to be exported from SA in 2023-24.

*Opportunities for improving circularity*

Across collection, sorting and reprocessing, the lowest modelled efficiency rate was for collection at 83%. This suggests the collection of end-of-life glass poses the most potential for improvement, with possible areas to target including building and demolition glass and commercial glass packaging. Household glass will be well collected via kerbside bins and container deposits.

Maximising the quantity of glass fines directed to recovery instead of landfill at sorting facilities is another potential opportunity.

# 4.6 Textiles

The MFA results for textiles are summarised in Figure 39 and Table 41. The MFA estimates about 57 kt of textiles were consumed in SA in 2023-24. Waste generation is estimated at 64 kt, of which 15 kt was recovered. This is higher than reported textiles recovery elsewhere in this report because the MFA includes estimates of textiles reuse and repurposing to local and overseas markets through charities and other networks[10]. It is worth noting textiles sent overseas for recycling or reuse may ultimately end up in another fate (e.g. landfilled or dumped). This will be explored further in the CERRR 2024-25. Onshore textiles recycling capability is relatively limited and less than 100 t of textiles was reported to be locally recycled, although over 3 kt went to local energy recovery

**Figure 39** Textiles material flow diagram, SA 2023-24

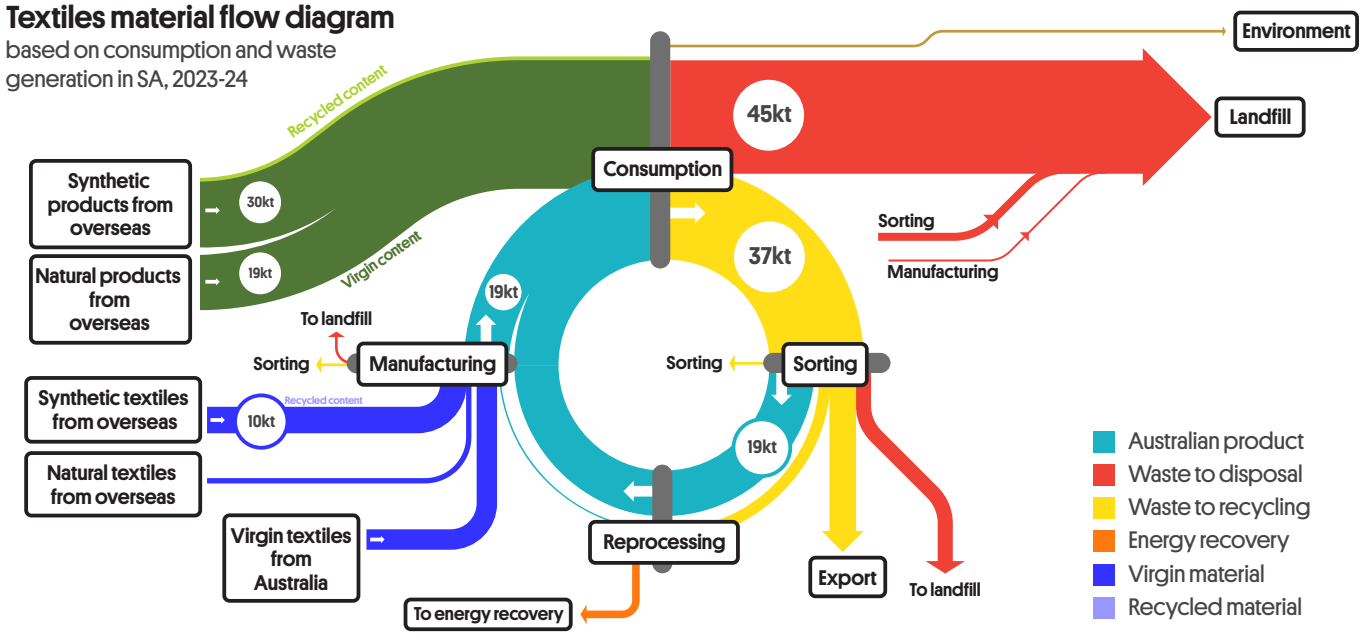



**Table 41** Textiles MFA indicators, SA 2023-24

| Indicator | Unit | Value |
|---|---|---|
| Consumption | kt | 57 |
| Waste generation | kt | 64 |
| Recovery | kt | 15 |
| Recycled content | % | 1% |
| Collection efficiency | % | 58% |
| Sorting efficiency | % | 92% |
| Reprocessing efficiency | % | 94% |
| Recycling rate | % | 5% |
| Energy recovery rate | % | 5% |
| Recovery rate | % | 24% |
| Local material utilisation rate | % | 0% |

10 The sorting to export flow and the recovery rate for the textiles material flow analysis include both recycling and reuse.

# 4.7 Tyres

The MFA results for tyres are summarised in Figure 40 and Table 42. It is estimated about 52 kt of tyres were consumed in SA in 2023-24, with 50 kt of waste generated. About 29 kt of tyres waste was recovered, which equates to an estimated recovery rate of 58%. This includes tyres processed locally into tyre-derived fuel. Tyres wear during use to generate 'tyre dust', which is represented in the 8 kt flow from consumption to environment.

**Figure 40** Tyres material flow diagram, SA 2023-24

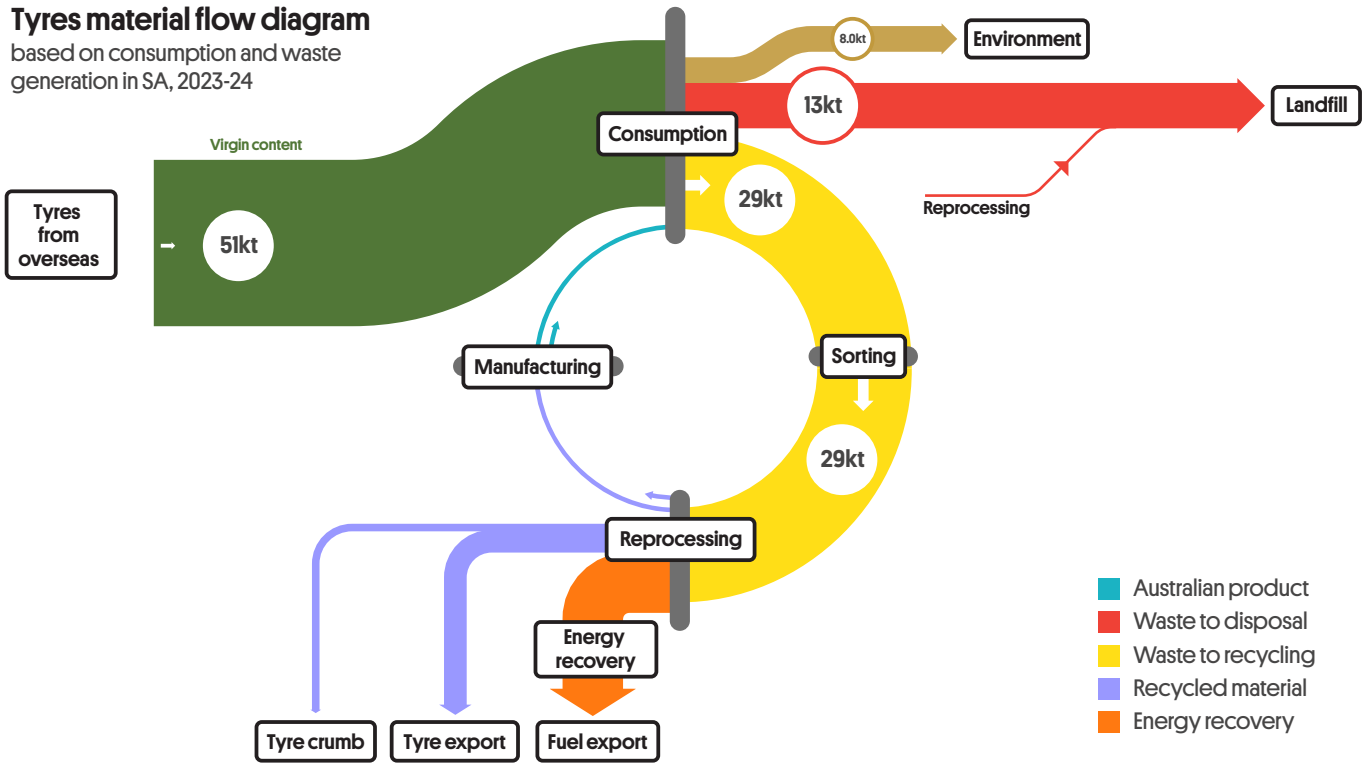



**Table 42** Tyres MFA indicators, SA 2023-24

| Indicator | Unit | Value |
|---|---|---|
| Consumption | kt | 52 |
| Waste generation | kt | 50 |
| Recovery | kt | 29 |
| Recycled content | % | 2% |
| Collection efficiency | % | 58% |
| Sorting efficiency | % | 100% |
| Reprocessing efficiency | % | 100% |
| Recycling rate | % | 21% |
| Energy recovery rate | % | 37% |
| Recovery rate | % | 58% |
| Local material utilisation rate | % | 7% |


HyFlex

# 5 Electrical and electronic waste

- Electrical and electronic waste (e-waste) is a globally growing waste stream.
- Reported e-waste recovery in SA increased by 2% from 2022-23 to 2023-24, rising from about 8.2 kt to about 8.4 kt.

Electronic waste (e-waste) means 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 is made up of metals, glass, plastics and other materials that are already accounted for in Section 3. E-waste, as a growing and complicated waste stream, is worth discussing in its own right.

Reported e-waste recovery in SA stayed relatively steady from 2022-23 to 2023-24, increasing by 2% from about 8.2 kt to about 8.4 kt. The quantity of batteries reportedly recovered continued to increase 2023-24, at about 4.8 kt. Table 43 summarises e-waste recovery in SA from 2019-20 to 2023-24.

**Table 43** Reported tonnes of e-waste, SA, 2019-20 to 2023-24, tonnes

| E-waste type | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | Change (%) |
|---|---|---|---|---|---|---|
| Printer cartridges | 170 | 150 | 20 | 980 | 90 | -91% |
| Compact fluorescent lamps | 120 | 120 | 120 | 0 | 120 | 0% |
| Batteries | 50 | 90 | 2,270 | 3,490 | 4,790 | 37% |
| Computers | 2,600 | 1,660 | 860 | 1,590 | 1,560 | -2% |
| Televisions/monitors | 1,700 | 2,930 | 1,140 | 1,830 | 1,780 | -2% |
| Mobile phones | 6.0 | 5.7 | 4.8 | 3.6 | 3.7 | 3% |
| Other e-waste | 740 | 920 | 860 | 330 | 80 | -77% |
| **Total** | **5,390** | **5,870** | **5,270** | **8,220** | **8,420** | **2%** |

Table 44 lists the proportion of total e-waste recovered from different source streams, geographical origins and reprocessing locations. Most e-waste was reported from the C&I source stream (64%) and 36% from MSW. Table 44 shows that e-waste is mostly recovered in SA (88%) or interstate (10%) with a small amount sent overseas. Materials from e-waste products were also sent overseas for reprocessing after dismantlement and sorting in SA but the exported figures are captured in exports of plastics, metals and other materials.

**Table 44** E-waste recovered in 2023-24 by source stream, geographical origin and reprocessing location

| | Source stream (%) | | | Geographical origin (%) | | Reprocessing location (%) | | |
|---|---|---|---|---|---|---|---|---|
| Material type | MSW | C&I | C&D | Metro | Regional | SA | Interstate | Overseas |
| E-waste | 36% | 64% | 0% | 91% | 9% | 88% | 10% | 2% |

Figure 41 and Figure 42 show e-waste trends since 2009-10, while Figure 43 shows a comparison of 2022-23 and 2023-24 data.

**Figure 41** Reported e-waste recovered since 2009-10 (batteries, televisions and monitors, computers and other e waste)

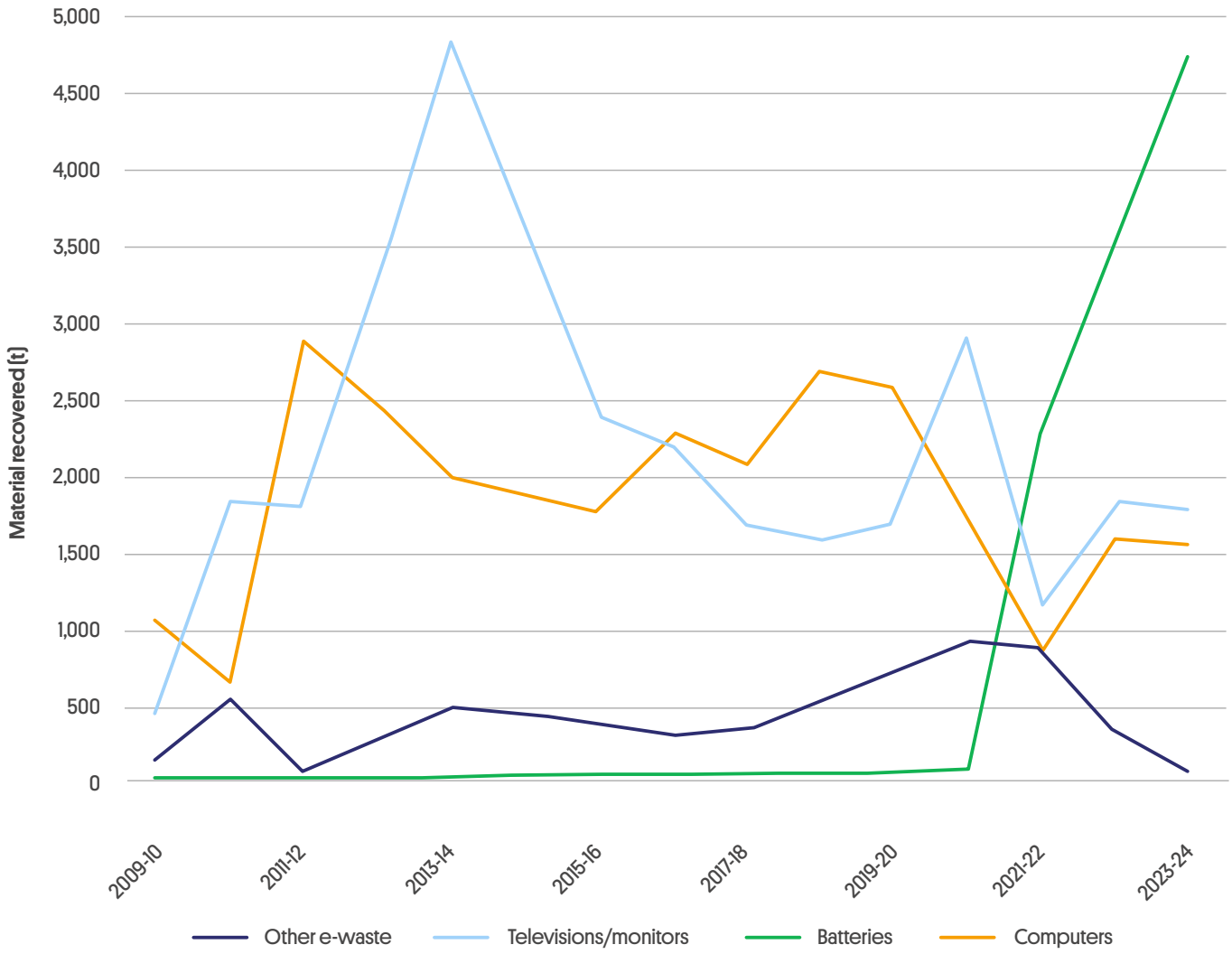


**Figure 42** Reported e-waste recovered since 2009-10 (compact fluorescent lamps, printer cartridges and mobile phones)

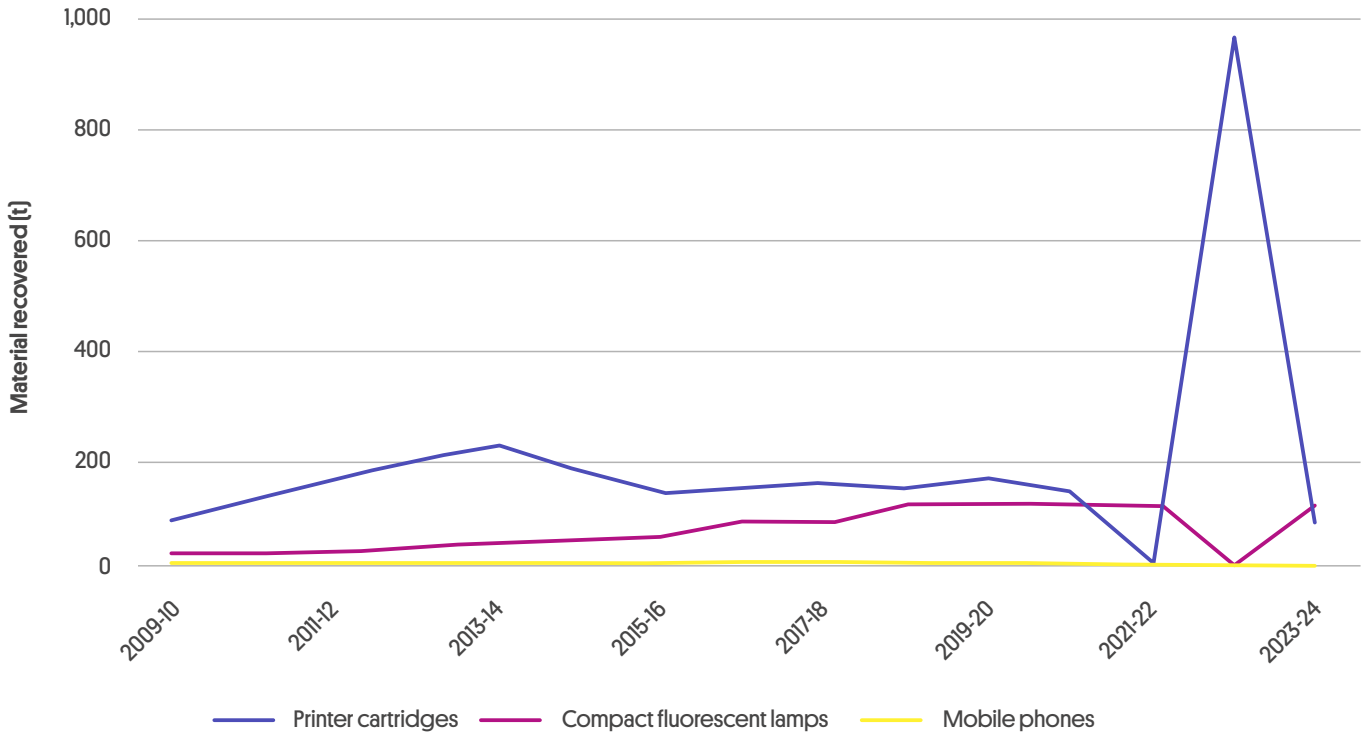
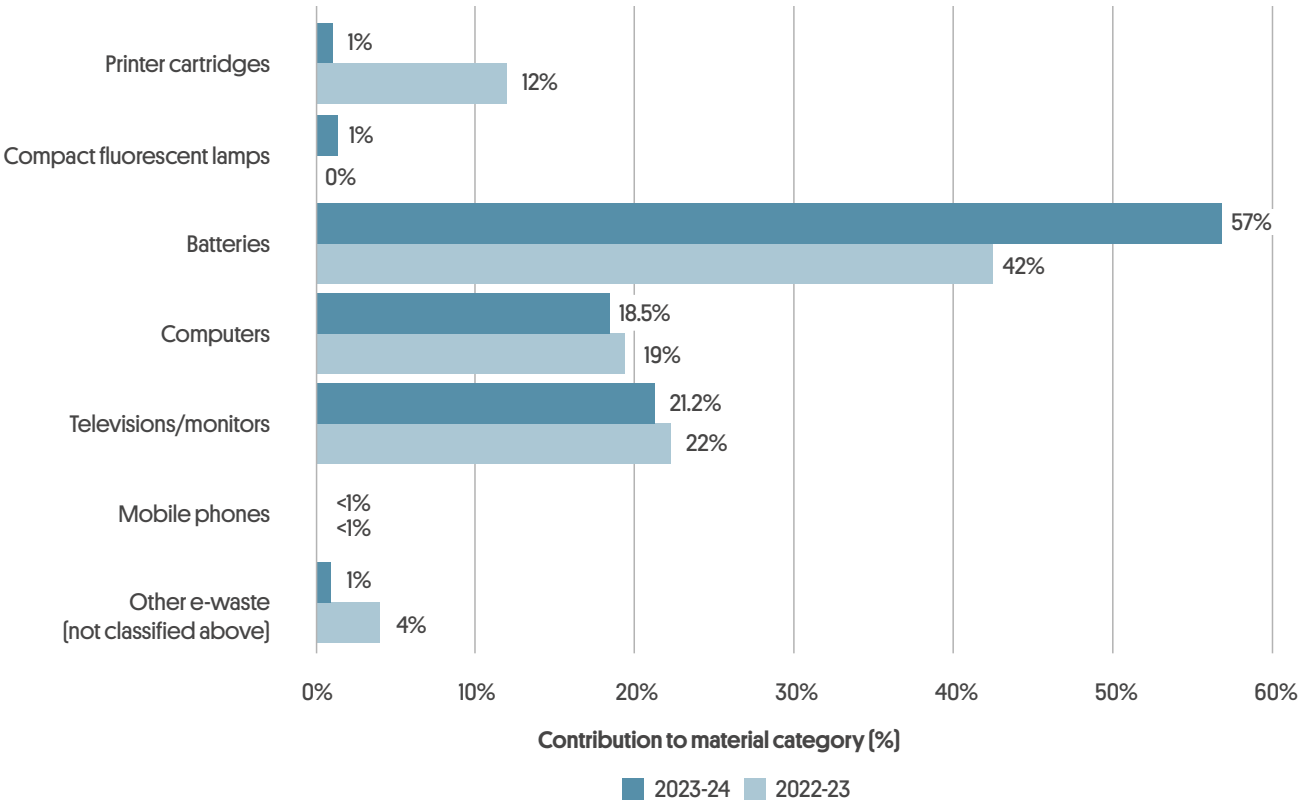
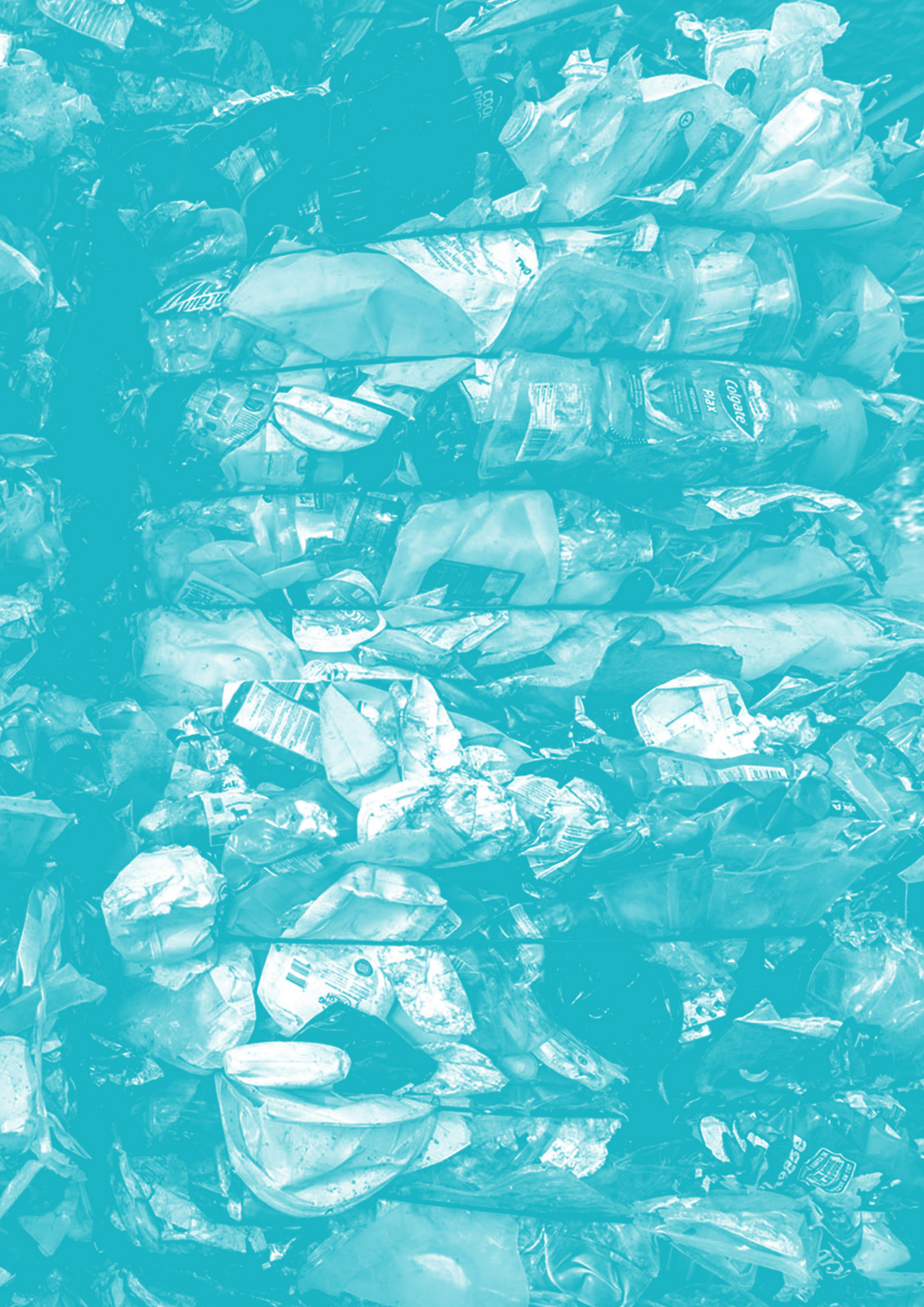



**Figure 43** Reported percent composition of e-waste recovered in 2022-23 and 2023-24




Colgate
plax

# 6 Packaging

Australia 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.

It is now widely accepted that these targets will not be met, and the industry association that developed them (the Australian Packaging Covenant Organisation) has shifted its target date to 2030. However, the recovery of packaging waste remains an important part of sustainable waste management in Australia. Packaging data is requested in the survey but is regularly answered poorly. The data presented is based on Australian Packaging Covenant Organisation (APCO) data and represents a subset of the data in Section 3. This is a different method for estimating packaging recovery than in previous Circular Economy Resource Recovery Reports.

## Overview

Data in this section includes container deposit legislation (CDL) materials, as well as any other packaging collected from kerbside collections and businesses. Overall, SA recovered about 249 kt of packaging materials in 2023-24, comprising 35 kt (14%) CDL materials and 212 kt non CDL materials.

Table 45 summarises estimated packaging recovery in SA in 2023-24. Compared to 2022-23, packaging recovered by returning through the CDL system declined by about three tonnes.


**Table 45** Estimated packaging recovered in SA in 2023-24 (kt)

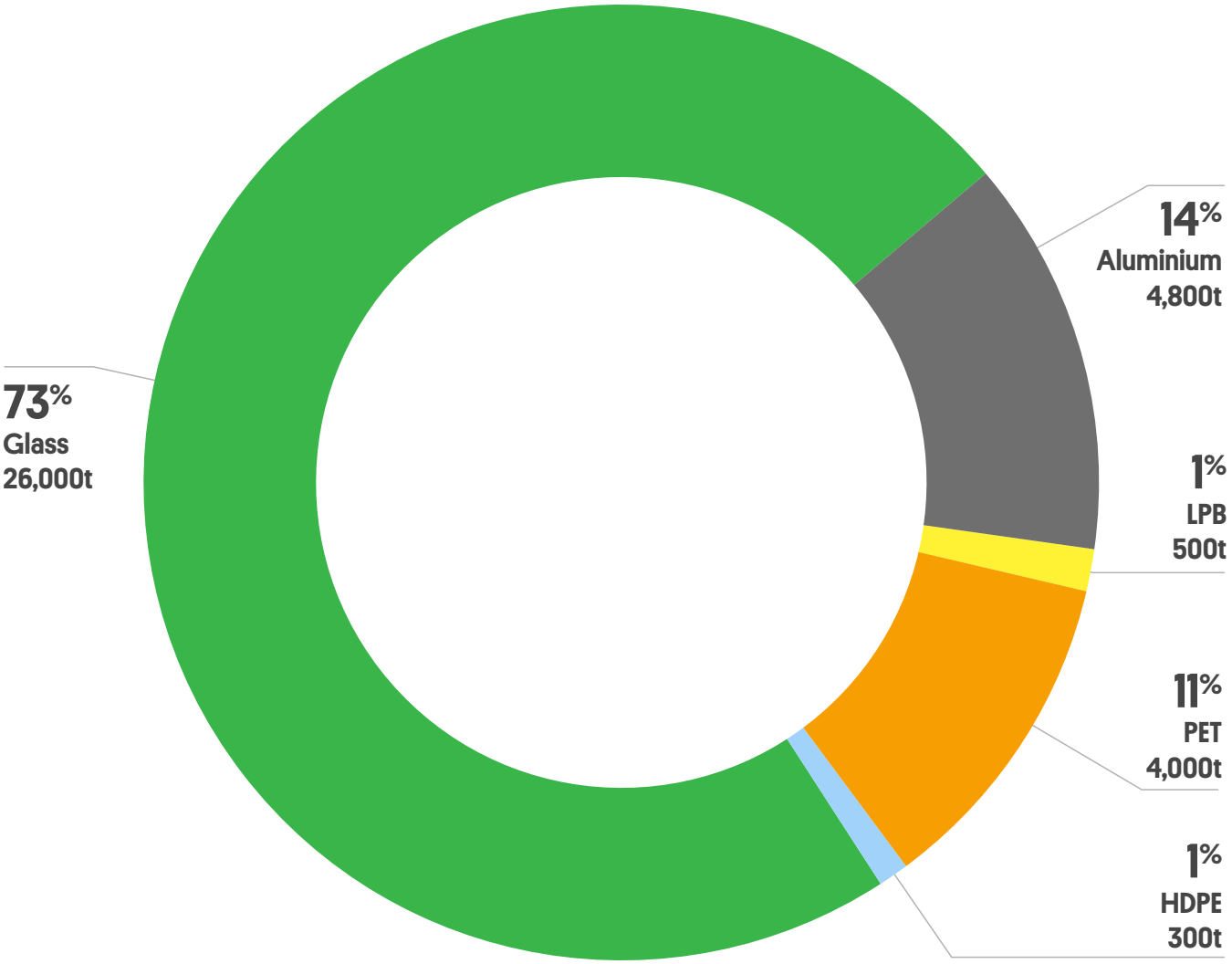
| Packaging type | Recovered (kt) | | | Total recovery which is packaging |
|---|---|---|---|---|
| | CDL | Other | Total | |
| Aluminium packaging | 5 | 0 | 5 | 11% |
| Steel packaging | 0 | 6 | 6 | 2% |
| Cardboard packaging | 0 | 140 | 140 | 100% |
| Liquid paperboard packaging | 0 | 1 | 1 | 100% |
| Other cardboard and paper packaging | 0 | 17 | 17 | n/a |
| PET packaging | 4 | 0 | 4 | 98% |
| HDPE packaging | 0 | 7 | 7 | 83% |
| PVC packaging | 0 | <0.1 | <0.1 | 21% |
| LDPE packaging | 0 | 13 | 13 | 94% |
| PP packaging | 0 | 4 | 4 | 85% |
| PS packaging | 0 | 2 | 2 | 80% |
| Other plastic packaging | 0 | <0.1 | <0.1 | n/a |
| Glass bottles and jars | 26 | 25 | 51 | 100% |
| **Total** | **35** | **214** | **249** | **n/a** |

## 6.1 Container deposit legislation

SA has the longest established container deposit scheme (CDS) in Australia, having introduced its container deposit scheme in 1977. The next jurisdiction after SA to implement a CDS was the NT in 2012. Today, all states and territories have implemented a CDS, with the most recent, Tasmania beginning in May 2025.

In total, South Australians returned about 35 kt of containers to CDS locations across the State in 2023-24. The bulk of these materials were glass containers, which made up about 26 kt (73% by weight) of total CDS materials in 2023-24. About 4.8 kt of aluminium cans, 4.0 kt of PET, 500 tonnes of liquid paperboard and 300 tonnes of HDPE packaging was returned.

**Figure 44** Relative proportions of returned container deposit legislation materials by weight, SA, 2023-24




The return rates for CDL materials are provided in Table 46 below. Return rates 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 steady compared to return rates in 2022-23.

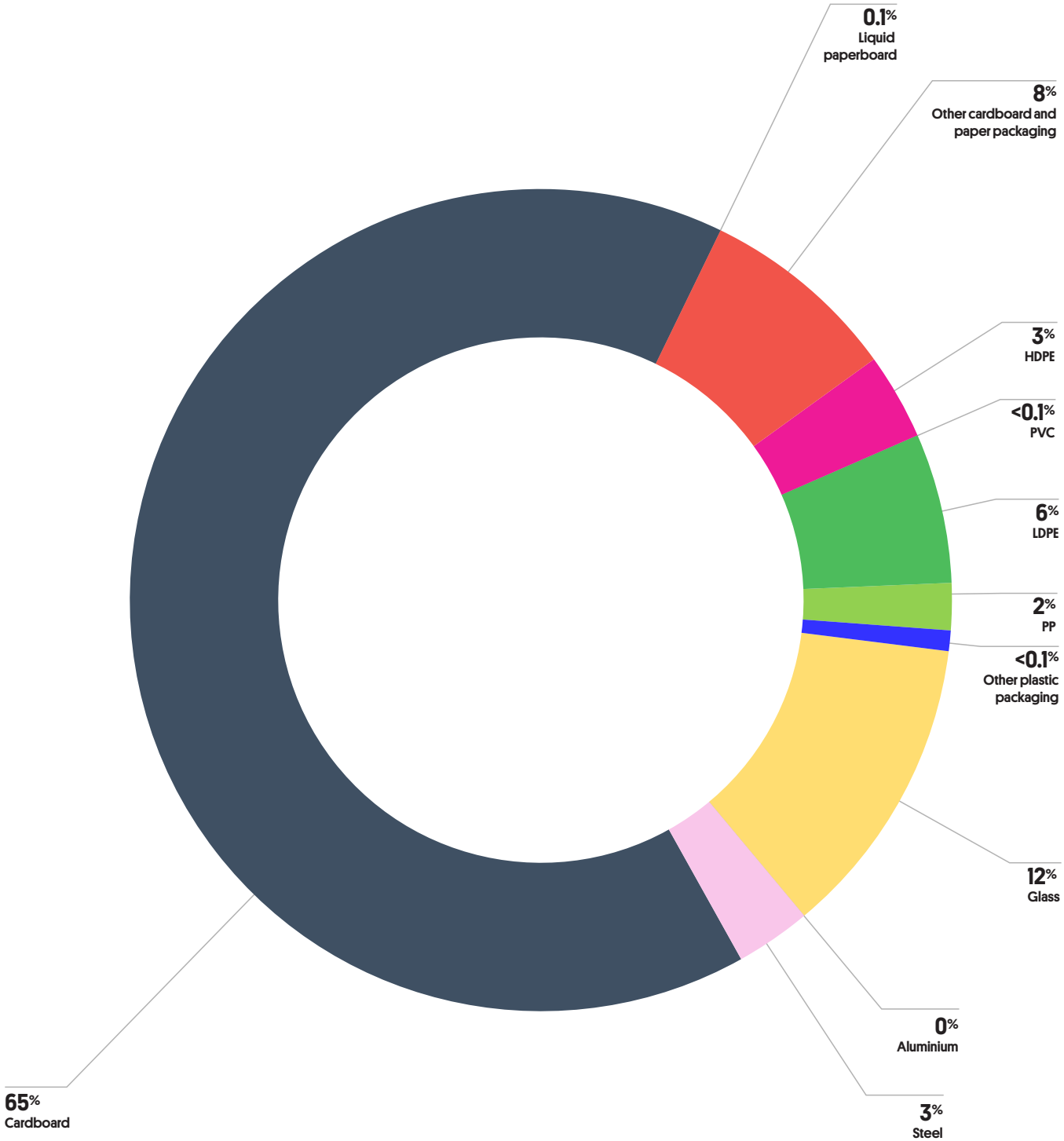
**Table 46** Return rates for SA's container deposit legislation materials in 2023-24

| Packaging material | kt | Return rate (%) |
|---|---|---|
| Aluminium | 4.8 | 80% |
| Liquid paperboard | 0.5 | 49% |
| PET | 4.0 | 66% |
| HDPE | 0.3 | 55% |
| Glass | 26 | 84% |

## 6.2 Other packaging materials

Figure 45 presents the tonnes and proportions of non-CDL recovered packaging material from 2023-24. Cardboard packaging remained the highest contributor (65%). The second highest proportion was glass bottles and jars (12%).

**Figure 45** Relative proportions of other (non-CDL) packaging materials, SA, 2023-24




kids
Lactose Free
10

# 7 Resource recovery value

- The total value of resource recovery in SA in 2023-24 is estimated at about $783 million.
- Overall, the metals category contributed the most to the resource recovery value in 2023-24, followed by organics, cardboard and paper, plastics, masonry, separately reported materials, glass and other materials.

Surveyed companies and organisations were asked to provide the value per tonne for each of the materials they recycled. These were used to estimate the market value of resource recovery in SA. Not all respondents provided this information, an average of the values reported by other recyclers for each material is used in the absence of primary data.

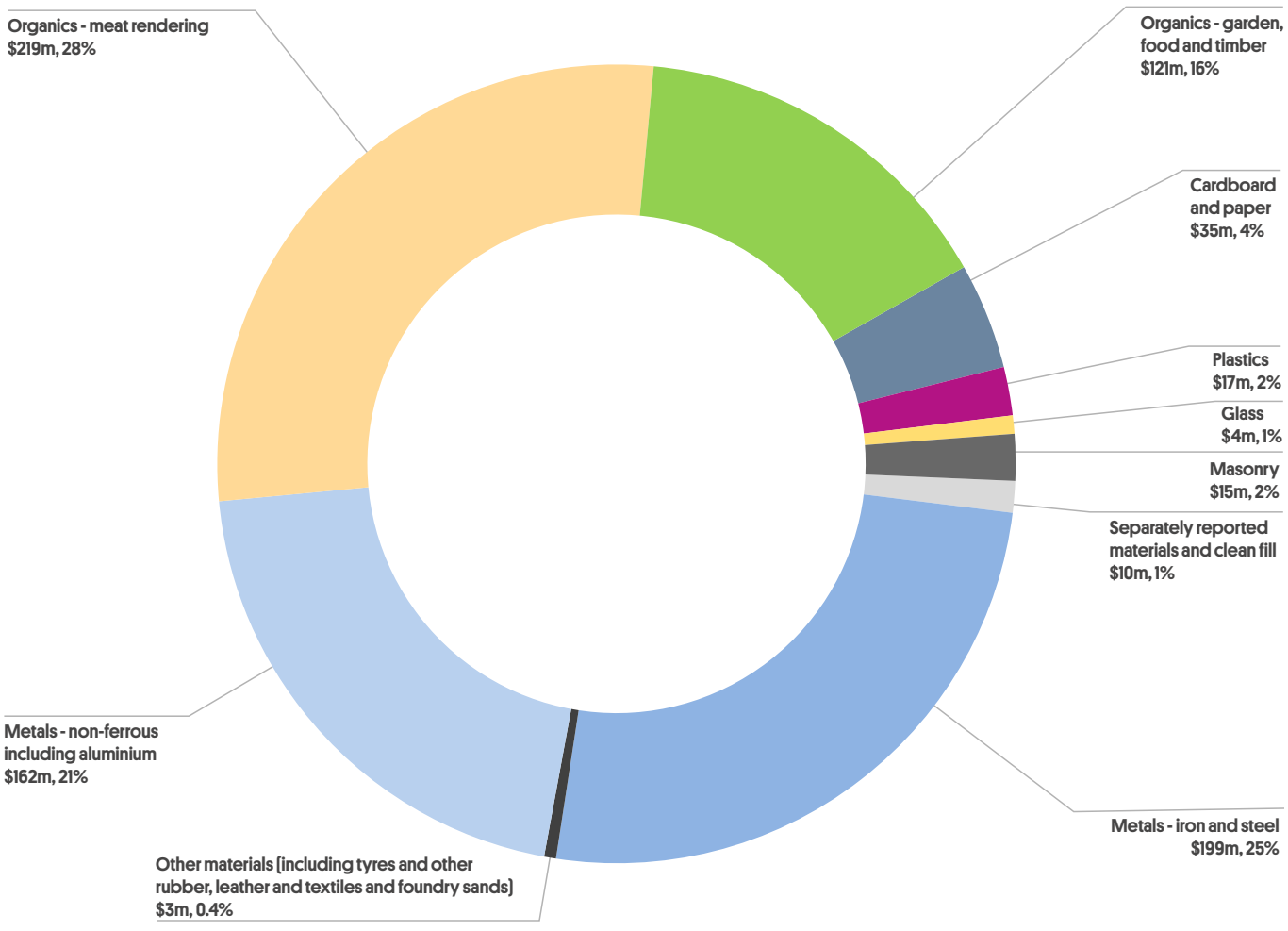
Table 47 summarises the estimated value of recovery in SA in 2023-24, including recovered tonnes by material, estimated on-sale values per tonne and estimated overall value per material. The total value of recovery in SA in 2023-24 is estimated at about $783 million, a decrease from the estimated 2022-23 value of $811 million. This may be due to the slightly lower volumes of scrap metal reported in 2023-24 given that metal scrap is of high value.

Overall, metals recovery ($360m) was the greatest contributor to total resource recovery value in 2023-24, followed by organics ($339m), cardboard and paper ($35m), plastics ($17m), masonry ($15m), separately reported materials (clays, fines, rubble and soils) ($10m), glass ($4m) and other materials ($3m) recovery.

**Table 47** Estimated resource value for recovered materials in SA in 2023-24

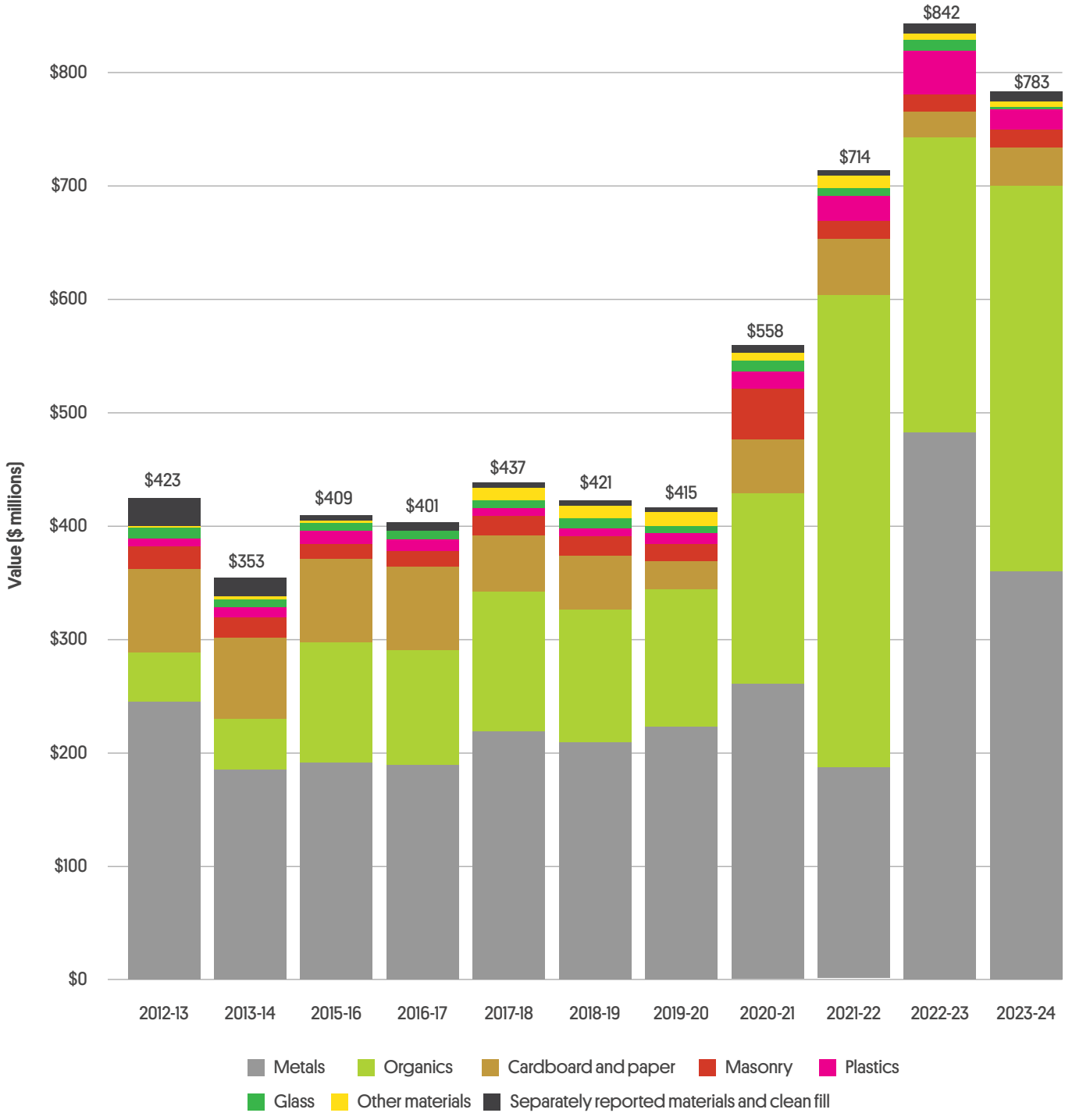
| Material category or type | Quantity recovered (kt) | Estimated on-sale price ($/tonne) | Estimated value ($ millions) |
|---|---|---|---|
| Masonry | 1,178 | $13 | $15 |
| Metals – iron and steel | 379 | $524 | $199 |
| Metals – non-ferrous including aluminium | 58 | $2,796 | $162 |
| Organics – meat rendering | 109 | $2,000 | $219 |
| Organics – garden, food and timber | 740 | $164 | $121 |
| Organics – other | 437 | Variable | Not calculated |
| Cardboard and paper | 223 | $155 | $35 |
| Plastics | 42 | $393 | $17 |
| Glass | 74 | $54 | $4 |
| Other materials (including tyres and other rubber, leather and textiles and foundry sands) | 36 | $84 | $3 |
| Separately reported materials and clean fill | 1,085 | $9 | $10 |

**Figure 46** Estimated market value of resource recovered materials, SA, 2023-24



The trend for estimated market value of resource recovery in SA is shown in Figure 47. The value in 2023-24 is lower than in 2022-23 and more similar to 2021-22. Metals and 'other' materials contributed less of the value of resource recovery than in previous years. Separately reported materials (clays, fines, rubbles and soils) and masonry are contributing less to the estimated market value than in previous years, although it is noted that not all C&D recyclers handling these materials responded to the section of the survey corresponding with $ per tonne value.

**Figure 47** Estimated market value of resource recovered materials in SA, 2012-13 to 2023-24[11]




11 Historical values have been adjusted to account for inflation. No data available for 2014-15.

# 8 Environmental benefits of recycling

Resource recovery in SA in 2023-24 was estimated to achieve the following environmental benefits:

- greenhouse gas emissions savings about 1.76 million tonnes of carbon dioxide equivalent (Mt $CO_2$-e)
- energy savings of about 20,300 terajoules (TJ).
- water savings of about 7,740 megalitres (ML).

The production and consumption of materials requires the use of energy and water and emits greenhouse gases. When a recoverable material is landfilled, the resource and the energy 'embodied' within it (that is, the energy used to make it) are wasted. Additionally, when materials prone to biological decay (organics, paper and cardboard or textiles) are landfilled, they generate and release the potent greenhouse gas, methane.

This section details the environmental benefits of SA's resource recovery sector, including the estimated emissions, energy and water savings the sector achieved in 2023-24. This assumes the recovered materials substitute for virgin materials so the relative savings can be estimated from life cycle assessments and other information sources as given in Appendix B. The results are summarised below in Table 48.

**Table 48** Estimated environmental benefits of recycling in SA in 2023-24

| Material type | Recycling kt | Emissions avoided kt $CO_2$-e | Energy saved TJ LHV | Water saved ML |
|---|---|---|---|---|
| **Masonry** | | | | |
| Asphalt | 245 | 7 | 582 | 215 |
| Bricks | 35 | 1 | 10 | 45 |
| Concrete | 898 | 18 | 314 | 1,150 |
| Plasterboard | <1 | <1 | 0 | 0 |
| **Metals** | | | | |
| Steel | 379 | 167 | 2,840 | -895 |
| Aluminium | 42 | 700 | 8,680 | 1,230 |
| Non-ferrous metals (ex. aluminium) | 16 | 14 | 569 | 94 |
| **Organics** | | | | |
| Food organics | 85 | 49 | 15 | 38 |
| Garden organics | 354 | 237 | 109 | 1,980 |
| Timber | 222 | 40 | 2,380 | -9 |
| Other organics | 656 | 315 | 1,420 | 151 |
| **Cardboard and paper** | | | | |
| Cardboard and waxed cardboard | 120 | 20 | 56 | 1,330 |
| Liquid paperboard | 1 | 0 | 1 | 12 |
| Magazines and newsprint | 44 | 20 | 16 | 477 |
| Printing and writing paper | 21 | 28 | -15 | 236 |


| Material type | Recycling kt | Emissions avoided kt $CO_2$-e | Energy saved TJ LHV | Water saved ML |
|---|---|---|---|---|
| **Plastics** | | | | |
| Polyethylene terephthalate | 3 | 4 | 170 | 213 |
| High density polyethylene | 7 | 6 | 358 | 163 |
| Polyvinyl chloride | 0 | 0 | 2 | 2 |
| Low density polyethylene | 6 | 5 | 285 | 130 |
| Polypropylene | 3 | 1 | 93 | 82 |
| Polystyrene | 0 | 0 | 0 | 0 |
| Mixed and/or other plastics | 2 | 0 | 47 | 41 |
| **Glass** | | | | |
| Glass | 74 | 39 | 331 | 69 |
| **Other materials** | | | | |
| Foundry sands | 1 | 0 | 0 | 0 |
| Leather and textiles | 3 | 0 | 0 | 0 |
| Tyres and other rubber | 30 | 32 | 1,890 | 1,540 |
| **Separately reported materials** | | | | |
| Fly ash | 0 | 0 | 0 | 0 |
| Clay, fines, rubble and soil | 893 | 79 | 1,270 | 393 |
| **Total** | **4,120** | **1,760** | **20,300** | **7,740** |


## 8.1 Greenhouse gas emission savings

It is estimated that SA saved about 1.76 million tonnes of carbon dioxide equivalent ($CO_2$-e) through recycling its materials in 2023-24. This is an increase from the estimated emissions savings reported in the previous year (1.67 million tonnes $CO_2$-e).

Metals recycling contributed the greatest proportion of greenhouse gas emissions savings at about 881 kt $CO_2$-e or half of total estimated emissions savings. This benefit is from avoided emissions from manufacture of metals from virgin materials, which is more emissions intensive than recycling.

The next greatest contribution was from recycling organics, which contributed 641 kt $CO_2$-about 36% of total emission savings. This is due to avoided landfill emissions.

Recycling of cardboard and paper and separately reported materials (clays, fines, rubbles and soils) contributed 4% of total emissions savings each, glass was about 2% and masonry and plastics and other materials each contributed about 1%.

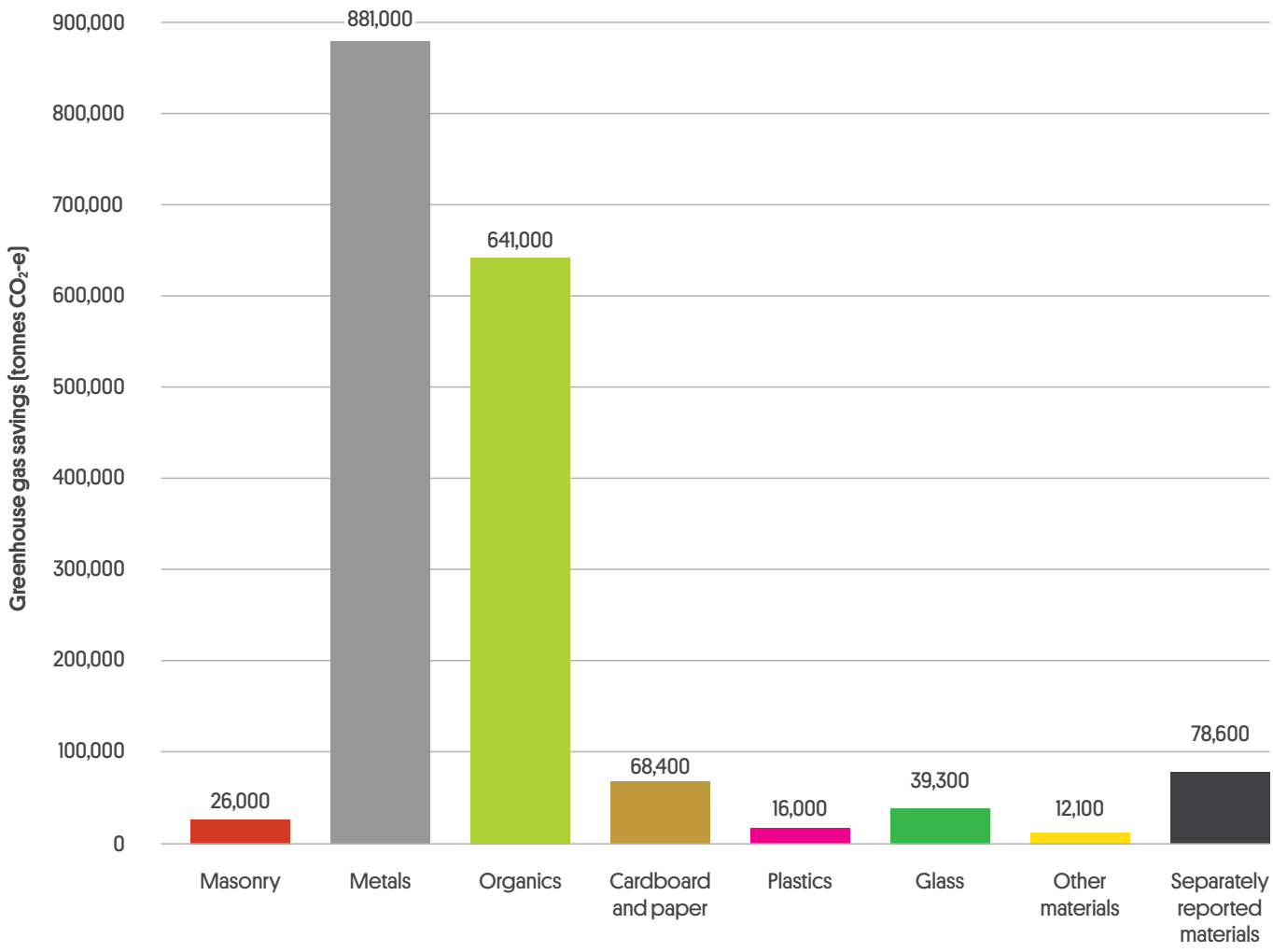
Table 49 and Figure 48 provide detail on estimated greenhouse gas emissions savings due to recycling in 2023-24. It is estimated that emissions saved due to recycling is approximately equivalent to:

- the $CO_2$ absorbed by 2.63 million trees
- the annual emissions from 352,000 cars.

**Table 49** Estimated greenhouse gas emissions savings due to recycling in SA in 2023-24

| Material category | Emissions saved (kt $CO_2$-e) | Equivalent trees planted required for carbon absorption | Equivalent cars off the road in one year |
|---|---|---|---|
| Masonry | 26 | 39,000 | 5,000 |
| Metals | 881 | 1,312,000 | 176,000 |
| Organics | 641 | 955,000 | 128,000 |
| Cardboard and paper | 68 | 102,000 | 14,000 |
| Plastics | 16 | 24,000 | 3,000 |
| Glass | 39 | 59,000 | 8,000 |
| Other materials | 12 | 18,000 | 2,000 |
| Separately reported materials | 79 | 117,000 | 16,000 |
| **Total** | **1,760** | **2,630,000** | **352,000** |

**Figure 48** Estimated greenhouse gas emissions savings due to recycling, SA, 2023-24



## 8.2 Energy savings

Energy savings from recycling in SA during 2023-24 were estimated at 20,300 terajoules (TJ). This is higher than the 2022-23 estimate of 19,400 TJ. This increase is influenced by the reported increase in timber recovery in 2023-24.

The top contributors to total energy savings in 2023-24 were metals (60%), followed by organics at 19%.

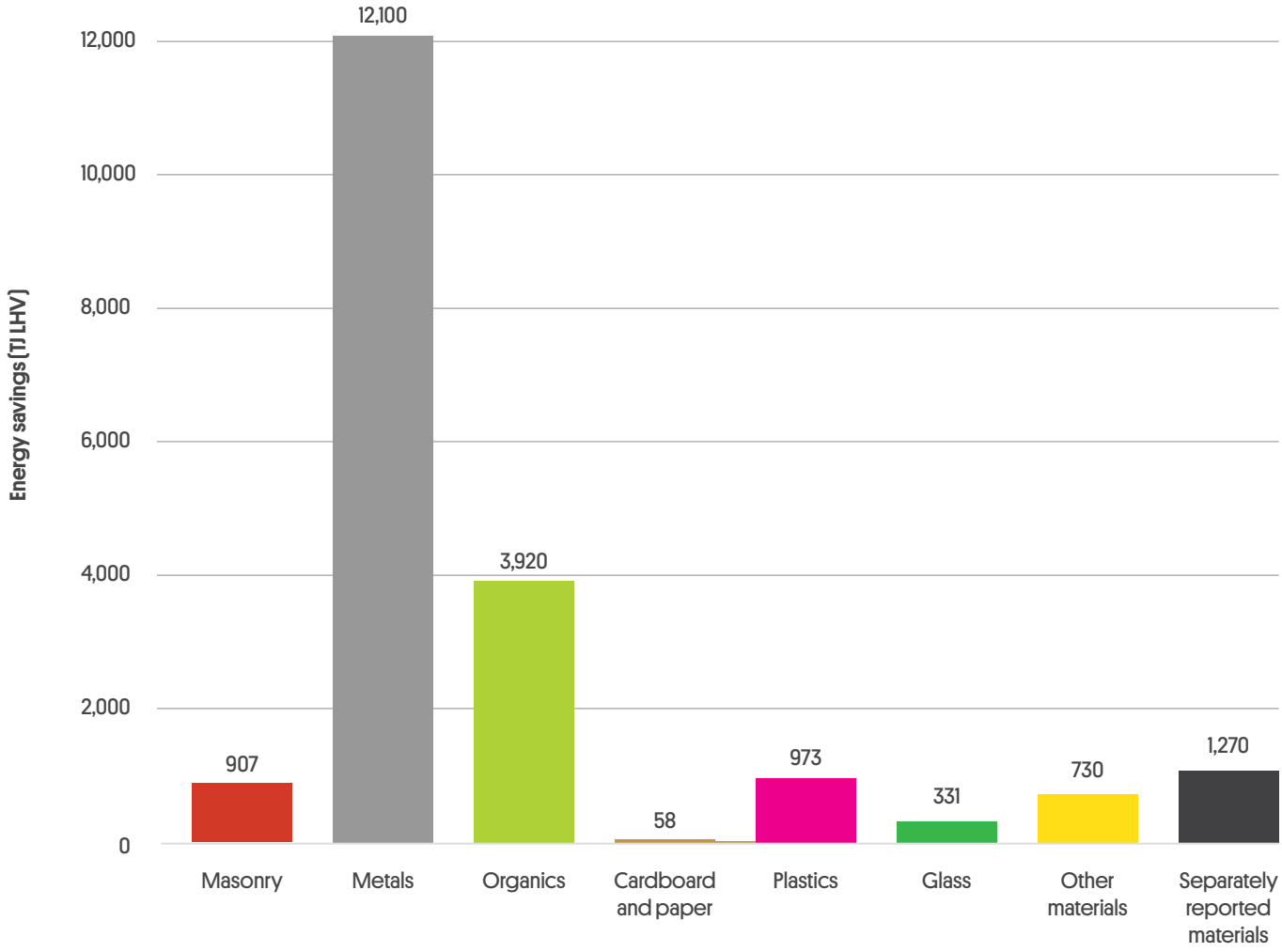
It is estimated that energy savings due to the recycling of SA materials in 2023-24 are equivalent to:

- energy use from 397,000 households in one year
- the energy supplied by 3.32 million barrels of oil.

**Table 50** Estimated energy savings due to recycling in SA in 2023-24

| Material category | Energy saved (TJ LHV) | Equivalent energy use from households in one year | Barrel of oil equivalents |
|---|---|---|---|
| Masonry | 907 | 17,800 | 149,000 |
| Metals | 12,100 | 237,000 | 1,980,000 |
| Organics | 3,920 | 76,900 | 643,000 |
| Cardboard and paper | 58 | 1,130 | 9,450 |
| Plastics | 956 | 19,000 | 157,000 |
| Glass | 331 | 6,480 | 54,200 |
| Other materials | 730 | 14,200 | 119,000 |
| Separately reported materials | 1,270 | 24,900 | 208,000 |
| **Total** | **20,300** | **397,000** | **3,320,000** |

**Figure 49** Estimated energy savings due to recycling, SA, 2023-24



## 8.3 Water savings

The total estimated water saved from recycling SA materials in 2023-24 was 7,740 megalitres (ML), this is an increase from the 6,400 ML estimated in 2022-23. This is possibly due to more cardboard and paper products recovery, which saves water when recycled material is used rather than virgin pulp.

Organics contributed to highest proportion of these savings at 28%, followed closely by cardboard and paper (27%) and then masonry (16%).

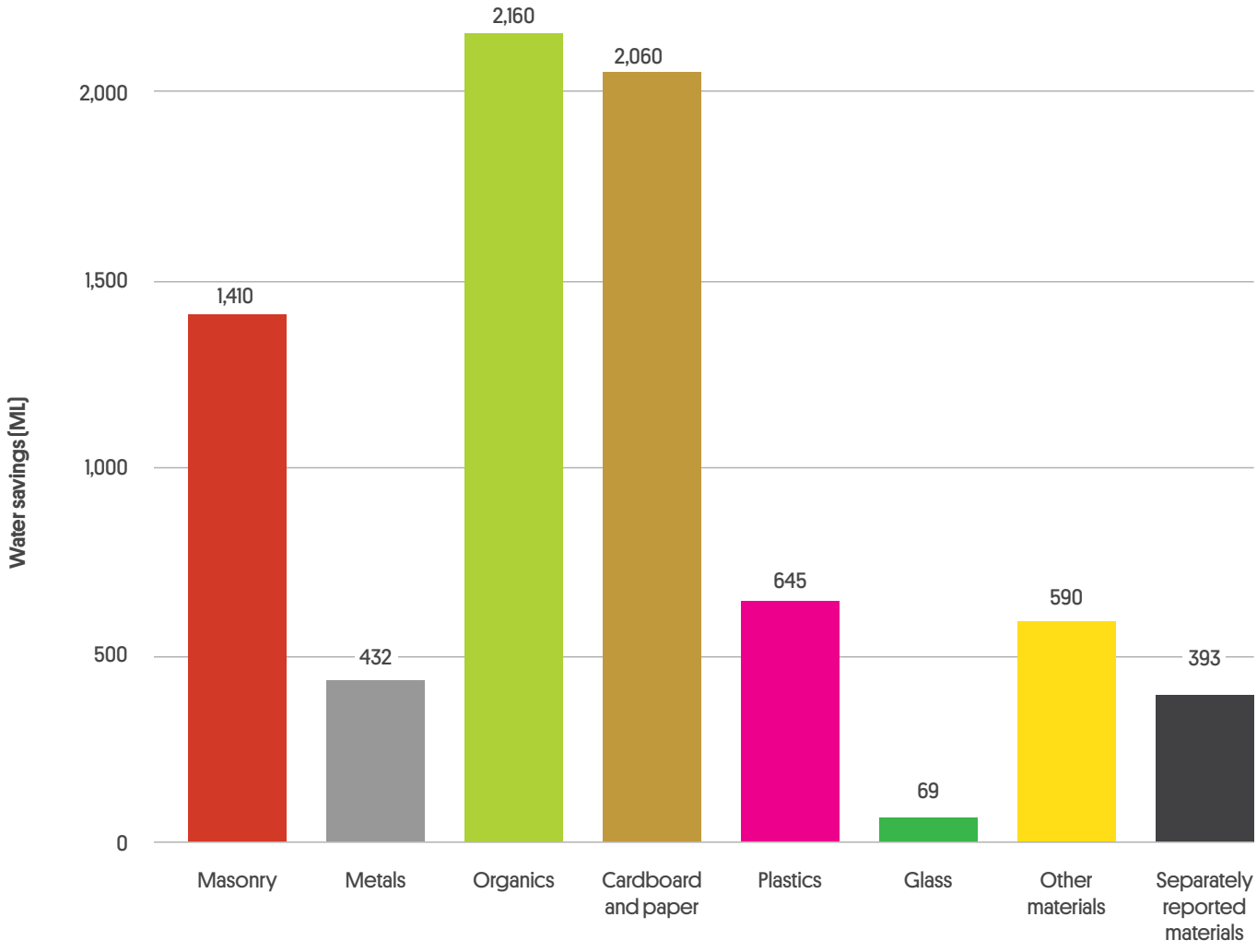
Water savings from recycling in SA in 2023-24 are estimated to be approximately equivalent to:

- annual water use of 44,500 households
- the water contained in 2,940 Olympic sized swimming pools.

**Table 51** Estimated water savings due to recycling in SA in 2023-24

| Material category | Water saved (ML) | Equivalent household water use in one year | Equivalent Olympic swimming pools |
|---|---|---|---|
| Masonry | 1,410 | 8,500 | 560 |
| Metals | 432 | 2,620 | 173 |
| Organics | 2,160 | 13,100 | 863 |
| Cardboard and paper | 2,060 | 12,500 | 823 |
| Plastics | 630 | 3,820 | 252 |
| Glass | 69 | 420 | 28 |
| Other materials | 592 | 3,590 | 237 |
| Separately reported materials | 393 | 2,380 | 157 |
| **Total** | **7,740** | **44,500** | **2,940** |

**Figure 50** Estimated water savings due to recycling, SA, 2023-24



# References


ABS (2024a) *Australian National Accounts: State Accounts*, online at: https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-state-accounts

ABS (2024b) *National, state and territory population*, online at: https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/

ABS (2025) *Consumer Price Index*, Australia, online at: https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/consumer-price-index-australia/dec-quarter-2024

APCO (2024) *Australian packaging, consumption & recovery data 2022–23, online* at https://apco.org.au/news/20YOI00000HTRcYMAX

Brunner, P. and Rechberger, H. (2017) Handbook of Material Flow Analysis - for Environmental, Resource and Waste Engineers, CRC Press, Boca Raton, USA

Department of Climate Change, Energy, the Environment and Water (2024) *Australian standard for waste and resource recovery data and reporting (second edition)*, prepared by Blue Environment, online at: https://www.dcceew.gov.au/environment/protection/waste/publications/national-standard-waste-resource-recovery-data-reporting-second-edition

Blue Environment (2024) *National Waste and Resource Recovery Report 2024*, prepared for the Department of Climate Change, Energy, the Environment and Water, online at https://www.dcceew.gov.au/environment/protection/waste/publications/national-waste-resource-recovery-reporting

Green Industries SA (2024) River Murray flood clean-up progress, web page: https://www.greenindustries.sa.gov.au/clean-up-progress

Green Industries SA (2021) *Recycling Activity Survey 2019-20 Report*, online at: www.greenindustries.sa.gov.au/resources/recycling-activity-in-south-australia-2019-20

Green Industries SA (2020) *South Australia's Waste Strategy 2020-2025*, online at: www.greenindustries.sa.gov.au/resources/sa-waste-strategy-2020-2025

NWRIC (National Waste and Recycling Industry Council 2023) *Economic and Environment Benefits from an Australian Unprocessed Ferrous Scrap Metal Export Ban*, online at: https://www.pc.gov.au/__data/assets/pdf_file/0007/388240/sub171-circular-economy-attachment2.pdf

SA EPA (SA Environment Protection Authority 2025) *Waste levy*, online at: https://www.epa.sa.gov.au/business_and_industry/waste-levy

Sustainability Victoria (2014) *Market summary –shredder floc*

Trellis Technologies (2019) G*reen Industries South Australia - Emission Factor Review*, prepared for Green Industries SA

UNEP (United Nations Environment Programme 2020) *International Resource Panel Glossary*, online at: https://www.resourcepanel.org/glossary

World Steel Association (2023) *Steel and raw materials fact sheet*, online at: https://worldsteel.org/media/fact-sheets/

World Steel Association (2021) *Scrap use in the steel industry*, online at https://worldsteel.org/media/fact-sheets/

World Steel Association (2024) *World steel in figures 2024*, online at: https://worldsteel.org/data/world-steel-in-figures/world-steel-in-figures-2024/


Kálaini
5
GIVE WEEKLY
FOGO
FOOD ORGANICS | GARDEN ORGANICS
A GOGO
CITY OF
HOLDFAST BAY

# Appendices

# Appendix A Technical method

## A1 Overview

Green Industries SA commissioned Blue Environment to undertake a survey on SA's recycling and energy recovery industries for the 2023-24 financial year. This section outlines the approach for conducting the survey and analysing the collected data.

## A2 The survey

### A2.1 Design

The survey was based on the survey from used in CERRR 2022-23 with some minor changes to facilitate information gathering. The survey remained consistent with the Commonwealth Government's *Australian standard for waste and resource recovery data and reporting*. The changes were:

- limiting the scope of recovery to mean recycled, recovered by energy recovery or waste reuse of clays, fines, rubble and soil
- use of four specialised survey forms tailored to the type of recycling business
- including 'checks' throughout the survey to help respondents make sure they were fully completing the data requests.

The survey questionnaire was developed in consultation with Green Industries SA and can be seen in Appendix C.

### A2.2 Participants

Using the Circular Economy Resource Recovery Survey 2022-23 respondents as a foundation, a list of companies and organisations involved with recycling, reuse and energy recovery in SA was developed. This covered recovery facilities, reprocessors, industry bodies, local government waste management authorities and reuse organisations. The final list, developed in consultation with Green Industries SA, comprised 104 companies and organisations. Some composters received a separate survey from Green Industries SA, the data from which were received and applied in this report.

### A2.3 Delivery

The survey was deployed to participants in October and November 2024 via email. The survey form, an introduction letter from GISA and a confidentiality deed from the consultant team were attached to the email.

Participants were offered an opportunity to go through the survey with a member of the consultant team or fill out the form in their own time. Participants were sent follow-up reminders on the survey via email and/or phone multiple times to encourage submission. The surveying period lasted several weeks and closed in December 2024, although some data was received in early 2025.

A selection of key SA recyclers nominated by GISA were approached for a site visit and face-to-face survey interview. Eight site visits were conducted, where members of the consultant team and a representative from GISA filled out the survey questionnaire in-person alongside the survey respondent. Two interviews were conducted via videoconference. These face-to-face consultations provided additional detail and industry insights that guided the interpretation of data and the report.

The survey was voluntary and not all approached companies and organisations provided a response, despite the consultant team's best efforts. In instances of non-response, data were filled where possible using previous years' data, mass balance reporting data from SA EPA or the ABS exports data.

# A3 Data analysis

## A3.1 Survey data analysis

Data collected via the survey were collated into a Microsoft Excel database. The data were cleaned and verified, and then analysed to determine the following for each material type:

- **Net recovery:** the quantity of SA materials recovered, net of residuals and accounting for known and assumed double-counts.
- **Source stream:** the source stream from which the SA materials came from, including MSW, C&I and C&D.
- **Geographical origin:** the geographical origin within SA from which the material came from.
- **Destination:** where the material was sent for recycling, including in SA, interstate or overseas.

The following principles were applied when analysing survey data to generate reported figures:

- The scope of the survey was for materials generated in SA only. Therefore, any materials imported into SA from interstate or overseas for recovery were excluded.
- The proportion of received materials that were residual waste sent to landfill was excluded from reported quantities.
- Care was taken to avoid double-counts of materials, which can arise when material flows through more than one facility and is subsequently reported by more than one survey participant. Double-counts were mostly addressed via a survey question regarding where materials were sent offsite to for further processing.
- Some companies did not provide the requested survey data. Where available, SA EPA provided mass balance data to GISA for aggregated use in this report. Mass balance data is compulsorily reported under Environment Protection Act 1993 by companies handling more than 20 kt/year of waste. Where mass balance data was not available, previously reported survey data was applied.
- Some respondents were only able to provide an estimate of the quantity of material processed at their site. Factors such as rainfall and seasonality had major impacts on the quantity of material recovered and therefore some survey responses had large margins of error. This issue particularly affects the accuracy of organics recovery reported.

## A3.2 Reuse and the circular economy

The survey sought data on reuse and the circular economy, building on the progress of the CERRR 2020-21 through to 2022-23. This involved asking all survey participants about their motivations within a circular economy context. The change of scope to include only soils recovered by waste reuse is a departure from previous years. The approach to circular economy analysis will continue to be refined and improved in future surveys.

## A3.3 Per capita analysis

Metrics for per capita statistics were calculated using population and demographic data from the Australian Bureau of Statistics (ABS 2024a and ABS 2024b).

## A3.4 Packaging

The survey sought data on the recovery of packaging materials. These were supplemented by container deposit legislation data provided by SA EPA. For non-CDL packaging, packaging data was obtained from the Australian Packaging Covenant Organisation's *Packaging Consumption and Recovery Report 2022-23* and assumed to be consistent with the 2023-24 context.

## A3.5 Environmental benefits of recycling

The method for the environmental benefits of recycling used the same approach as for previous *Circular Economy Resource Recovery and Recycling Activity Survey* reports. The scope of environmental benefits analysis included the following metrics:

- **Greenhouse gas emissions savings** (in tonnes $CO_2$-e): The reduction in greenhouse gas emissions achieved by replacing virgin materials with recycled materials.

- **Energy savings** (in terajoules): The amount of energy saved, including all fossil, renewable, electrical, and embodied energy, by using recycled materials.
- **Water savings** (in megalitres): The reduction in water consumption by substituting recycled materials that would otherwise be required if virgin materials had been used.

The factors used to assess the benefits of recycling materials are based on life cycle analysis techniques. These can be found in Appendix B. Sufficiently comprehensive and/or reliable factors could not be identified for foundry sands and leather and textiles. Therefore, these materials were not included in the environmental benefits analysis.

The following limitations apply to the environmental benefits analysis presented in this report:

- Many of the conversion and emission factors adopted are derived from interstate studies and were not calculated specifically for SA. This may mean estimated savings do not account for all local factors.
- SA may not necessarily accrue all total estimated environmental benefits because:
  - » some of the virgin materials that are replaced by recycling are not manufactured in SA
  - » some material recovered from SA for recycling is used to manufacture products that end up being consumed outside of the State.

Due to this limitation, the environmental benefits assessment presented in this study is a generalised estimate and should be used with caution.

### A3.6 Value of resource recovery

Values for products used in this report were based on industry-responses to the survey. These were supplemented by personal consultations with industry conducted in late 2024, as well as publicly available information on market values of recovered materials.

## A4 Material flow analysis method

An introduction for material flow analysis is provided in Section 4, including key definitions. This section provides more detail on the MFA method used for this report.

### A4.1 Material scope

The materials in scope of the MFAs are metals, cardboard and paper, plastics, glass, textiles and tyres. Note metals, cardboard and paper, plastics and glass are material categories, while textiles and tyres are material types.

### A4.2 Geographical scope

The geographical scope of the MFAs is centred around consumption and waste generation of materials in SA. Upstream processes from consumption (e.g. manufacturing) and downstream processes from waste generation (e.g. recovered waste to export) may occur outside of SA, as specified.

### A4.3 Time boundary

The MFA time boundary is financial year 2023-24. The underlying model, however, has been set up with a time boundary of 1918-19 to 2049-50. The modelling period is wider than is minimally necessary for the material groups modelled, but this ensures good model coverage into historical stocks, particular in the built environment, and the ongoing use of some of the materials in long-lived applications, again primarily in the built environment.

### A4.4 Modelling software

The modelling for the MFAs was undertaken in Microsoft Excel. Widespread use of this software supports transparency of the modelling and data manipulations and is simpler and more 'future-proof'.

## A4.5 Sankey diagrams

Sankey diagrams are visual tools that can be used to show the flow of material through a system. The software used for this project was e!Sankey. In e!Sankey, the diagram is built, using boxes and arrows. The arrow width is adjusted automatically by the software so that flow quantity proportions can be accurately represented.

## A4.6 Indicator selection

A potentially large number of indicators can be established from economy-wide MFAs, as undertaken for the pilot MFAs. Those selected for this work are outlined in Table 52. These different types of indicators deliver complementary information about various aspects related to material use.

**Table 52** Circular economy indicators developed through MFA

| Performance metric | Definition | What it measures | Numerator | Denominator |
|---|---|---|---|---|
| **Recycled content** | Secondary sourced material divided by consumption. | Performance of the manufacturing system in utilising recycled materials. | Import recycled to Manufacturing + Import recycled to Use + Reprocessing to Manufacturing | Use (input) |
| **Collection efficiency** | Discarded materials that are collected for recovery (not directed to landfill), divided by total materials entering the waste system. | Performance of the collection system. Low efficiency means a high proportion of material isn't separated from material flows at the household or business and is directed to landfill, e.g., owing to limited source separation and/or poor disposal practices. | Manufacturing to Sorting + Use to Sorting | Use (output) + Manufacturing to Sorting + Manufacturing to Land-fill - Sorting to Use |
| **Sorting efficiency** | Materials recovered out of sorting divided by materials sent to sorting. | Performance of the system to sort materials designated for specific recovery pathways. Low sorting efficiency high-lights opportunities to reduce contamination of collected materials received and/or improve sorting processes at the sorting facilities. | Sorting to Reprocessing + Sorting to Export | Sorting (input) |
| **Reprocessing efficiency** | Materials recovered out of reprocessing divided by materials sent to reprocessing. | Performance of the system to reprocess materials to be ready for specific remanufacturing or energy recovery pathways. Low reprocessing efficiency highlights opportunities to reduce contamination of sorted materials received, improve product design, and/or improve reprocessing processes at the re-processing facilities. | Reprocessing to Manufacturing + Reprocessing to Export + Reprocessing to Energy recovery + Reprocessing to Open loop[12] | Reprocessing (in-put) |
| **Recycling rate** | Materials recycled back to local or overseas manufacturing divided by material entering the waste system. | Performance of the system in recycling end-of-life materials. | Sorting to Export + Reprocessing to Manufacturing + Reprocessing to Export + Reprocessing to Open loop | Use (output) + Manufacturing to Sorting + Manufacturing to Land-fill - Sorting to Use |
| **Energy recovery rate** | Post-consumer materials recovered back to local or overseas energy recovery (excluding residuals from energy recovery) divided by post-consumer material entering the waste system. | Performance of the system in diverting end-of-life materials to energy recovery. | Reprocessing to Energy recovery | Use (output) + Manufacturing to Sorting + Manufacturing to Land-fill - Sorting to Use |
| **Recovery rate** | Materials recovered back to local or overseas manufacturing, and to energy recovery (excluding residuals), divided by material entering the waste system. | Performance of the system in diverting end-of-life materials to reuse, recycling and energy recovery. | Sorting to Export + Reprocessing to Manufacturing + Reprocessing to Export + Reprocessing to Energy recovery + Reprocessing to Open loop | Use (output) + Manufacturing to Sorting + Manufacturing to Land-fill - Sorting to Use |
| **Local material utilisation rate** | Secondary material used locally for manufacturing, divided by total mate-rial potentially avail-able for local manufacturing. | Performance of the system in on-shore remanufacturing, relative to the amount of material that is potentially avail-able. | Reprocessing to Manufacturing + Reprocessing to Open loop | Use (output) + Manufacturing to Sorting + Manufacturing to Land-fill - Sorting to Use |

12 The downstream process of reprocessing materials into other material systems. This could be considered manufacture of new products different to those from which the recovered material was derived. For example, glass packaging that is crushed and processed into an input for road base.

# Appendix B Environmental benefits factors, 2023-24

The table below lists factors used to estimate the environmental benefits of recycling SA materials in 2023-24. They are based on a study commissioned by Green Industries SA by Trellis Technologies (2019) and the greenhouse gas (GHG) emissions factors updated in 2021-22 for food organics, garden organics and timber.

**Table 53** Environmental benefits factors 2023-24

| | | GHG emissions saved | Energy saved | Water saved |
|---|---|---|---|---|
| **Category** | **Type** | **Emissions factor (t $CO_2$-e/t)** | **Conversion factor (GJ LHV/t)** | **Conversion factor (kL/t)** |
| **Masonry** | Asphalt | 0.030 | 2.380 | 0.880 |
| | Bricks | 0.020 | 0.280 | 1.260 |
| | Concrete | 0.020 | 0.350 | 1.280 |
| | Plasterboard | 0.030 | 0.550 | -0.030 |
| | Clay, fines, rubble and soil | 0.088 | 1.420 | 0.440 |
| **Metals** | Iron and steel | 0.440 | 7.490 | -2.360 |
| | Aluminium | 16.667 | 206.667 | 29.333 |
| | Non-ferrous metals | 0.880 | 36.090 | 5.970 |
| **Organics** | Food organics | 0.980 | 0.180 | 0.440 |
| | Garden organics | 0.670 | 0.309 | 5.592 |
| | Timber | 0.180 | 10.730 | -0.040 |
| | Organics – other | 0.481 | 2.165 | 0.230 |
| **Cardboard and paper** | Cardboard and waxed cardboard | 0.169 | 0.467 | 11.111 |
| | Liquid paperboard | 0.169 | 0.467 | 11.111 |
| | Magazines | 0.455 | 0.364 | 10.909 |
| | Newsprint | 0.455 | 0.364 | 10.909 |
| | Phonebooks | 0.455 | 0.364 | 10.909 |
| | Printing and writing paper | 1.300 | -0.680 | 11.000 |

| | | GHG emissions saved | Energy saved | Water saved |
|---|---|---|---|---|
| **Category** | **Type** | **Emissions factor (t $CO_2$-e/t)** | **Conversion factor (GJ LHV/t)** | **Conversion factor (kL/t)** |
| **Plastics** | Polyethylene terephthalate | 1.200 | 55.000 | 68.750 |
| | High density polyethylene | 0.825 | 50.000 | 22.750 |
| | Polyvinyl chloride | 0.313 | 30.000 | 26.250 |
| | Low density polyethylene | 0.825 | 50.000 | 22.750 |
| | Polypropylene | 0.313 | 30.000 | 26.250 |
| | Polystyrene | 0.313 | 30.000 | 26.250 |
| | Mixed and/or other plastics | 0.313 | 30.000 | 26.250 |
| **Glass** | Glass | 0.528 | 4.444 | 0.931 |
| **Other materials** | Fly ash | 0.029 | 0.552 | 1.260 |
| | Foundry sands | Not specified as insufficient reference data identified | | |
| | Leather and textiles | | | |
| | Tyres and other rubber | 1.070 | 64.080 | 52.250 |

The emissions factors for food organics, garden organics and timber were calculated by Blue Environment based on *National Greenhouse and Energy Reporting (Measurement) Determination 2008* methods. The calculations compared emissions from landfilling these organics types with emissions from composting them. We assume a landfill gas recovery rate of 43%, commensurate with recent values reported in the national inventory.

# Appendix C Circular Economy Resource Recovery Survey 2023-24, general version

| SA Circular Economy and Resource Recovery Survey 2023-24 | (1 July 2023 - 30 June 2024) |
|---|---|
| *Please enter information in white cells in this worksheet.*<br>*This form is for recyclers of material generated in South Australia* | |
| **1. Please provide details of the person filling out this survey.** | |
| Name | |
| Position | |
| Phone | |
| Email | |
| **2. Please provide your company or organisation's contact address and details. Please also include the address of your main facility(ies) for reprocessing or handling of materials.** | |
| Company/organisation name | |
| ABN | |
| Contact address | |
| | |
| Address of your main facility(ies) for reprocessing or handling of materials | |
| Primary waste and resource recovery facility classification | |
| Annual throughput capacity (without significant capital expenditure or new approvals) in tonnes per year | |
| **3. Are you happy for your company to be recognised in the report as participating in the 2023-24 Circular Economy and Resource Recovery Survey?** | |
| **4. Please fill in Table 1 for each relevant material you received for recycling or energy recovery. This is the critical information required for the survey. All data will be kept confidential and anonymised for reporting purposes.** | |

**Table 1: Material recovery data from the 2023-24 financial year**

| | MATERIAL SOURCE / INPUT | | | | | | | | | MATERIAL SOURCE / INPUT | | | | RESIDUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MATERIAL TYPE** | Total quantity of material received in-the-gate for recycling or energy recovery in 2023-24 | Main fate of this material | Proportion of material derived from post-consumer packaging[1] % | Quantity of material received from these regions | | | | Please check the geographic sources of material total 100% | | Quantity of material from these source streams | | | | Proportion of in-the-gate material sent to landfill |
| | | | | From SA - Metro | From SA - Regional | From interstate | | | | MSW[2] | C&I[3] | C&D[4] | Please check the geographic sources of material total 100% | |
| | *Select unit from drop down* | | | *Select unit from drop down* | | | *Jurisdiction* | *Total* | | *Select unit from drop down* | | | *Total* | *Select unit from drop down* |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

Question 4 continued on next page

**Notes:**

1. Exclude pre-consumer packaging manufacturing scrap
2. MSW = Municipal solid waste - domestic household sourced waste
3. C&I = Commercial and industrial - industry and business sourced waste
4. Construction and demolition - building, construction and demolition
5. If more than one productive use for this material, go to Question 7
6. Commodity or market price

**SA Circular Economy and Resource Recovery Survey 2023-24**

| DESTINATION OF REPROCESSING | | | | | | | | | VALUE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Reprocessed at your SA site(s) | | Material sent offsite from your site(s) for further processing at a waste and resource recovery facility | | | | Material sent offsite from your site(s) for further processing at a waste and resource recovery facility | | | | Approx. average value per tonne[6] | Comments | |
| Quantity recovered | Productive use type[5] | Elsewhere in SA - Metro | Elsewhere in SA - Regional | *Name of SA receiving waste or resource recovery facility* | | Sent interstate | | Sent overseas | | | | |
| *Select unit from drop down* | *Select from list or write your own* | *Select unit from drop down* | *Select unit from drop down* | | | *Select unit from drop down* | *Jurisdiction* | *Select unit from drop down* | *Country* | $/tonne | | Output total |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Notes:**

1. Exclude pre-consumer packaging manufacturing scrap
2. MSW = Municipal solid waste - domestic household sourced waste
3. C&I = Commercial and industrial - industry and business sourced waste
4. Construction and demolition - building, construction and demolition
5. If more than one productive use for this material, go to Question 7
6. Commodity or market price

**5. What is the method for measuring the data provided in Table 1?**

Measurement method

**6. What is the estimated accuracy of the data provided in Table 1 (e.g. ±5%)?**
*If using a weighbridge, a suitable accuracy may be ±1%.*

**7. If your facility reprocesses a material type listed in Table 1 which becomes multiple products, how much of it was returned to each productive use?**

| Incoming material type listed in Table 1 | Productive use type #1 | % sent to productive use #1 | Productive use type #2 | % sent to productive use #2 | Productive use type #3 | % sent to productive use #3 |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**8. If there have been any significant changes in quantities, stockpiles, sources or destinations from the 2022-23 financial year, what was the reason for this?**

**9. Where do you receive most of your material from (e.g. Councils, manufacturing, retail, hospitality, donations, etc.)?**

**10a. How many people (FTEs) are directly employed by your company/organisation's site(s) or operations(s) associated with material collection, resource recovery and/or recycling (i.e. permanent or casual staff, individual contractors)?**

**10b. What are the employment classifications in your company/organisation? Please complete the following table.**

| Classification | No. FTE |
|---|---|
| Administration | |
| Construction/design | |
| Driver | |
| Machinery operator | |
| Sales/marketing | |
| Sorting | |
| Supervisor | |
| Technical support | |
| Unskilled | |
| Other | |

| | Material | Comments on market strength/ prospects |
|---|---|---|
| **11. What is your opinion about the market strength/prospects for the recycled goods and materials your company handles?** | | |
| **12. Does your company or organisation intend to expand or contract its SA facilities or make new investments in recycling activity? If yes, what will this involve?** | | |
| **13. What opportunities do you see to improve recovery?** | | |
| **14. What are the biggest problems that obstruct your recycling or recovery operations?** | | |
| **15. What is your organisation's approximate annual sales revenue (turnover) from goods and material collection, resource recovery and/or recycling activities?** | | |
| **16. What is your company's highest priority when identifying the reprocessing destination for materials?** *Pick from suggested list or write your own* | Circular economy factor | |
| **17. Would you like to be invited to an industry seminar by Green Industries SA summarising the findings of the Circular Economy Resource Recovery Survey 2023-24?** | | |
| **18. Do you have any feedback on this survey?** | | |
| **19. Approximately how long did it take you to fill in this survey?** | | |


Government
of South Australia

Green Industries SA

**Level 4, 81-95 Waymouth Street**
**Adelaide, South Australia 5001**

**+61 8 8204 2051**

**www.greenindustries.sa.gov.au**