



# **REVIEW OF TOTAL RECYCLING ACTIVITY IN WESTERN AUSTRALIA**

**2005/06**

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## EXECUTIVE SUMMARY

Cardno BSD have been appointed by the Waste Management Branch (within the Department of Environment and Conservation (DEC)) to complete an analysis of the level of reprocessing of recyclable material in Western Australia by both material type and product category in the financial year 2005/06.

The term 'recycling' can cover a wide range of activities including collection, sorting, reprocessing and manufacturing of new products. For the purposes of this project, recycling is defined as the material recovered that would have otherwise been disposed to landfill that has undergone some form of physical processing to create a saleable product or raw material.

In total 72 recycling companies were identified (an addition of 18 companies). 58 companies or **80% of recycling companies submitted data**. 95% of companies that submitted data in last years report have been included in this years report. Data was collected from written questionnaires, site visits, telephone interviews and published industry data.

During 2005/06 Western Australia recyclers recovered **1,665,700 tonnes** of material. This appears to be an apparent increase of 693,090 tonnes over the past financial year, however care should be taken in the interpretation of this result. It should be noted that additional data has been made available for organic material processing and there are changes in the number of recycling companies identified for this study, compared to last year.

The observed increase in tonnage of material reprocessed can largely be attributed to:

- Expansion of the construction and demolition recycling sector which reported a 46% increase (154,670 tonnes) in recovered material;
- Inclusion of different data sources resulting in additional organics data (~430,000 tonne) and rubber data (~4,100 tonnes);
- Inclusion of additional recycling companies; and
- An increase in recycling activity across most sectors

**Table E1: Comparison between total recyclables recovered between 2004/05 and 2005/06 for each material type**

Material Type	04/05	05/06	% Increase
Organics *	148,150	578,630	7 ^
C&D	333,870	488,540	46
Metal	276,500	352,920	28
Paper	185,820	207,690	12
Glass	18,000	18,000	0
Plastic	7,130	13,360	87
Rubber **	1,900	5,000	0 ^^
Textiles	1,240	1,560	26
<b>Total</b>	<b>972,610</b>	<b>1,665,700</b>	<b>71</b>

\* - Compost Australia (2005/06) data (RRRS data used in 2004/05)

^ - Compared with 2004/05 Compost Australia data (539,363 tonnes)

\*\* - Rubber Industry (2005/06) data (Controlled Waste Inventory data used in 2004/05)

^^ - Rubber recycling has remained static

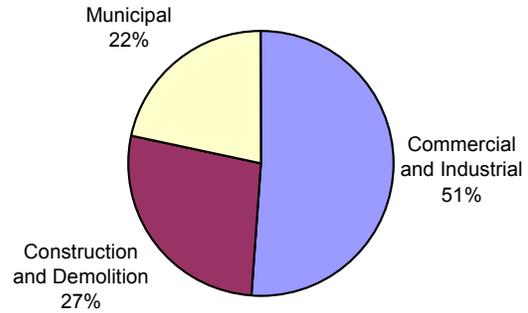
### Source Sector

For the purpose of this study, the material recycled has been divided into three standard source sectors: "municipal", "commercial and industrial" (C&I) and "construction and

demolition” (C&D). There are some limitations to these definitions as it is not always possible to determine precisely the source of all the materials recycled in Western Australia. In terms of source sector it should be noted that C&D waste includes all material that is received by C&D recyclers (including metals), even though the original source of this material is not always known. In addition, the C&I sector also includes material sourced from schools, government, agriculture and charities. Municipal waste consists of material collected from kerbside services and drop-off facilities at local government transfer stations and landfills.

**Table E2 and Figure E1: Total recyclables recovered (tonnes) and percentage from each source sector 2005/06**

Source Sector	Tonnes
Commercial and Industrial	852,240
Construction and Demolition	451,750
Municipal	361,710
<b>Total</b>	<b>1,665,700</b>

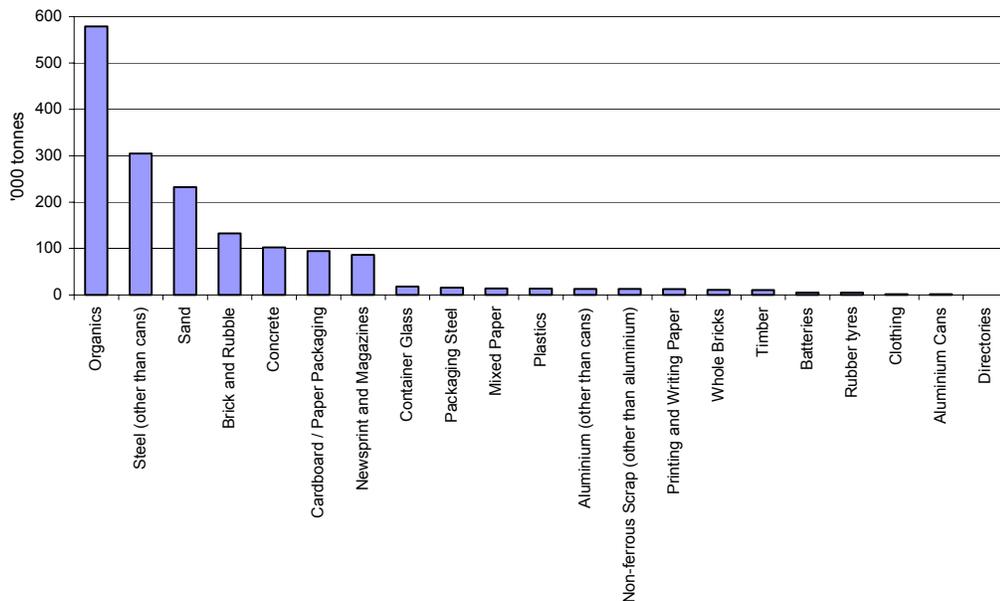


### Material Types

Of each type of material recovered, organics made up the highest contribution to the total 578,630 tonnes being recycled in 2005/06. Other materials that contributed significantly to the overall recycling for Western Australia were: steel, sand, brick and rubble, concrete, newspaper / magazines and cardboard / paper packaging that were each recycled in quantities greater than 50,000 tonnes. Excluding organics\*; sand and steel (non packaging) had the largest increases for a single category of 89,360 tonnes and 66,790 tonnes respectively.

*\*The increase in observed organics recycling is likely to be due to the use of a different data source in this years report. Figures from the Resource Recovery Rebate Scheme (RRRS) show that organics recovered from municipal sources have remained relatively static.*

**Figure E2: Total tonnes recycled by material or product 2005/06**

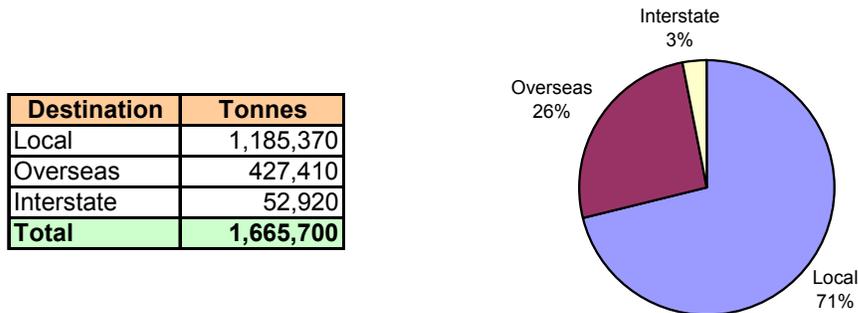


### Reprocessing Destination

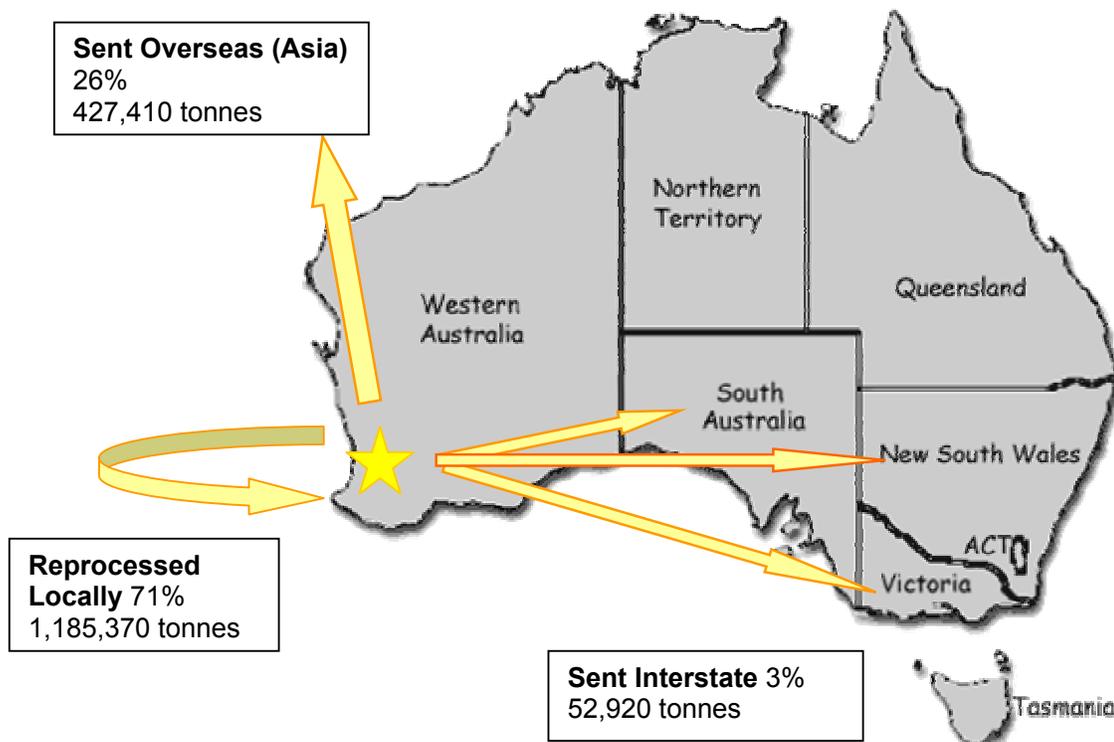
There has been an increase in tonnages to all reprocessing destinations since last year's report. An apparent increase in local reprocessing from 566,780 tonnes to 1,185,370 tonnes can mostly be attributed to the increase in C&D material being recovered and the incorporation of more comprehensive Compost Australia data for organics (all processed locally). There has also been an increase in the tonnages of material being sent interstate from 42,930 tonnes to 52,920 tonnes and an increase in exportation overseas, from 362,900 tonnes to 427,410 tonnes. The increase in tonnages being sent interstate can be attributed to an increase in the amount of paper being recovered and demand from paper mills interstate. The increase in the amount of material being sent overseas can be attributed to the increase in the amount of metal being recovered and the demand from Asia.

The majority of materials recovered are recycled locally in Western Australia (71%). Access to Asian markets has contributed to a low tonnage of material being sent to the Eastern States.

**Table E3 / Figure E3: Reprocessing location of Western Australia's recyclables 2005/06**



**Figure E4: Reprocessing destinations and associated tonnages of recovered materials 2005 / 06**



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### ***Barriers and Conclusion***

Feedback from the recycling industry has indicated that the major barriers to increased growth of recycling in the state are; the relatively low landfill gate fees (especially inert), contamination of materials, marketability of the products, labour and freight costs. While there are opportunities to increase the amount of material being recycled, many recyclers are reluctant to invest more capital without some indication that there is progress towards overcoming some of these barriers.

Unfortunately, accurate data about the quantity of each material stream landfilled in Western Australia is not available. Without this data it is not possible to determine whether there has been an increase in the proportion of total waste that is now reprocessed, or if the increase in the quantity of waste reprocessed simply reflects an increase in the total quantity of waste produced.

It is envisaged by the Department of Environment and Conservation that mechanisms for better collection of landfill data will become available in the near future. This will set the benchmark for the proportion of waste reprocessed and will give an indication of Western Australia's progress towards meeting its vision 'Towards Zero Waste'.

## Review of Total Recycling in Western Australia 2005/06

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## 1. INTRODUCTION

### 1.1 Strategic Context

The State Government has paid increasing attention to waste management issues in recent years. A number of policy documents relating to waste management have been published with the aim of reducing the amount of waste going to landfill by maximising waste recycling, reuse and recovery.

Key documents *WAste 2020* and *Strategic Direction for Waste Management in Western Australia* (published by the Department of Environment) present a pathway 'Towards Zero Waste'. Both documents place emphasis on the principles of 'reduce', 'reuse', 'recycle' and 'maximising the recovery and recycling of resources from waste'. The documents also discuss the need to measure the performance of Western Australia's recycling activities.

### 1.2 Background

Western Australia's total recycling performance was first measured in 2004/05, setting the benchmark from which the government and community can now measure any future changes. **Cardno BSD** have been appointed by the Department of Environment and Conservation's (DEC) Waste Management Branch to carry out an analysis of the level of collection and reprocessing of recyclable material in Western Australia by both material type and product category during the 2005/06 financial year.

This will be the first report to determine whether Western Australia has improved its recycling performance in relation to the previous reporting period. The format of the report is similar to last years to maintain consistency and to allow for easy comparison of recycling performance.

The term 'recycling' covers a wide range of activities including collection, sorting, reprocessing and manufacturing of new products. For the purpose of this project recycling is defined, as the material recovered that would have otherwise been disposed of to landfill; that has undergone some form of physical reprocessing to create a saleable product or raw material.

Reprocessing is defined as changing the physical structure and properties of a waste material in order to add financial value to the processed material. Reprocessed material can be used as a substitute virgin raw material in the manufacturing process.

'Recycling' in this report does not include 'un-reprocessed' items such as:

- ✘ The moving of excavated material for use as fill without having gone through any form of physical processing
- ✘ Industrial scrap (metal / plastic) off cuts being re-introduced into the manufacturing process
- ✘ Re-use of garments from charity stores

Whilst re-use is a vitally important part of waste reduction, for the purpose of this report it is excluded so that clear parameters can be set.

### 1.3 Methodology

The methodology of the report maintains consistency with the previous report in terms of the recycling sectors that were targeted and the areas of the recycling industry that were analysed. Target recycling categories and analysis sectors are listed below.

**Table 1.1: Target recycling sectors and categories**

Recycling Sector	Type
<b>Construction and Demolition</b>	Brick (whole)
	Bricks and Rubble
	Concrete
	Sand
	Timber
<b>Metal (inc C&amp;D)</b>	Aluminium
	Aluminium Cans
	Batteries (Automotive)
	Non-Ferrous (other than Al)
	Steel (packaging)
	Steel (non-packaging)
<b>Paper</b>	Newsprint / Magazines
	Cardboard / Paper Packaging
	Mixed Paper
	Printing and Writing Paper
	Directories
<b>Glass</b>	Container Glass
<b>Plastics</b>	Domestic Packaging
	Industrial Packaging
	Non-packaging
<b>Rubber</b>	Rubber Tyres
<b>Textiles</b>	Clothing
<b>Organics</b>	Food and Garden Organics
	Other Organics

The analysis includes the following:

- Recovery by material type and waste sector (municipal, construction & demolition and commercial & industrial) measured in tonnes
- Flows of material interstate and overseas for reprocessing
- Trends affecting future changes in reprocessing activity
- Barriers to recycling and future opportunities for increased recycling

In total 72 recycling companies were identified for this years survey (an addition of 14 companies from 2004/05). 58 companies or **80% of recycling companies submitted data**. It must be noted that many of the additional companies were only the primary destination for material and acknowledged they sent the material elsewhere for further reprocessing.

95% of companies that submitted data in last years report have been included in this years report. As 14 companies did not submit data, the total tonnage reported is less than actual tonnage; however the companies that did not submit data were of a relatively small size and would not have affected the results significantly. Cardno BSD

is confident that due to the high participation rate and integrity of the data, the totals in this report are  $\pm 5\%$  of the actual reprocessed tonnages for Western Australia.

The methodology for the collection of data differed to that used in the previous report, in that a written questionnaire was sent to each of the recyclers in W.A instead of using a telephone interview to gather the data. This enabled the recyclers to have additional time in collating the required data. Follow-up telephone calls were made to ensure the highest possible response rate was achieved. Key recyclers from each recycling sector were visited to gain a better understanding of the processes and issues currently faced by their recycling sector.

To eliminate the possibility of double counting, only specific sections of the recycling 'chain' were sent questionnaires. These were the primary destinations of materials (that may be exported directly), local reprocessors and in some cases external reprocessors (e.g. ACI glass reprocessor in South Australia). Questionnaires included sections that related to where the material was obtained and where it was sent to prevent double counting.

External sources, such as the Australian Bureau of Statistics (ABS) and industry associations, such as Plastics and Chemicals Industry Association (PACIA) and Compost Australia (organics) were also contacted to obtain data. Questionnaires were sent to plastics recyclers for comparison, to track the flows of materials and to provide plastic recyclers an opportunity to communicate the barriers they are currently facing and possible opportunities for expansion within the industry.

## 2. TOTAL RECYCLING ACTIVITY

### 2.1 Recovery in Western Australia

During the 2005/06 financial year, Western Australia recycled in **excess of 1 million tonnes** of material. Based upon the information gathered by this survey **1,665,700 tonnes** was recycled in 2005/06. This equates to 812kg per person / year based on a population of 2,050,900 people (Australian Bureau of Statistics (June qtr 2006)). Whilst there is a perceived increase from the 2004/05 total of 693,090 tonnes, it must be noted that different data sources were used for organics and rubber in this years report.

As outlined in **Table 2.1** and **Figure 2.1**, organics accounted for the highest tonnage of recovered material at 578,630 tonnes. C&D material (488,540 tonnes), metal (352,920 tonnes) and paper / cardboard (207,690 tonnes) were also recovered in high tonnages. The large apparent increase in organic tonnages can be attributed to the use of Compost Australia data, which includes more organic categories than the Resource Recovery Rebate Scheme (RRRS) data used in the 2004/05 report. Compost Australia data was not available in time for the publication of the previous report. A data comparison between the 2004/05 and 2005/06 Compost Australia reports shows there has been a 39,270 tonne or 7% increase in the amount of organics being recovered in Western Australia in 2005/06.

All other recycling sectors have reported an increase in tonnages since the previous report, with the exception of glass and rubber recycling which have remained static. Rubber data obtained for this report is from the source sector itself rather than the DEC Controlled Waste Inventory, which was the source of data for the 2004/05 report. The rubber industry has indicated that the controlled waste inventory is not a reliable source of data and that the increased tonnage is due to the different data sources used. As such, the level of activity in the rubber recycling industry is largely unchanged since last year.

**Table 2.1: Total tonnage of material recycled from each recycling sector for 2005/06 and percentage increase over 2004/05**

Material Type	04/05	05/06	% Increase
Organics *	148,150	578,630	7 ^
C&D	333,870	488,540	46
Metal	276,500	352,920	28
Paper	185,820	207,690	12
Glass	18,000	18,000	0
Plastic	7,130	13,360	87
Rubber **	1,900	5,000	0 ^^
Textiles	1,240	1,560	26
<b>Total</b>	<b>972,610</b>	<b>1,665,700</b>	<b>71</b>

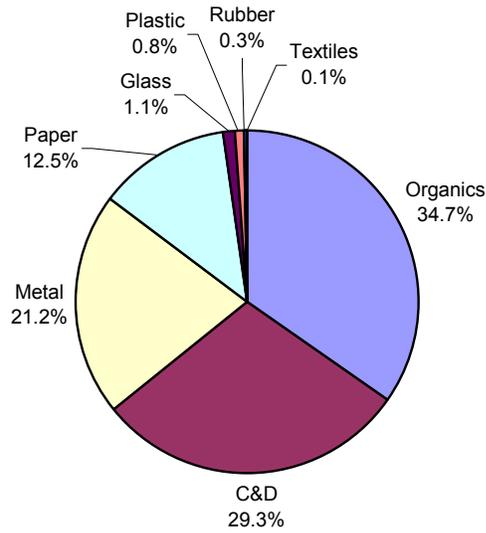
\* - Compost Australia (2005/06) data (RRRS data used in 2004/05)

^ - Compared with 2004/05 Compost Australia data (539,363 tonnes)

\*\* - Rubber Industry (2005/06) data (Controlled Waste Inventory data used in 2004/05)

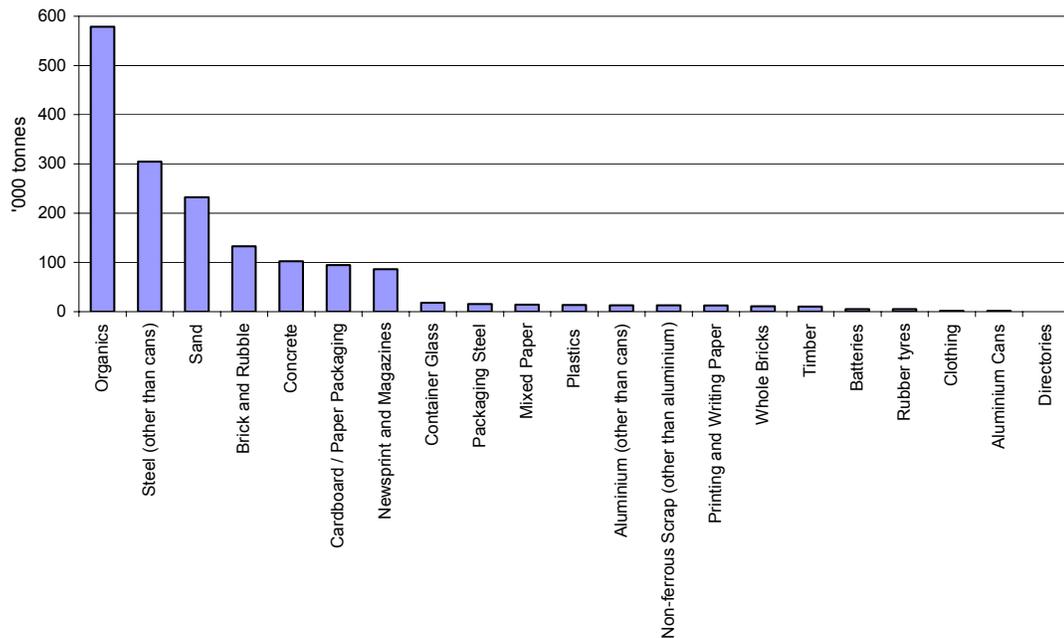
^^ - Rubber recycling has remained static

**Figure 2.1: Percentage composition of materials recycled in Western Australia for 2005/06**



**Figure 2.2** shows the tonnages of each material type recovered in Western Australia during 2005/06. The recycled organics category had the highest recovery at 578,630 tonnes in 2005/06. Steel (other than cans), sand, brick and rubble, concrete, newspaper and cardboard packing are all recycled in large quantities (i.e. in excess of 50,000 tonnes). Sand and Steel (other than cans) had the highest increases in quantity of material recycled, with increases of 89,360 tonnes and 66,790 tonnes respectively.

**Figure 2.2: Total tonnes recycled by material or product 2005/06**

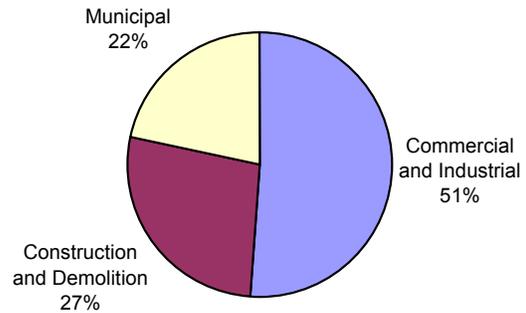


## 2.2 Source Sector of Material

Source sector material is commonly divided into Commercial and Industrial (C&I), Construction and Demolition (C&D) and Municipal (household). These nominated sectors provide the recycling companies with waste material to be recycled and reprocessed into new material. The C&I sector (813,760 tonnes) has the greatest contribution (by weight) to total recycling in Western Australia, **Table 2.2** and **Figure 2.3**. This high recovery weight from the C&I sector can be attributed to the high tonnages recovered from the metal and organics industries. Eastern States recycling reports generally indicate that around 50% of their recyclables are recovered from the C&D sector.

**Table 2.2 and Figure 2.3: Source of material (tonnes) that was recycled in 2005/06 and its associated percentage**

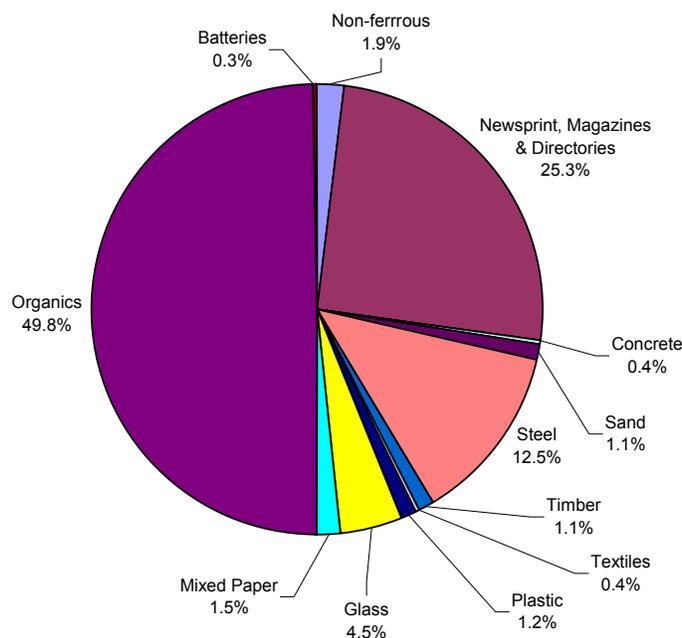
Source Sector	Tonnes
Commercial and Industrial	852,240
Construction and Demolition	451,750
Municipal	361,710
<b>Total</b>	<b>1,665,700</b>



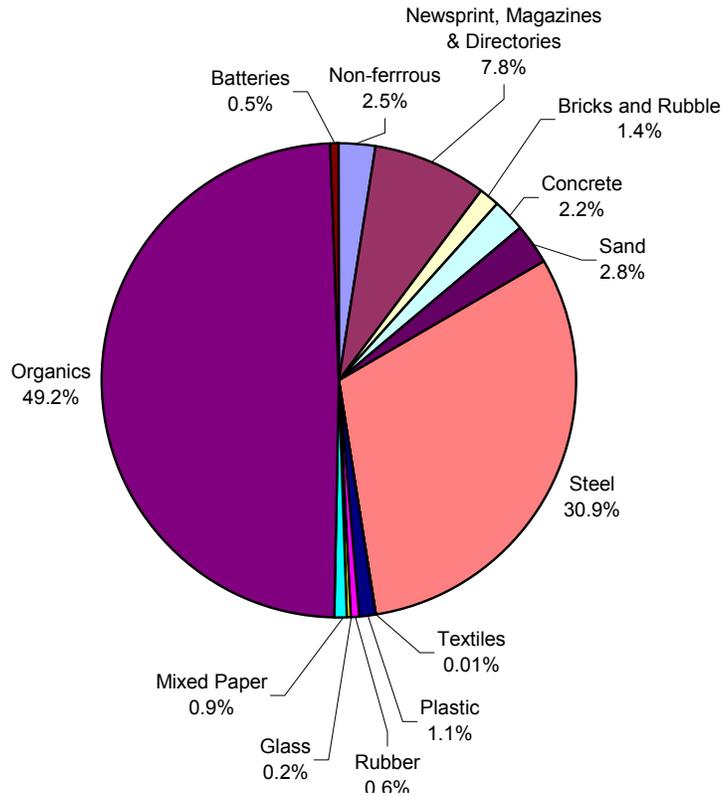
*C&D sector in Table 2.2 includes metals recovered.*

The recyclables recovered from each source sector is shown in the **Figures 2.4, 2.5 and 2.6**.

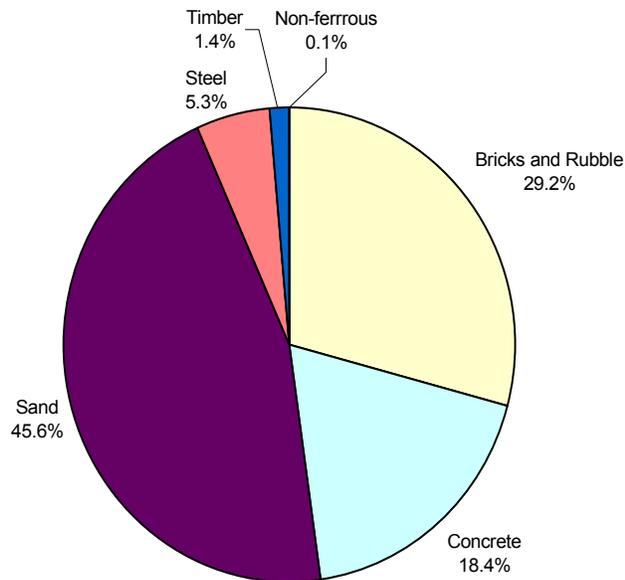
**Figure 2.4: Composition of material recovered for reprocessing from the municipal sector (2005/06)**



**Figure 2.5: Composition of material recovered for reprocessing from the commercial and industrial sector (2005/06)**



**Figure 2.6: Composition of material recovered for reprocessing from the construction and demolition sector (2005/06)**



### 2.3 Destination of Recovered Material

The materials recovered in Western Australia are reprocessed at local, national and international facilities.

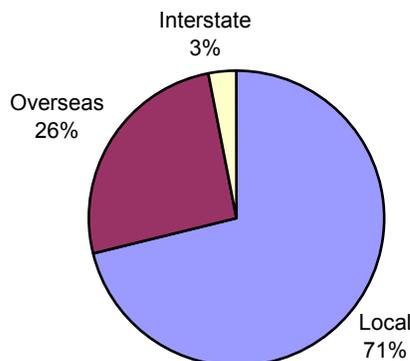
The majority of the material (71% by weight) was reprocessed locally within Western Australia during 2005/06 (**Table 2.3** and **Figure 2.7**). In 2005/06, the local reprocessing industry was dominated by C&D, organics and paper recycling. The exportation of materials such as metal, paper and plastic overseas is large (26%), this is partially due to the accessibility of the Asian market and the demand for these materials. This has resulted in a relatively small amount of material (3%) is sent to the Eastern States. Recovered glass is currently being sent to South Australia for reprocessing, whilst a small amount of municipal paper and plastics are sent to Victoria and New South Wales.

Asian facilities reprocess high quantities of metal, plastic and paper from Western Australia due to minimal local reprocessing capability and / or the high demand for these materials in Asia. The exceptions are the AMCOR paper mill and local foundries such as Bradken. Due to the recent closure of the AMCOR paper mill in 2006, it can be expected that the local paper reprocessing tonnage will decrease and interstate reprocessing will increase significantly for the 2006/07 financial year. At the time of publication (June 2007), all the collected paper that was previously reprocessed at the AMCOR paper mill in Western Australia is now sent to the eastern states for reprocessing.

**Table 2.3: Destination of materials recovered by weight (tonnes) for reprocessing, Western Australia 2005/06**

Material	Destination						Total
	Local	%	Interstate	%	Overseas	%	
C&D	488,540	100	0	0	0	0	488,540
Metal	16,670	5	7,000	2	329,250	93	352,920
Paper	88,960	43	25,450	12	93,280	45	207,690
Organics	578,630	100	0	0	0	0	578,630
Glass	0	0	18,000	100	0	0	18,000
Plastic	6,010	45	2,470	18	4,880	37	13,360
Rubber	5,000	100	0	0	0	0	5,000
Textiles	1,560	100	0	0	0	0	1,560
<b>Total</b>	<b>1,185,370</b>	<b>71</b>	<b>52,920</b>	<b>3</b>	<b>427,410</b>	<b>26</b>	<b>1,665,700</b>

**Figure 2.7: Destination of materials for reprocessing, Western Australia 2005/06**



**Table 2.4: Breakdown of recovered material (tonnes) and destination for reprocessing in 2005/06**

Material	Destination			Total Recovery	Past Report (2004/05)
	Local	Interstate	Overseas		
(Tonnes)					
<b>Construction and Demolition</b>					
Sand	232,600	0	0	232,600	143,240
Brick and Rubble	132,580	0	0	132,580	82,450
Concrete / Bitumen	102,330	0	0	102,330	103,110
Bricks (Whole)	10,860	0	0	10,860	5,070
Timber	10,170	0	0	10,170	N.A
<b>Total C&amp;D</b>	<b>488,540</b>	<b>0</b>	<b>0</b>	<b>488,540</b>	<b>333,870</b>
<b>Metal</b>					
Aluminium	20	2,000	11,060	13,080	16,510
Aluminium Cans	0	0	1,390	1,390	2,470
Batteries	0	5,000	300	5,300	7,420
Non Ferrous (Other than Al)	1,030	0	12,000	13,030	11,230
Steel (non packaging)	15,190	0	289,500	304,690	237,900
Steel (packaging)	430	0	15,000	15,430	970
<b>Total Metal</b>	<b>16,670</b>	<b>7,000</b>	<b>329,250</b>	<b>352,920</b>	<b>276,500</b>
<b>Paper</b>					
Newsprint & Magazines	10,660	2,500	73,310	86,470	74,250
Cardboard / paper packaging	60,300	18,160	16,000	94,460	72,990
Mixed Paper	10,000	2,540	1,500	14,040	18,070
Printing & writing paper	8,000	2,250	2,250	12,500	20,120
Directories	0	0	220	220	390
<b>Total Paper</b>	<b>88,960</b>	<b>25,450</b>	<b>93,280</b>	<b>207,690</b>	<b>185,820</b>
<b>Organics *</b>					
All Organics	578,630	0	0	578,630	148,150
<b>Total Organics</b>	<b>578,630</b>	<b>0</b>	<b>0</b>	<b>578,630</b>	<b>148,150</b>
<b>Glass (ACI)</b>					
Container Glass	0	18,000	0	18,000	18,000
<b>Total Glass</b>	<b>0</b>	<b>18,000</b>	<b>0</b>	<b>18,000</b>	<b>18,000</b>
<b>Plastic (PACIA)</b>					
Domestic Packaging	10,320	n.a	n.a	10,320	3,880
Industrial Packaging	3,040	0	0	3,040	890
Non-packaging	0	n.a	n.a	0	2,360
<b>Total Plastic</b>	<b>6,060</b>	<b>2,390</b>	<b>4,880</b>	<b>13,360</b>	<b>7,130</b>
<b>Rubber **</b>					
Rubber Tyres	5,000	0	0	5,000	1,900
<b>Total Rubber</b>	<b>5,000</b>	<b>0</b>	<b>0</b>	<b>5,000</b>	<b>1,900</b>
<b>Textiles</b>					
Clothing	1,560			1,560	1,240
<b>Total Textiles</b>	<b>1,560</b>	<b>0</b>	<b>0</b>	<b>1,560</b>	<b>1,240</b>
<b>TOTAL ALL MATERIALS</b>	<b>1,185,420</b>	<b>52,840</b>	<b>427,410</b>	<b>1,665,700</b>	<b>972,610</b>
				2005/06	2004/05

**NOTE:**

- \* **Organics:** Compost Australia (2005/06) data has been used. (RRRS data used in 2004/05)
- \*\* **Rubber:** Rubber Industry (2005/06) data has been used (Controlled Waste Inventory data used in 2004/05)

Please take care in the interpretation of the data above.

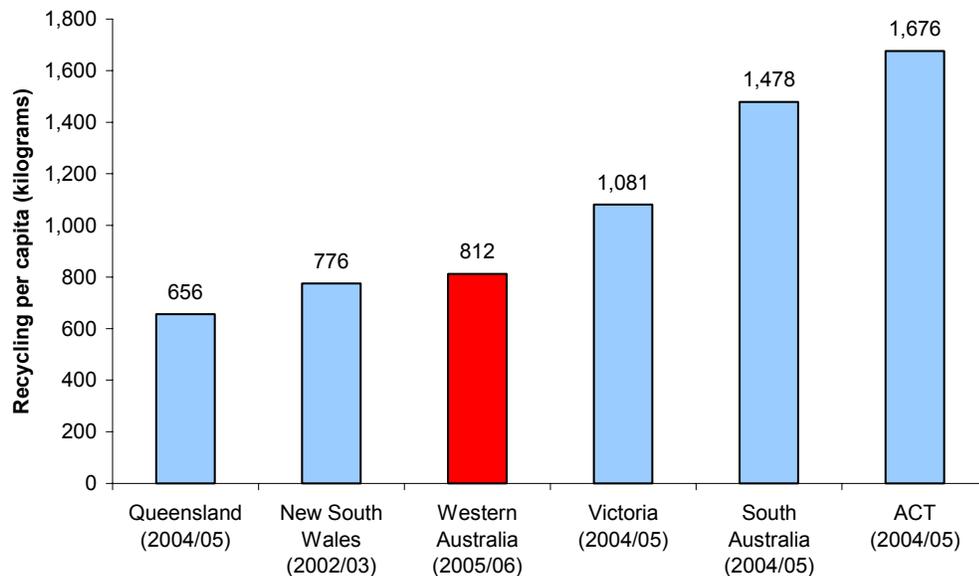
## 2.4 Benchmarking of Recycling Activity

Based on 2005/06 recycling performance figures, approximately 812kg of material is recycled per capita in Western Australia. An apparent increase of approximately 401kg per person compared to the previous report. This can mostly be attributed to the increased activity of the C&D sector and the use of different data sources for organics. Nevertheless, recycling activity has increased in most categories.

When Western Australia is benchmarked against most states, it is comparable to NSW (2002/03 data) based on tonnages recovered per capita but it falls considerably behind 2004/05 Victoria, South Australia and ACT data (**Figure 2.8**). This can be attributed to a number of reasons including the relatively small recycling industry present in Western Australia, low landfill gate-fees and small markets for recycled material when compared to the eastern states.

Reasons for the eastern states performing better may include South Australia's very large C&D recycling industry (that reprocesses over one million tonnes of material annually), Victoria's large manufacturing industry (and the associated markets for recycled material) and the ACT's high population density that facilitates the collection of material for recycling. The ACT currently recycles 75% of all the waste it produces

**Figure 2.8: Comparison of per capita recycling activity by State**



**Note:**

Source: State Annual Recycling Reports

Year - NSW - only 2002/03 available  
- QLD, VIC, SA and ACT - only 2004/05 available

Population - QLD, VIC, SA and ACT - June 2005 quarter (ABS)  
- WA - June 2006 quarter (ABS)  
- NSW - June 2003 quarter (ABS)

Omitted - Fly Ash from SA total, Used Oils from all totals, Fats and Reuse from ACT total

### 3. CONSTRUCTION AND DEMOLITION MATERIAL

#### 3.1 C&D Recycling Process

The recycling of construction and demolition (C&D) material including concrete, bitumen, metal, sand, timber and rubble involves separating the material into each category. This can either be undertaken at source (e.g. during demolition activities) or at the recycling facility (see **Photo 3.1** and **Photo 3.2**). It is preferable for the material to be separated at source as the separation of mixed material is a labour intensive process and increases the recycling costs. Contamination is also more likely with mixed loads, especially when green waste is included. As such, most mixed material is currently sent to inert landfill as this provides a cost effective waste management option.

Once the materials are separated they are put through a number of processes depending on the material characteristics. Concrete, bitumen, brick and rubble are crushed and screened to reduce the material to a uniform aggregate size. Sand is cleaned and screened to produce uniform sized fractions of sand grains. Bricks may be crushed and screened to produce an aggregate or they are cleaned to be recycled as whole bricks. These aggregates are either sold as raw materials or combined to produce products such as road base or drainage aggregate. Metal recovered from the separation process (using magnets and eddy-current separators) is usually sold to metal scrap dealers, however the direct exportation of metal is now starting to occur.

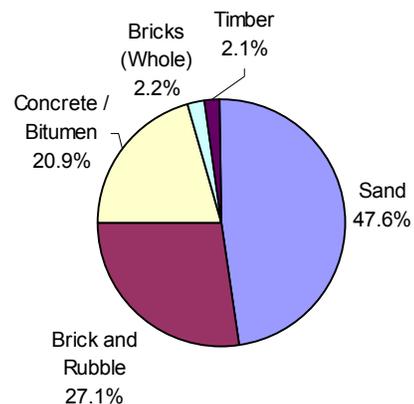
Until recently there have been few markets for post consumer timber products; however Laminex have started a process in Western Australia to produce particleboard. Types of wood that can be processed include pine off cuts, pine sawdust, waferboard, plywood, pallets, wooden boxes and crates.

#### 3.2 Total Recovery of C&D

Approximately 488,540 tonnes of C&D material was recovered from the waste stream in 2005/06 (**Table 3.1**). The majority of material recovered in the C&D sector (48% or 232,600 tonnes) was sand. When compared to the previous financial year, there has been a significant increase in total recovery of C&D material of approximately 155,500 tonnes, This may largely be a result of the increase in construction activity that Western Australia is currently experiencing, combined with an increase in C&D recycling capacity within the state.

**Table 3.1 / Figure 3.1: Breakdown of C&D tonnages recovered and their proportions in the C&D waste stream.**

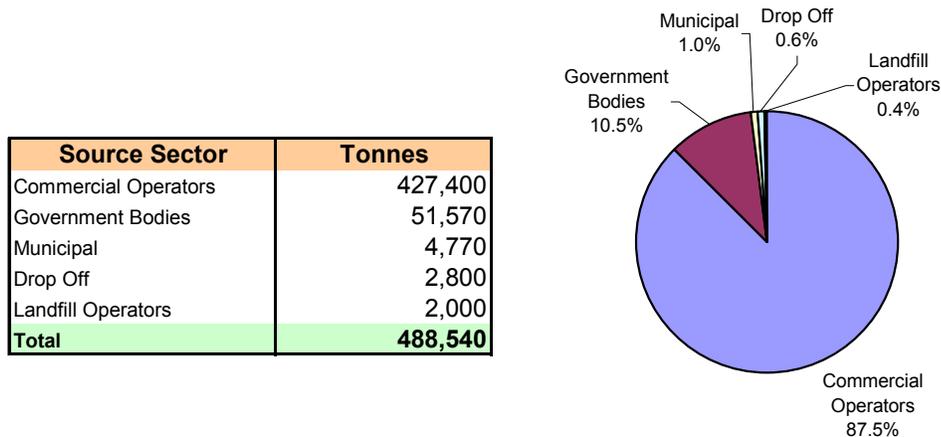
C&D Material	Tonnes
Sand	232,600
Brick and Rubble	132,580
Concrete / Bitumen	102,330
Bricks (Whole)	10,860
Timber	10,170
<b>Total</b>	<b>488,540</b>



### 3.3 Source Sector of Recovered C&D Material

The majority of recovered C&D material is sourced from the commercial sector. Approximately 427,400 tonnes or 88% of C&D material recovered in 2005/06 was from this sector. Government bodies are the next largest source of recovered C&D material (11%).

**Table 3.2 / Figure 3.2: Breakdown of tonnages and the proportions sourced from each sector.**



### 3.4 Destination of Recovered C&D Material

All recovered C&D material is reprocessed in Western Australia, with the exception of recovered metals (sold to metal scrap dealers – See Section 4). All reprocessed material is sold within Western Australia for use in the construction industry.

The main markets for recovered C&D products are aggregate, road base and fill for private contractors where the reprocessed material competes directly with virgin products. Recycled brick companies sell their material for paving and building applications. Figure 3.3 outlines the flow of recovered C&D material from its source sector through to the reprocessor.

### 3.5 Barriers / Opportunities Outlined by the C&D Industry

Key barriers outlined by the recycling industry as inhibiting further growth include; low cost of disposal to landfill, an unaware market and increasing operational costs (labour, fuel, land, equipment and insurance).

At present, it is often more economical to send C&D waste material to an inert landfill for disposal rather than to a C&D recycling facility. This is due to the low gate fees and their competitive locations throughout the Perth Metropolitan area. Provided disposal remains a lower cost option to recovery it is likely that material will continue to be sent to these cheaper disposal options unless either economic or regulatory factors are changed.

There are limited markets for C&D products, this is partially due to the perception that recycled building products are of inferior quality to virgin products, despite research proving that recycled products are at least equal or greater in quality than virgin products. Construction specifications often do not recognise recycled aggregate. Specifications outlined in contracts can usually be met by recycled aggregate, however contractors are reluctant to incorporate recycled material into their operations in fear of material not meeting contractual requirements.

Whilst local and state governments are eager for their waste C&D material to be recycled, this is not always reflected in their procurement and contracting processes. Recently there has been the creation of recycled aggregate specifications by Main Roads Western Australia. This presents an opportunity for recycled aggregates to be used as road base in Main Roads infrastructure projects, however to date Main Roads have continued to use virgin quarried material in their roads.

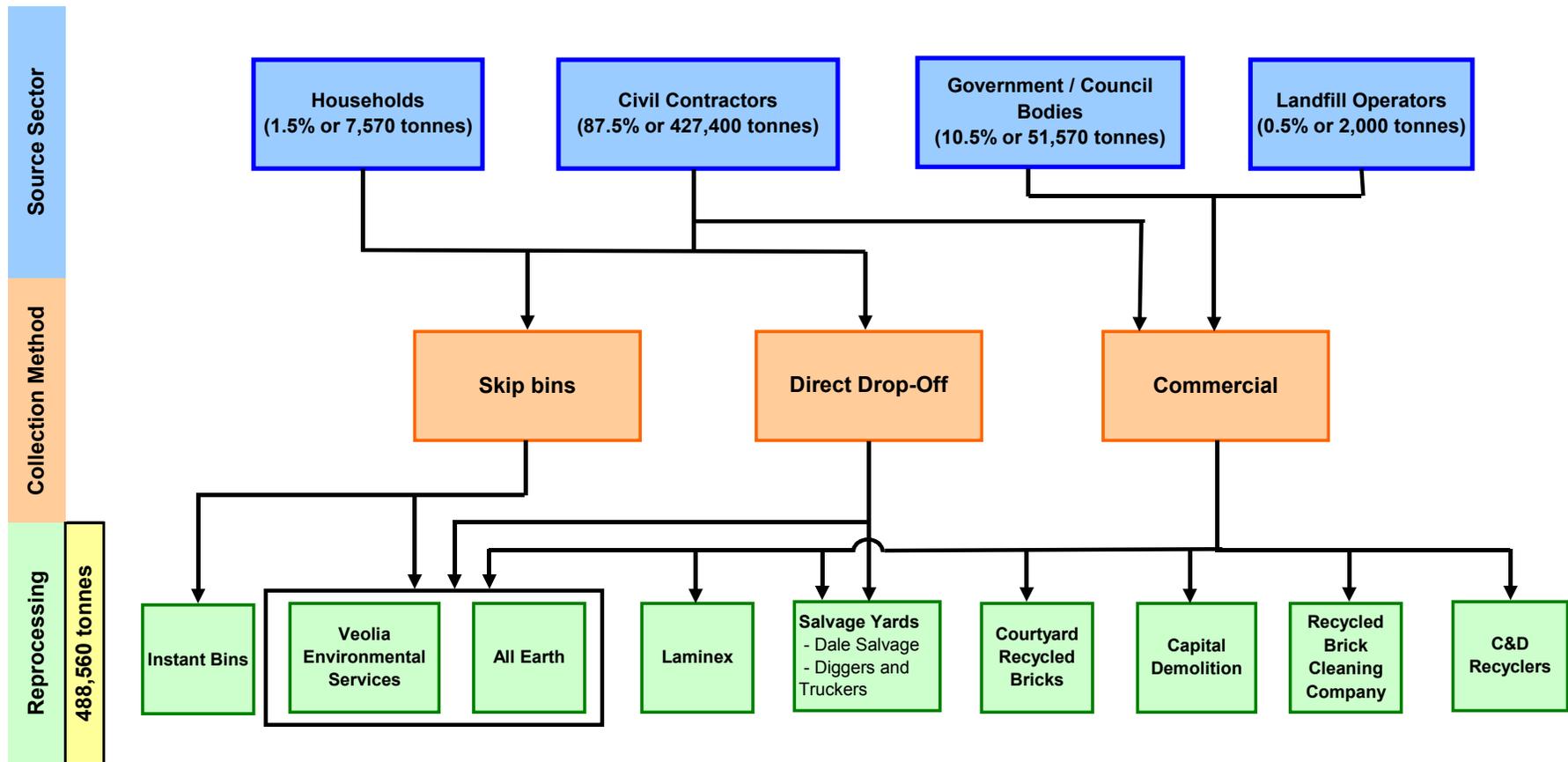
**Photo 3.1 - Stockpile of bricks at a C&D Recycler ready for market**



**Photo 3.2 – Separation and transportation of material at a C&D Recycler**



Figure 3.3 – Flow of C&D material recovered for reprocessing from sector of origin through to recycling destination (2005/06)



## 4. METALS

### 4.1 Metal Recycling Process

Metals are a desirable material to be recycled due to their durable properties and current high market value. Metals collected and recycled include ferrous metals (such as steel scrap, stainless steel and steel cans) and non-ferrous metal (such as aluminium, nickel, brass and copper). These can come in various forms such as motor parts, car and truck bodies, wiring, cables, scrap metal off-cuts, household packaging, window frames and whitegoods.

The metals must be separated by type to optimise their market value. It is preferable that the materials are sorted at source, however other methods are available to separate materials (see **Photo 4.1**). Experienced on-site personnel can usually identify large materials visually or by using handheld electronic equipment. Smaller material can be sorted into different metal groups using magnets and eddy currents. Material Recovery Facilities (MRF's) recover materials, including metals, from the municipal sector.

To prepare metal for reprocessing, all items must be reduced to a uniform particle size. For large items (e.g. containers) manual oxyacetylene cutting is used to break down the items to a size that can be fed into an industrial shredder. Shredders are now in operation at two metal recyclers, Sims Metal in Spearwood and Smorgon Steel in Kewdale. The shredded metals are sent to a limited number of local foundries or exported to Asia for reprocessing. Materials such as aluminium cans and non-ferrous material are baled ready for reprocessing.

Foundry blast furnaces generate the extremely high temperatures needed to remould the material. The finished product is identical to a virgin material as all contaminants are incinerated in the furnace and there is no loss of physical strength or integrity.

Automotive battery recyclers crush batteries into pieces and separate the plastic and lead components. The plastic is sent to a reprocessor for manufacture into new plastic products whilst the purified lead is sent to battery manufacturers and other industries. A typical automotive lead-acid battery is around 98% recyclable.

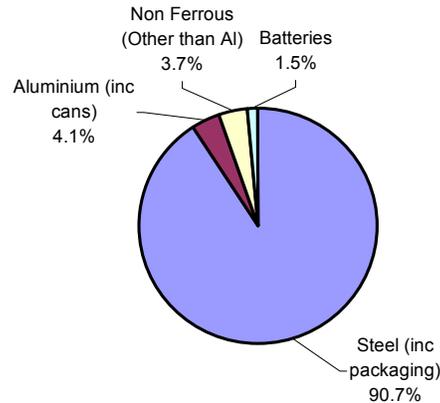
### 4.2 Total Recovery of Metal

Approximately 352,920 tonnes of metal was recycled in Western Australia during the 2005/06 financial year. This is an increase of 76,400 tonnes from 2004/05 figures. During 2005/06, non-packaging steel was recovered in the highest tonnages (304,693 tonnes), followed by packaging steel (15,430 tonnes). This increase is likely to be due to the currently buoyant global market for steel.

Whilst steel is showing strong growth, the collection of aluminium (14,080 tonnes) and automotive batteries (5,300 tonnes) has decreased when compared to 2004/05 figures (see **Table 2.4**). It is likely that reduced market prices for aluminium and automotive batteries are the key cause of this observed trend. The breakdown of metals recovered is outlined in **Table 4.1** and **Figure 4.1**

**Table 4.1 / Figure 4.1: Composition of metals recovered by weight (tonnes) for reprocessing, Western Australia 2005/06**

Metal Composition	Tonnes
Steel (non packaging)	304,690
Steel (packaging)	15,430
Aluminium	13,080
Non Ferrous (Other than Al)	13,030
Batteries (Automotive)	5,300
Aluminium Cans	1,390
<b>Total</b>	<b>352,920</b>



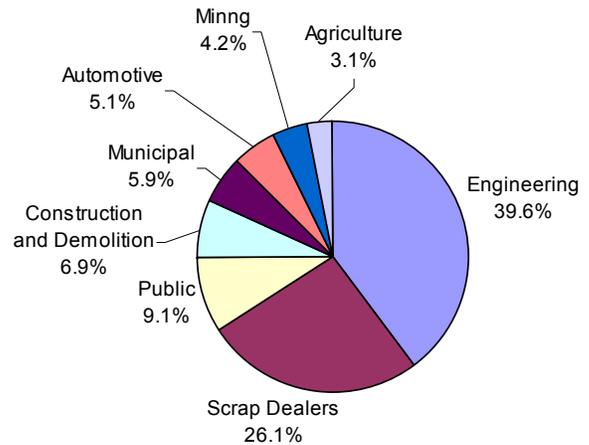
### 4.3 Source Sector of Recovered Metals

As noted in the 2004/05 recycling review, it is difficult for the metal recyclers to determine the exact source of the material they receive. The questionnaire responses indicated that a significant proportion of metal (39.6%) is sourced from the engineering industry. A large proportion is also sourced from numerous smaller scrap dealers (26.1%), which unfortunately masks the original source sector. However, it can be assumed that the source sectors for smaller dealers are similar in proportion to the larger dealers. **Table 4.2** and **Figure 4.2** outline the source sector of material and the general proportion accepted from each scrap dealer.

For the 2005/06 report, actual source sector data was provided by metal recyclers, whereas estimated stakeholder data was incorporated into the previous years report. This has possibly resulted in the tonnages for each source sector being quite different to the 2004/05 data, where mining and C&D were the largest source of material.

**Table 4.2 / Figure 4.2: Proportion of metal products recovered by weight (tonnes) for reprocessing, Western Australia 2005/06**

Source Sector	Tonnes
Engineering	139,050
Scrap Dealers	92,000
Public	32,030
Construction and Demolition	24,310
Municipal	21,620
Automotive	18,080
Minng	14,830
Agriculture	11,000
<b>Total</b>	<b>352,920</b>



Due to a large number of source sectors, the material received can vary greatly in size and shape. Engineering material can vary between small steel off cuts to very large industrial tanks delivered by road train. C&D sourced material is mostly steel that has been extracted from reinforced concrete. Automotive materials are generally car shells, batteries and engines, whilst mining materials include piping, tanks and machinery. The municipal sector (which includes public drop off) can vary from aluminium and steel cans collected from kerbside recycling to kitchen pans, car bodies and alloy wheels.

During 2005/06, a low proportion of electronic waste (E-waste) was recycled in Western Australia, however in July 2006, Sims Metal opened an E-Waste processing facility in Spearwood. The facility is now accepting a wide range of electrical goods for recycling including used computers, televisions and printers. Tonnage data will be available for next years report.

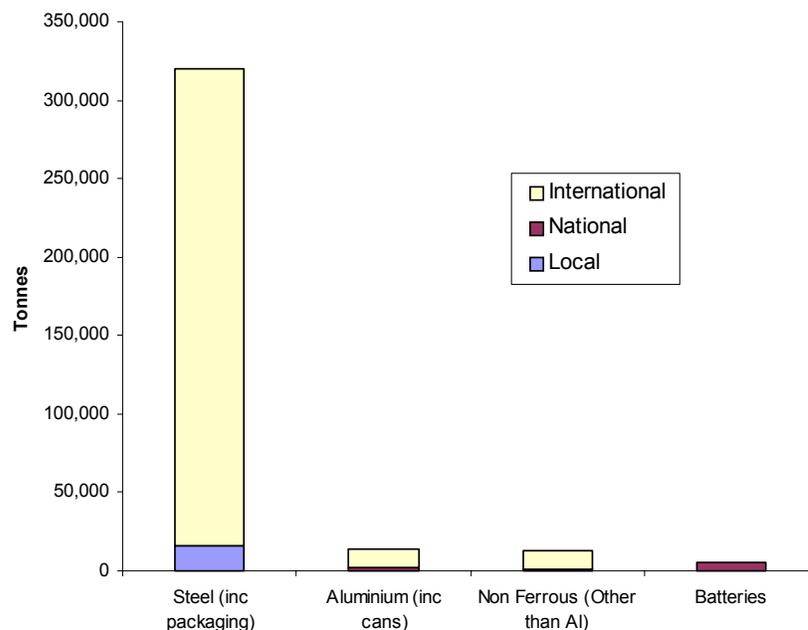
#### 4.4 Destination of Recovered Metals

The majority (93%) of recovered metals in Western Australia in 2005/06 were exported to China and Korea. Approximately 16,670 tonnes of metal are sent to local foundries (Bradken, Dobbie Dico, R.D.G and BHP Whyalla). Approximately 7,000 tonnes (mostly automotive batteries) are sent interstate for reprocessing. Tonnages recovered and their destinations are outlined in **Table 4.3** and **Figure 4.3**.

**Table 4.3: Destination of metals recovered by weight (tonnes) for reprocessing (2005/06)**

Destination	Tonnes	%
Local	16,670	5
National	7,000	2
International	329,250	93
<b>Total</b>	<b>352,920</b>	

**Figure 4.3: Type of metal recovered by weight (tonnes) and destination for reprocessing (2005/06)**



#### 4.5 Barriers / Opportunities Outlined by the Metal Recycling Industry

Key barriers outlined by the metal recycling industry include; transport costs to regional areas, landfill levies being applicable to recyclers residual waste and difficulty in obtaining scrap metal from mining operations.

Many metal containing products such as car bodies and fridges have a high 'floc' component. Floc is the residue (such as electronic components and rubber) left after the desired material (metal) is extracted. At present floc does not have a market and requires disposal to a landfill or additional treatment. This additional disposal and treatment cost may restrict the viability of recycling some products.

Currently a large quantity of metal is available in regional Western Australia, especially in mining areas, however transport costs are making the collection of these materials uneconomical. Metal recycling facilities in regional areas are also experiencing increasing labour and operational costs. In addition, under the current mining act, mines are exempt from a number of landfill regulations, which creates little financial incentive for materials to be recycled as the cost for disposal to landfill is low. This in turn creates a large barrier for recyclers to pick up these materials for reprocessing.

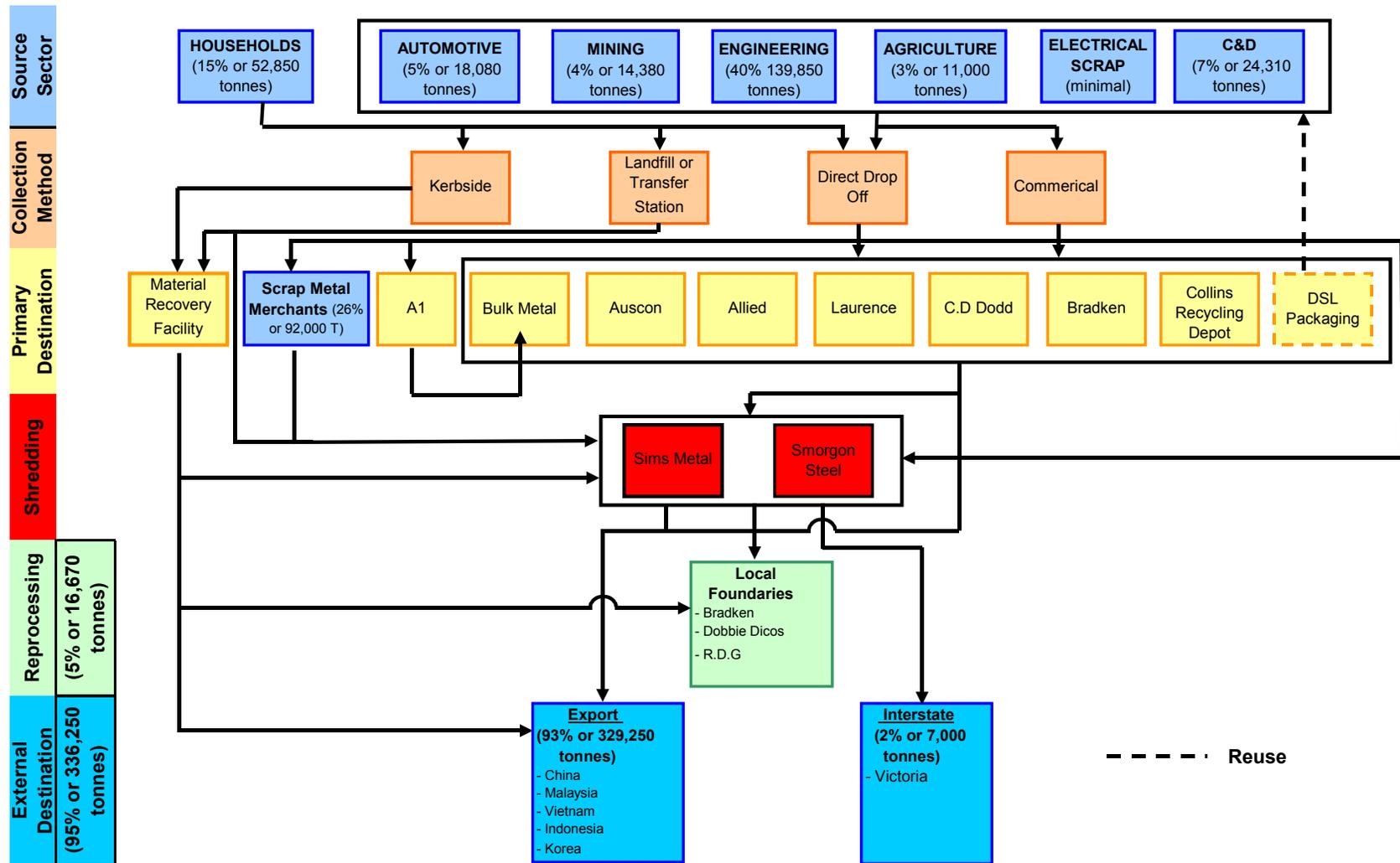
Other barriers outlined by recyclers include: increased cost of labour, operational costs, competition and poor promotion of recycling at some landfills. Opportunities for the metal recycling industry, other than the removal of the barriers outlined above, include government incentives to be used as a subsidy for regional transport costs thus enabling the materials currently produced in regional areas to be collected for recovery.

**Figure 4.4** The following page shows the source sector of recovered metal and flows to the final destination for reprocessing. It must be noted that due to the methodology of collecting information, scrap metal merchants have been allocated 26% of the source sector

**Photo 4.1 – Machinery at a metal recycler stockpiling recovered steel off-cuts.**



Figure 4.4 – Flow of metal recovered for reprocessing from sector of origin through to recycling destination (2005/06)



Note: Due to the methodology of collecting information, scrap metal merchants have been allocated 26% of the source sector

## 5. PAPER

### 5.1 Paper Recycling Process

Paper products of different grades are collected and recycled in Western Australia. These include newsprint / magazines, telephone directories, mixed paper, cardboard / paper packaging, printing / writing paper and wax board. Like metals, paper receives a higher price if it is separated into associated grades, however mixed paper can still be used and pulped into a new product.

The majority of waste paper sourced from the municipal and commercial sector is separated at the MRF's throughout the state, however for certain commercial operations, such as supermarkets, the waste paper/cardboard can be collected at source, as the majority of the material is already source separated (e.g. cardboard bales).

Once the paper has been separated into its associated grades it can be reprocessed. Local reprocessors operating in 2005/06 included the AMCOR paper mill in Spearwood and numerous insulation companies (e.g. Cool or Cosy, Insul fibre Ultra Block). The paper mill operated by AMCOR was closed down in the latter part of 2006.

At the AMCOR paper mill, reprocessing involved the waste paper being mixed with water in a pulping process to enable separation of the paper fibres. Contaminants (inks and adhesives) were removed during this process. Some types of materials such as juice cartons required shredding prior to pulping to enable easier reprocessing and the removal of plastic and metal contaminants. The recycled paper is then combined with a portion of virgin fibre to increase strength and quality. The finished products are large paper rolls that can then be used for packaging purposes on or off-site.

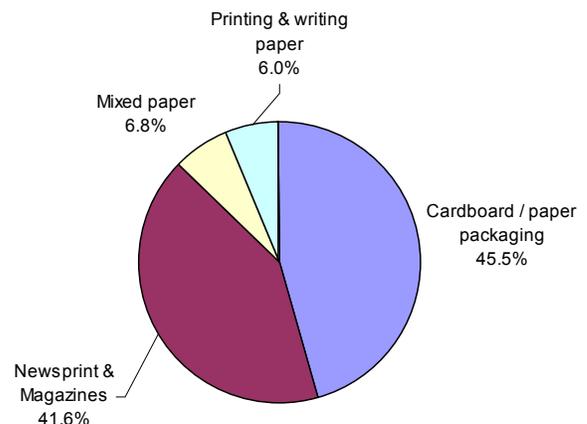
Pulped newspaper is an excellent insulator. Insulation companies source newspaper from paper recycling companies, pulp it and combine it with fire retardants. The product can then be easily installed in buildings to save on heating and cooling costs.

### 5.2 Paper Recovery by Product

Approximately 207,690 tonnes of paper was recycled in Western Australia during the 2005/06 financial year. This is an increase of 21,870 tonnes since the 2004/05 report. Cardboard / paper packaging had the largest tonnage of material recovered for a single paper grade, with a total of 94,460 tonnes. The next largest tonnage is for the newsprint & magazines grade with 86,470 tonnes. The breakdown of paper grades recovered is outlined in **Table 5.1** and **Figure 5.1**

**Table 5.1 / Figure 5.1: Composition of paper products recovered by weight (tonnes) for reprocessing (2005/06)**

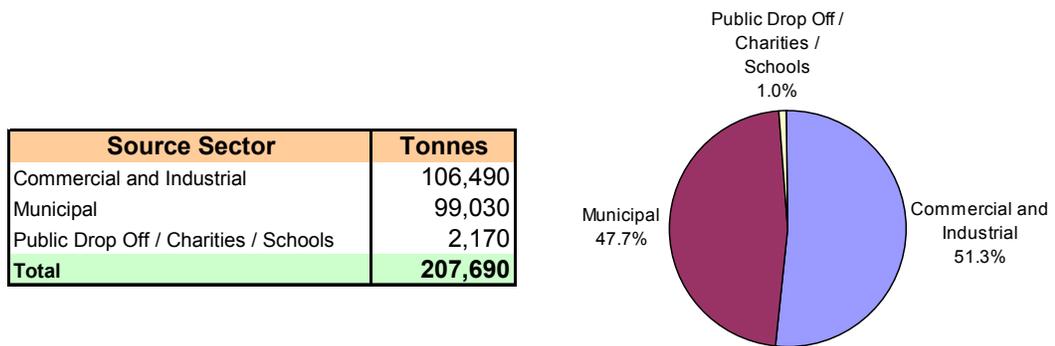
Paper Composition	Tonnes
Cardboard / paper packaging	94,460
Newsprint & Magazines	86,470
Mixed paper	14,040
Printing & writing paper	12,500
Directories	220
<b>Total</b>	<b>207,690</b>



### 5.3 Source Sector of Paper

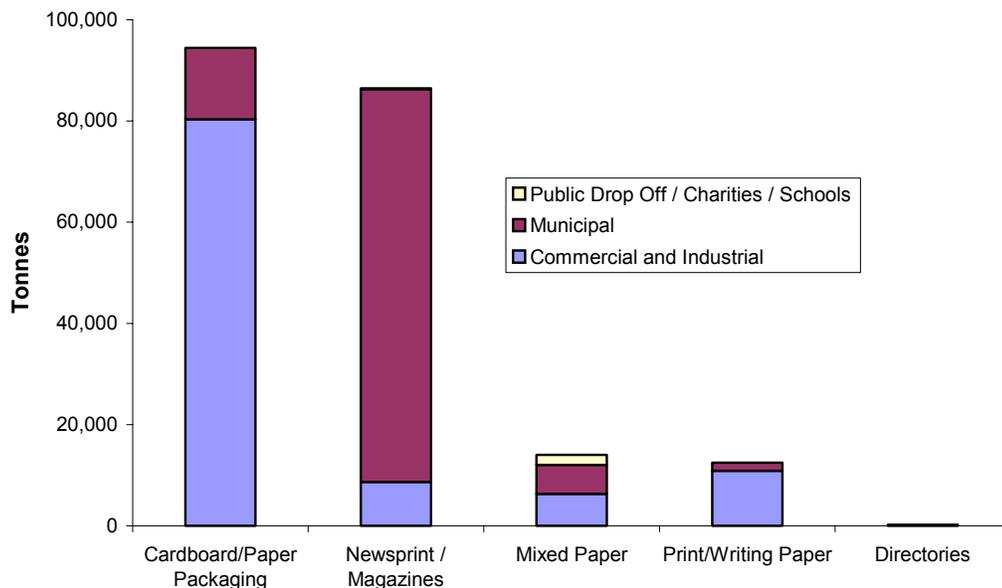
The majority of paper recovered in 2005/06 was sourced from the C&I sector (approximately 106,490 tonnes or 51%). Approximately 7,460 tonnes less was sourced from the C&I sector (**Table 5.2** and **Figure 5.2**). This is in stark contrast to the recovery rates in 2004/05 where the commercial sector contributed approximately 77% of the paper recovered. It is unknown why there is such a disparity. Drop off by charities, schools and the public also contributed a large quantity to the overall total. As outlined in **Section 5.1**, municipal paper is mostly collected through kerbside collections and provides 48% of the paper sourced for reprocessing. For the purposes of this study commercial collections are defined as collections from C&D, Office and Retail, Public Buildings and the Manufacturing Industry.

**Table 5.2 / Figure 5.2: Source of paper products recovered by weight (tonnes) from all sectors for reprocessing in 2005/06**



The majority of newsprint / magazines is sourced from the municipal sector (**Figure 5.3**), whereas most cardboard / paper packaging, print / writing paper and directories are sourced from the C&I sector. Mixed paper comes from all sources.

**Figure 5.3: Source of paper products by grade recovered by weight (tonnes) for reprocessing in 2005/06**



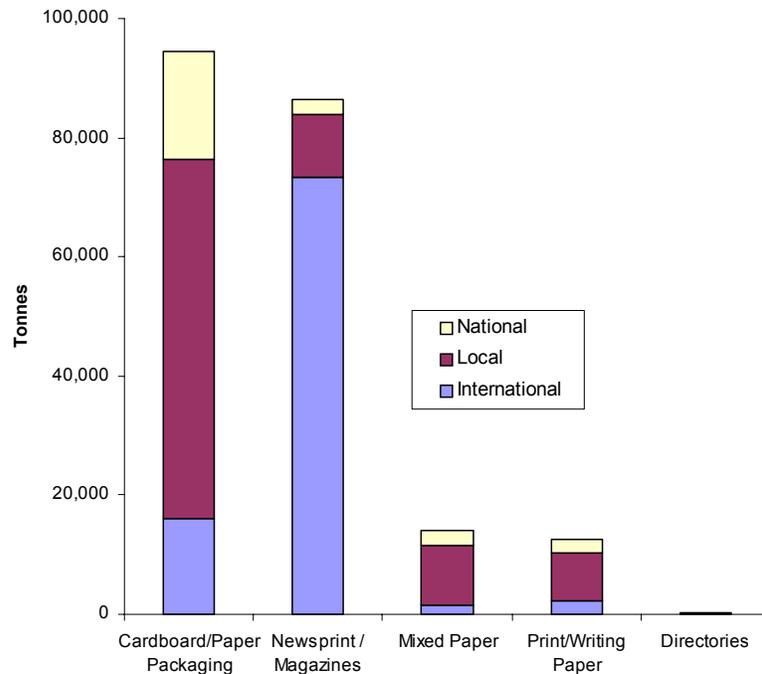
## 5.4 Destination of Recovered Paper

Approximately 43% or 88,960 tonnes of the paper recovered in Western Australia is reprocessed locally. The remainder was either sent interstate (12%) or overseas (45%). The high rate of exportation was due to a very high demand for paper products in Asia.

During 2005/06 the majority (73,310 tonnes) of newsprint / magazine grade paper was exported, while cardboard / paper, mixed paper and print / writing paper grades was mostly utilised by the AMCOR paper mill (Table 5.4 and Figure 5.4). A large amount of cardboard/paper packaging is also sent to the Eastern States for reprocessing (approx. 18,160 tonnes).

**Table 5.3 and Figure 5.4 – Source of paper products recovered by weight (tonnes) from all sectors for reprocessing in 2005/06**

Destination	Cardboard/Paper Packaging	Newsprint / Magazines	Mixed Paper	Print/Writing Paper	Directories	Total
International	16,000	73,310	1,500	2,250	220	93,280
Local	60,300	10,660	10,000	8,000	0	88,960
National	18,160	2,500	2,540	2,250	0	25,450
<b>Total</b>	<b>94,460</b>	<b>86,470</b>	<b>14,040</b>	<b>12,500</b>	<b>220</b>	<b>207,690</b>



In comparison to 2004/05 there has been a continued trend in the exportation of newsprint / magazine grade paper to Asia and local reprocessing of cardboard. However, with the closure of the AMCOR paper mill in late 2006, it is likely that a large quantity of cardboard / paper packaging, mixed paper and print / writing paper grades will be sent to the eastern states for reprocessing in the future.

## 5.5 Barriers / Opportunities Outlined by the Paper Recycling Industry

Key barriers outlined by the paper recycling industry include; the cost of disposal to landfill being too low, the lack of available material and poor source separation. The low cost of disposal to landfill in Western Australia provides little incentive for paper material to be recycled. This provides a flow on effect to paper recycling companies, as they are unable to obtain enough material to remain viable, especially smaller operations.

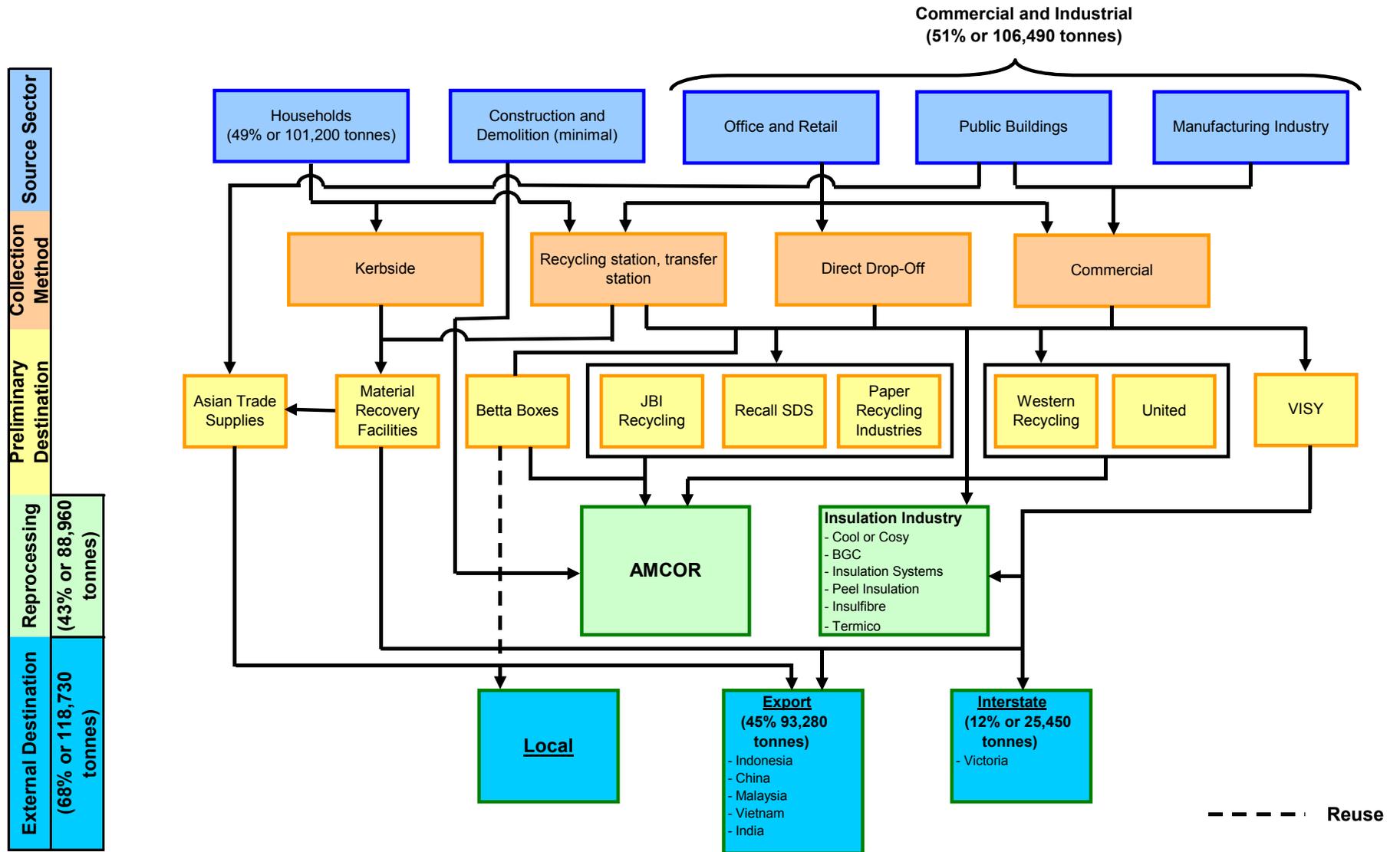
As outlined in **Section 5.1** the separation of paper into its grades is not always optimal. Separation is affected by the degree to which MRF's are set up to separate different grades of paper. Whether paper is to be used locally or exported, the material needs to meet a certain grade and tolerance level to be marketable, otherwise the material can be rejected and may require landfilling. Contamination of paper with other material such as plastics and glass can also make the product unmarketable.

Cellulose insulation companies in Western Australia attribute the low availability of newsprint to high demand, both locally and internationally. This in turn has increased the cost of newsprint. Contamination, transport costs and storage space are other barriers faced by the insulation industry.

Opportunities for increased recycling (outlined by industry), other than overcoming the barriers outlined above include; increased business and community education, increases to the landfill levy and increased access to waste paper from regional areas facilitated by government incentives. Insulation companies have indicated that opportunities will arise if cellulose is promoted more in the building industry. Other opportunities in the insulation industry include the creation of alternative cellulose products such as hydro-mulch and animal litter products. Hydro-mulch is cellulose fibre mulch mixed with fertilizer, seed, bonding agents, and water and can be used for land restoration or dust suppression.

The diagram on the following page (**Figure 5.5**) outlines the flow of materials from source sector through to the reprocessor.

Figure 5.5 – Flow of paper recovered for reprocessing from sector or origin through to recycling destination (2005/06)



## **6. CONTAINER GLASS**

### **6.1 Container Glass Recycling Process and Destination**

Glass is no longer reprocessed locally in Western Australia since the closure of ACI Glass in Canning Vale in 2002. Since 2003 all glass has been sent interstate to ACI Glass, South Australia for reprocessing. Material Recovery Facilities (MRF's) and commercial recyclers (Perth Glass) send their glass to a quality agent and then transport the material interstate by freight train.

Once at ACI in South Australia, the glass is crushed into cullet, melted in a high temperature furnace, blended with virgin material (for additional strength) and remoulded into glass containers. Most glass currently consumed in Australia is made from post consumer glass. ACI have indicated that glass can be up to 70% recycled material without any reduction in quality.

### **6.2 Container Glass Recovery**

Glass recycling in Western Australia has remained static since 2004/05. ACI Glass estimated that approximately 18,000 tonnes of material was recycled in 2005/06. The Resource Recovery Rebate Scheme (RRRS) data calculated a total of 17,268 tonnes. ACI have indicated that the recovery of glass has remained largely static due to glass containers slowly being replaced by plastics which are lighter to transport and cheaper to manufacture.

### **6.3 Source Sector of Glass**

The largest proportion of glass is sourced from municipal kerbside collections. Drop off facilities and commercial collections at pubs and hotels by Perth Glass are also a contributor to the overall recycling of glass in Western Australia.

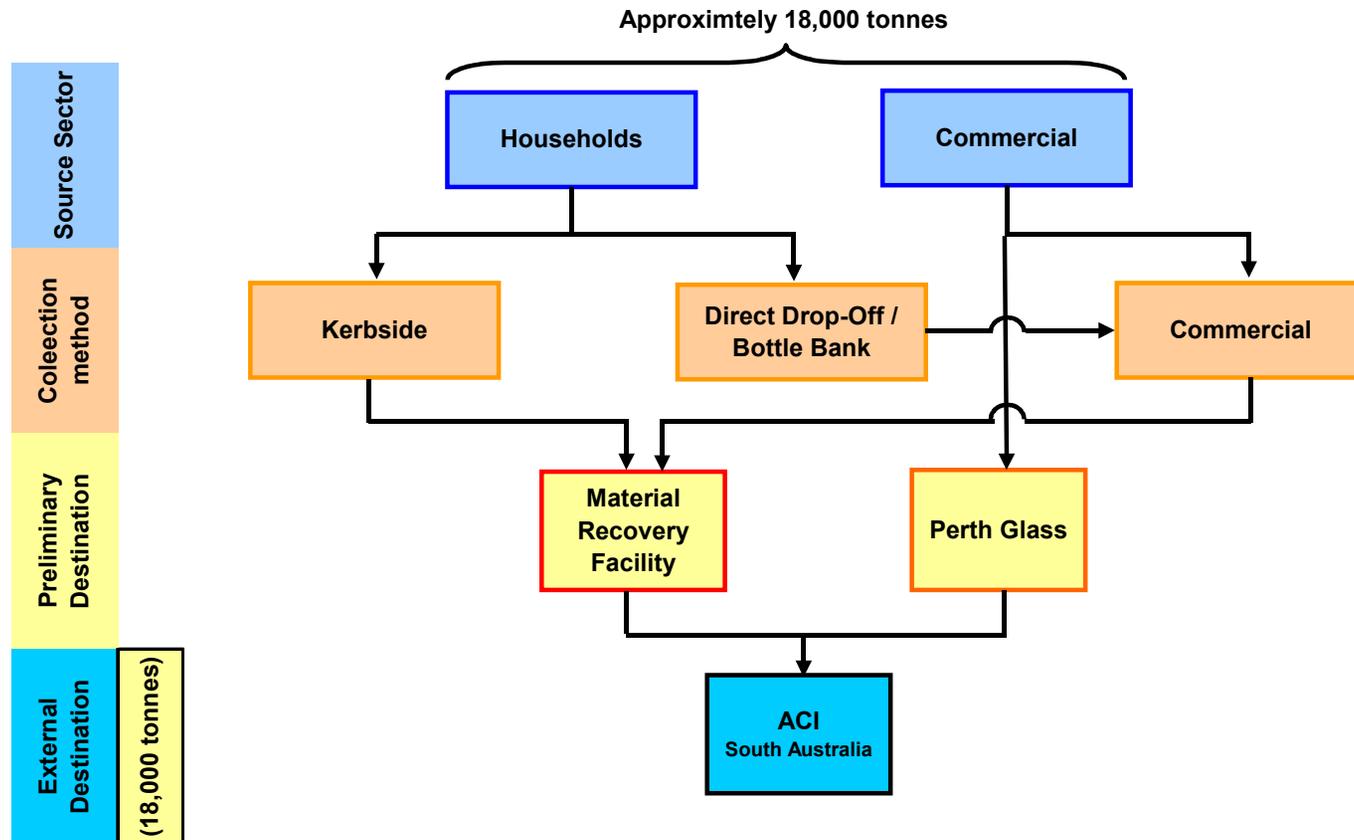
Perth Glass were not willing to contribute towards the survey, therefore the proportions of glass received from each source sector could not be calculated.

### **6.4 Barriers / Opportunities Outlined by the Glass Recycling Industry**

ACI identified a number of barriers that are currently in place in Western Australia that are limiting further recovery of glass and the re-establishment of a reprocessing facility. The main reason for the closure of the facility in Western Australia was the limited local markets for container glass. ACI stated that Western Australia does not consume enough container glass for the industry to remain viable. Excess glass had to be shipped to the Eastern States to avoid landfilling and this in turn increased freight costs making the glass reprocessing industry economically unviable. ACI also stated that until new markets are found in Western Australia, it is unlikely that a state based reprocessing facility will be established and glass will continue to be sent to the Eastern States for reprocessing.

Opportunities for increased recycling of glass would be through the establishment of local Western Australian markets for reprocessed glass. Some possible markets (other than container glass) include using glass as an abrasive and incorporation into bricks, tiles and aggregates. Glass is also an excellent insulator and could be incorporated in household insulation systems.

Figure 6.1 – Flow of container glass recovered for reprocessing from sector or origin through to recycling destination (2005/06)



## 7. PLASTICS

### 7.1 Plastics Recycling Process

There are many different types of plastic in the marketplace, with each type being used for various purposes. Kerbside recycling is currently limited to type 1 (PET), type 2 (HDPE) and type 3 (PVC), however, mixed plastic (all types) can be marketed by MRF's at a lower price to separated materials. Commercial operators such as CLAW, Recycla Plas and JoJo Plastics can accept all types 1-7 plastics. Type 5 (PP) plastics can also be recycled by Pot Recyclers who have drop-off collection points for used plastic plant pots.

Like other recyclable material, the separation of plastics into each type is necessary to avoid contamination and therefore retain the plastics properties. Separation of plastics is generally completed manually, however some MRF's have automatic separation equipment.

Recycling companies in Western Australia use slightly different recycling processes for each type of plastic depending on market requirements. If the plastic is in a solid form it is normally shredded and washed to remove any contaminants such as metals, organics or labelling. This shredded material is heated and granulated into pellets ready for reprocessing. Films are generally baled prior to exportation and reprocessing.

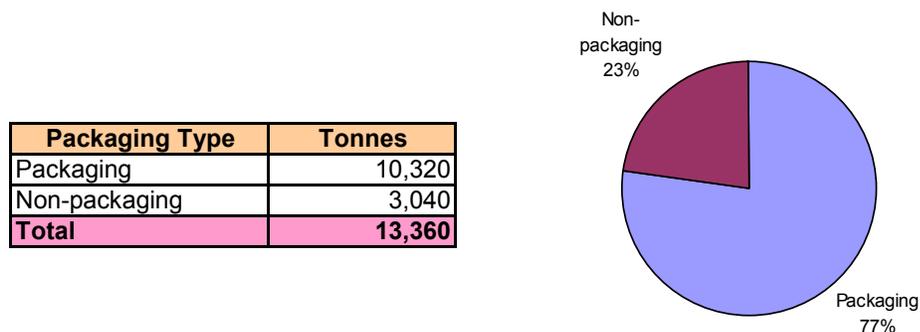
The reprocessing of plastic involves the shredded or granulated plastics being fed into a manufacturing process. This can involve; blow moulding, extrusion, injection moulding or injection blow moulding depending on the type of product that is being produced.

### 7.2 Total Plastics Recovery

In order to maintain consistency with the previous Recycling Review of Recycling Activity in Western Australia report, the plastics data has been obtained from the 2005 Plastics and Chemical Industries Association (PACIA) report. While the PACIA report represents the 2005 calendar year rather than the 2005/06 financial year it does give an indication of the recycling activity over a similar time period. It must be noted that reprocessing in the 2005 PACIA report defines 'reprocessing' as shredding or granulating of the material.

Overall recycling activity for the 2005 calendar year was 13,360 tonnes, an increase of 6,230 tonnes over the PACIA 2004 calendar year report (**Table 7.1**). This figure is generally consistent with tonnage data gathered from the Cardno BSD survey. Due to the small number of plastic recycling companies in Western Australia, the amount of plastic recovered by polymer type cannot be published due to the commercial sensitivity of this data, however it can be reported that PET, HDPE and LDPE (Type 4) were recovered in the largest quantities (Cardno BSD survey). This differs to the PACIA 2004 calendar year report that reported PET, HDPE and PVC to be the largest type of recycled plastic. Total plastics recovered by packaging type have been published by PACIA and are outlined below.

**Table 7.1 / Figure 7.1 – Total plastic recovery by packaging type (PACIA 2005)**

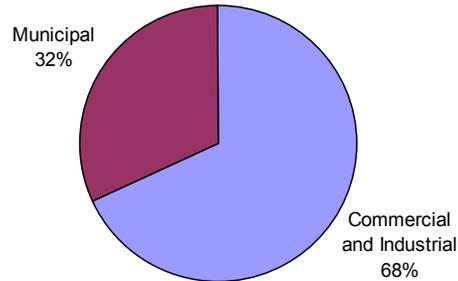


### 7.3 Source Sector of Plastics

Approximately 68% (9,080 tonnes) of recovered plastics were sourced from the commercial and industrial sector, whilst the remaining 32% (4,280 tonnes) was sourced from the municipal sector.

**Table 7.2 / Figure 7.2 – Source Sector of plastics recovered by weight (tonnes) for reprocessing (2005)**

Source Sector	Tonnes
Commercial and Indus	9,080
Municipal	4,280
<b>Total</b>	<b>13,360</b>



As outlined in **Section 7.1** municipal plastics include Type 1 (PET), Type 2 (HDPE), Type 3 (PVC) and associated mixed plastics (all types) collected from kerbside collection services. Commercial and Industrial plastics can include all types of plastics. **Table 7.3** provides examples of the products, relating to each type of plastic, that were recycled in Western Australia during 2005/06.

**Table 7.3: Examples of plastics accepted at various W.A recyclers in 2005/06**

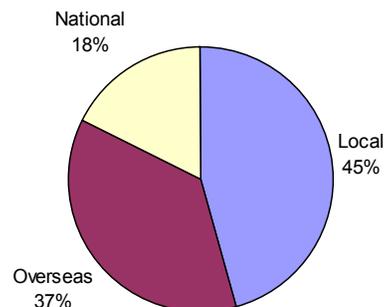
Plastic	Type	Products Recycled Examples
PET	1	Bottles
HDPE	2	Drums, Pipes, Bottles
PVC	3	Pipes, Food Packaging, Wires
LDPE	4	Film, Water Tanks, Bin Lids
PP	5	Bags, Plant Pots, Crates, Furniture
PS	6	Computer Components, Coat hangers
EPS	6	Fruit boxes
ABS/SAN	7	Television Surrounds, Car Parts
Nylon	7	Manufacturing Waste

### 7.4 Destination of Recovered Plastics

According to the PACIA report (2005) a large proportion of plastics were reprocessed locally (45%), followed by exportation overseas (37%) and finally interstate / national destinations (18%).

**Table 7.4 and Figure 7.3: Destination of plastics recovered by weight (tonnes) for reprocessing (2005)**

Destination	Tonnes
Local	6,010
Overseas	4,880
National	2,470
<b>Total</b>	<b>13,360</b>



All plastic types can be reprocessed within Western Australia or exported overseas. Municipal plastics (PET, HDPE, PVC and Mixed) collected by MRF's are currently being sent interstate or exported directly for reprocessing.

**Table 7.5: Recovered polymers reprocessing destination**

Polymer	Plastics Code	Reprocessed Locally	Sent Interstate	Sent Overseas
PET	1	Y	Y	Y
HDPE	2	Y	Y	Y
PVC	3	Y	Y	Y
LDPE	4	Y	N	Y
PP	5	Y	N	Y
PS	6	Y	N	Y
EPS	6	Y	N	Y
ABS/SAN	7	Y	N	Y
PU	7			
Nylon	7	Y	N	Y
Mixed	All	Y	Y	N
<b>Total (tonnes)</b>	All	<b>6,010</b>	<b>2,470</b>	<b>4,880</b>

Figure 7.4 on the following page shows the flow of plastic material from source sector through to reprocessing destination.

## 7.5 Barriers / Opportunities Outlined by the Plastics Recycling Industry

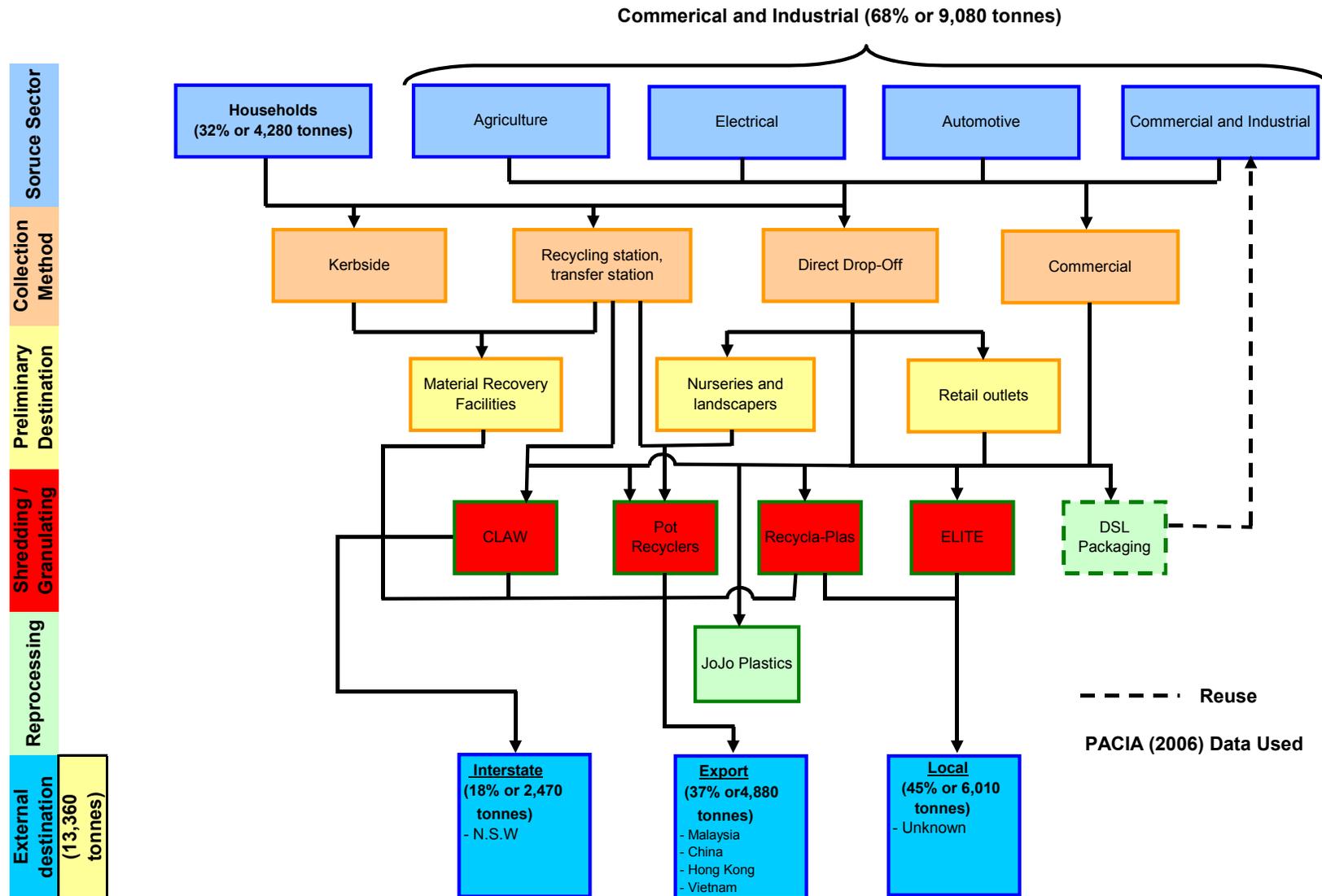
Key barriers limiting further increases in recycling, outlined by the plastic recycling industry include: the willingness for recycled plastic to be used in new products, the market value of plastic, the poor recycling culture of businesses and councils towards separation of plastics, the increase in labour and transportation costs and difficulties in obtaining grants from the government.

Demand for plastics by the local recycling industry is currently high, however supply is low when taking into account the total amount of plastic being consumed. In the local reprocessing market demand is outstripping supply, due to the majority of plastics being exported overseas for reprocessing.

To recycle plastic into a new product such as piping, a degree of surety about the origins, quality and type of plastic is required. Contamination of the plastic can damage plastic moulding equipment and degrade the finished product. However a company based in Wangara has developed a method that allows all types of plastics of different grades and origins to be formed into a new product.

Opportunities to increase the amount of plastic being recycled in Western Australia, identified by industry include: material being extruded back into piping products, increased marketing of recycled plastic by government and industry, increased availability of grants to expand businesses, local governments implementing recycling programme, commercial / industrial companies setting aside disused plastics for pick-up and lastly, an increase in the cost of landfill to give incentive for plastics to be collected and recycled.

Figure 7.4: Flow of plastics recovered for reprocessing from sector of origin through to recycling destinations (2005)



## 8. RUBBER

### 8.1 Rubber Recycling Process

The rubber recycling process is almost exclusively related to tyres. In order to prepare used truck and car tyres for reprocessing, they first undergo a shredding and granulating process, reducing the material to a small granule size. This process enables metals and other contaminants to be removed. This granulated material is then reprocessed to create new products (see **Photo 8.1** and **Photo 8.2**).

Reclaim Industries, based in Spearwood is Western Australia's only tyre reprocessing facility. Reclaim use post consumer tyres to create rubber-surfacing products that are used in a variety of applications including playgrounds, equestrian areas and building surrounds. The reclaimed rubber can be formed into many different shapes and sizes depending on the desired use. Unsuitable tyres are baled and sent to landfill.

Other companies specialising in used rubber include Tyre Waste WA and Tyre Recyclers (**Figure 8.1**). Whilst these companies are not currently recycling the rubber, they are baling and mono-filling (single material landfill) the tyres for possible recovery in the future. It is assumed that in the future when rubber becomes more valuable it will be exhumed or 'mined' from the landfills and reprocessed. For the purpose of this report these baled and landfilled tyres have not been incorporated into the reported totals. Retreading of tyres data has also been omitted from this report, as it is considered a reuse activity.

### 8.2 Source Sector and Total Recovery Rubber

The majority of rubber is sourced from the commercial and industrial sector, particularly tyre collectors and retailers. A small amount is also recovered from the mining industry and from household drop off facilities.

According to the DEC's Controlled Waste Tracking System approximately 1,320 tonnes of rubber was recycled in 2005/06, however industry feels this total is closer to 5,000 tonnes based on the tonnage of rubber they have reprocessed. The rubber reprocessing industry has suggested that the DEC tracking system is not a very reliable source of accurate numerical data due to its structure.

### 8.3 Destination of Recovered Rubber

Reclaim Industries reprocess most of their material locally in Western Australia, however some is sent to the Reclaim Industries facility in South Australia for reprocessing. The reprocessed material has a variety of local, national and international markets.

### 8.4 Barriers / Opportunities Outlined by the Rubber Recycling Industry

Reclaim Industries have identified that the 'environment' for rubber recycling in Western Australia is not sufficiently attractive for further investment in reprocessing capacity. The demand for tyres is high and the facility is running at full capacity, however Reclaim, and other potential reprocessors that could enter the market, are reluctant to make further capital investments without assurance that there will be government support.

The industry maintain that the environment for recycling is not favourable mainly due to the low gate fees for landfill, which in turn provide no incentive for the tyres to be sent to a tyre recycler. Gate fees for recycling need to be unsustainably low to compete with landfills, therefore further reducing the potential for further investment. Opportunities are high to

increase the recycling of rubber if the processing costs can become competitive with landfill.

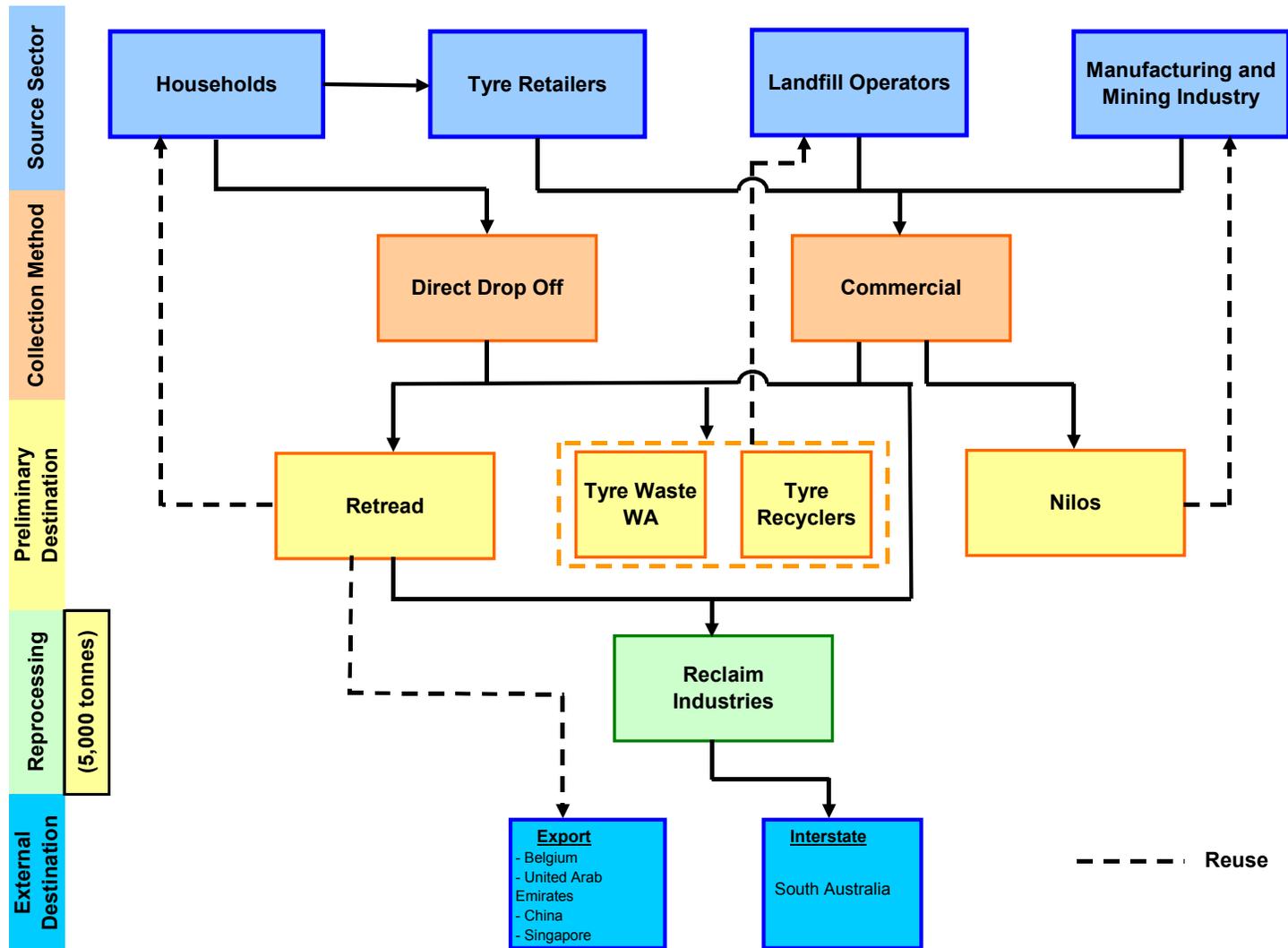
**Photo 8.1 – Stockpiled tyres ready for shredding at Reclaim Industries**



**Photo 8.2 – Shredded and granulated tyre end-product ready for reprocessing**



Figure 8.1: Flow of rubber recovered for reprocessing from sector of origin through to recycling destinations (2005/06)



## 9. TEXTILES

### 9.1 Textiles Recycling Process

Textiles are considered recycled when they undergo some degree of reprocessing. Reprocessing for textiles has been defined as the creation of a rag or padded product from recovered clothing. Damaged garments or clothing unsuitable for direct reuse are collected mainly from charities and shredded to form a rag product.

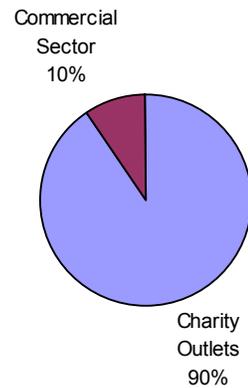
Shredding is a labour intensive process that involves the removal of button, zips and cuffs and cutting of the material into a standard size. Depending on the 'rag company' the material is then put through a scanning process to ensure no metal contaminants are present in the material. The material is baled before the rag is sold.

### 9.2 Clothing Recovery and Source Sector

The total amount of textile material recovered during the 2005/06 financial year totalled 1,560 tonnes (an increase of 303 tonnes over 2004/05). The largest proportion of textiles was sourced from charities (90% or 1,400 tonnes). The remainder is sourced from the commercial sector.

**Table 9.1 / Figure 9.1: Source of textiles recovered by weight (tonnes) from all sectors for reprocessing (2005/06)**

Source Sector	Tonnes
Charity Outlets	1,400
Commercial Sector	160
<b>Total</b>	<b>1,560</b>



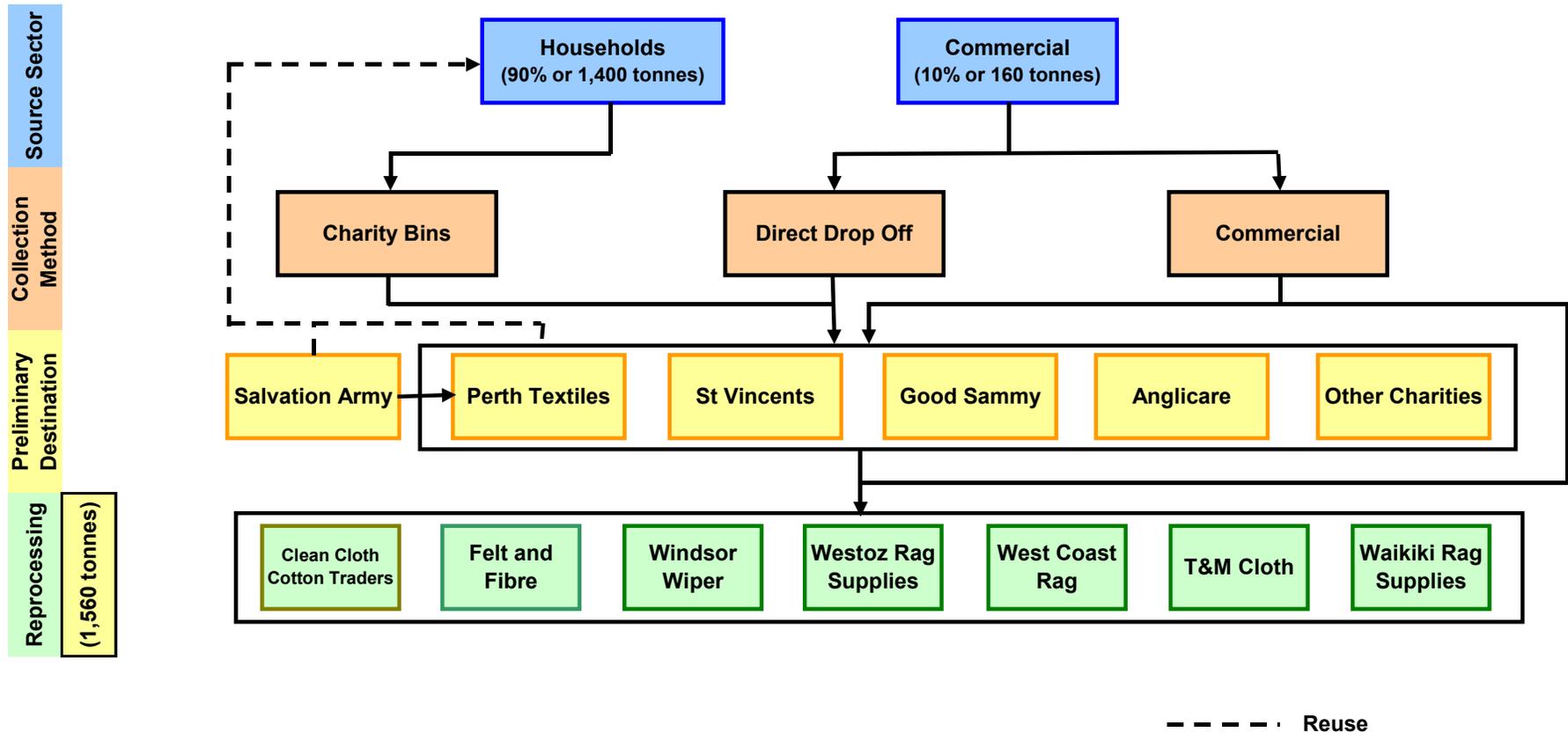
### 9.3 Destination of Recovered Clothing

All of the recovered textile material is reprocessed within Western Australia (**Figure 9.2**). Current markets for the material include car dealerships, industrial processes and the mining industry.

### 9.4 Barriers / Opportunities Outlined by the Textile Recycling Industry

Major barriers to further recycling within the textile recycling industry are the availability of staff at charity stores and the recycling companies. Demand for rag is high and is outstripping supply, however potential customers are being lost due to labour shortages. Emerging barriers are: the removal of charity bins by councils due to rubbish dumping and arson, inefficient processing machinery, contamination of material and low landfill disposal costs.

Figure 9.2: Flow of textiles recovered for reprocessing from sector of origin through to recycling destinations (2005/06)



## 10. ORGANICS

### 10.1 Organics Recycling Process

The organics reprocessing industry uses mechanical and biological systems to reprocess organic materials. Organic materials such as tree trunks and branches undergo mechanical processing to shred or grind the material to reduce its particle size. Additional mechanical processing or screening is sometimes required for some materials (e.g. Municipal Waste) to remove non-organic contaminants from the material.

Once the material has been reduced to a uniform particle size and any contamination has been removed, the resulting material undergoes a biological process to breakdown and stabilise the organic material. The biological process pasteurises the material to reduce any pathogens and weed seeds contained in the raw organic material. This process can be completed with a range of systems including static pile, turned windrows and enclosed tunnel or silo systems (see **Photo 10.1**). Once the organic material has been biologically processed, it may undergo further mechanical screening or blending with other materials to produce specific products.

The type of processing systems utilised generally depend upon the raw organic feedstock used and the intended market for the products. The two main product areas for reprocessed organic material are composts and mulches.

### 10.2 Organics Recovery and Source Sector

For the first time Compost Australia data has been included into the Recycling Review. As this data was not available for the 2004/05 report there are marked differences in total tonnages recovered. The Compost Australia data is from all sectors whereas the 2004/05 report used Resource Recovery Rebate Scheme (RRRS) data (conducted by the Municipal Waste Advisory Council (MWAC)). RRRS data is only from the municipal sector.

According to Compost Australia, organics recovery in Western Australia totalled approximately 578,630 tonnes in 2005/06. This total includes a wide variety of organic products ranging from garden organics, barks and food organics through to manure, animal bedding and paunch (animal stomachs). Garden organics (159,380 tonnes), barks (101,720 tonnes) and Municipal Solid Waste (95,180 tonnes) had the highest tonnage of material recovered.

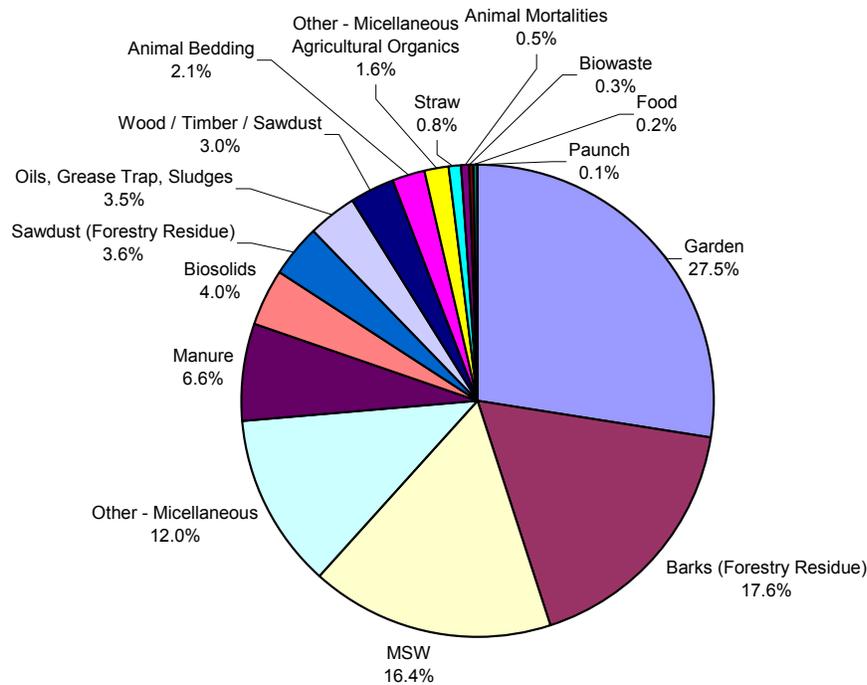
If 2004/05 Compost Australia is used as a comparison; there was an approximate increase of 39,270 tonnes (7.3%) in the 2005/06 financial year, however, garden organics recovery decreased in 2005/06 by approximately 12,300 tonnes.

**Table 10.1 / Figure 10.1** on the following page outline the breakdown of source sector in tonnages and proportions.

**Table 10.1 – Source Sector of organics recovered by weight (tonnes) for reprocessing (Compost Australia 2005/06)**

Source Sector	Tonnes
Garden	159,380
Barks (Forestry Residue)	101,720
MSW	95,180
Other - Miscellaneous	69,610
Manure	38,000
Biosolids	23,000
Sawdust (Forestry Residue)	20,590
Oils, Grease Trap, Sludges	20,350
Wood / Timber / Sawdust	17,630
Animal Bedding	12,350
Other - Miscellaneous Agricultural Organics	9,500
Straw	4,500
Animal Mortalities	3,010
Biowaste	2,000
Food	1,010
Paunch	800
<b>Total</b>	<b>578,630</b>

**Figure 10.1: Source Sector of recovered organics in 2005/06 (Compost Australia)**



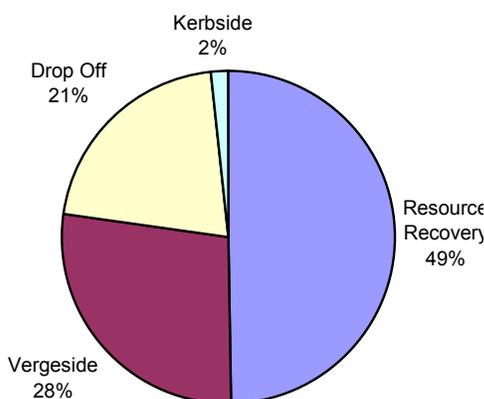
RRRS data concludes that 178,670 tonnes of municipal organics were recovered and reprocessed during 2005/06. This is an increase of 12,040 tonnes or 7% from 2004/05 figures. **Table 10.2** on the following page outlines the recovery in 6 month periods during 2005/06.

**Table 10.2 – Source Sector of organics recovered by weight (tonnes) for reprocessing (RRRS 2005/06)**

RRRS Scheme (05/06)	Jul-Dec	Jan-Jul	Total
Resource Recovery	61,100	27,140	88,240
Vergeside	21,670	27,450	49,120
Drop Off	19,800	17,480	37,280
Kerbside	200	2,940	3,140
<b>Total</b>	<b>102,770</b>	<b>75,010</b>	<b>177,780</b>

Resource recovery is the highest contributor to the recovery of organics sourced from the municipal sector (**Table 10.2 / Figure 10.2**). Resource recovery facilities (RRF) currently in operation are the Southern Metropolitan Regional Council in Canning Vale and the ATLAS facility in Mirrabooka. Proposed RRFs' in the Western Metropolitan Council and Mindarie Regional Council will increase the recovery of municipal organics.

**Figure 10.2: Source Sector of recovered municipal organics (RRRS 2005/06)**



The method adopted for this report to determine the organics source sector split between municipal and C&I is to subtract the RRRS data from the Compost Australia data. This gives a split between municipal and C&I of 178,670 tonnes (31%) and 399,960 tonnes (69%) respectively, assuming no organic material is sourced from the C&D sector.

### 10.3 Destination of Recovered Organics

The majority of reprocessed organic material is used to produce mulches or composts. Both of these product areas consist of many specialised markets that have particular requirements and specification for the organic products that they use. Due to the relatively low value of organic products, they are used locally within Western Australia as soil conditioners, weed suppressants or fertilisers. The markets that use organic products include agriculture, horticulture, viticulture, council works, landscaping and domestic gardening.

## 10.4 Barriers / Opportunities Outlined by the Organics Recycling Industry

Compost Australia surveyed a number of organics recycling companies for barriers that are currently faced by the industry. Barriers were ranked according to the number of responses given. These are listed below.

1. Site Regulation and planning consent – inconsistent, unnecessarily costly, requirements do not support policy, unaffordable new regulatory demands forcing exit from industry
2. Inadequate / not enforced regulation of competing products
3. Raw material contamination
4. Lack of financial incentives for growers (e.g. rebate)
5. Downward pressures on prices/quality from increasing supply (oversupply)
6. Lack of market development for new products/markets (particularly agriculture)

**Photo 10.1: An example of a windrow composting facility**



## 11. RECYCLING TRENDS

Based on feedback provided by the recycling industry, there has been a general increase in the amount of material being recycled in Western Australia. This has been driven by a number of factors including; population increases, increased economic activity, increased awareness about recycling, improved collection infrastructure and the development of markets for recovered materials. The table below outlines the key trends and associated reasons outlined by industry for increased, decreased, static or varied recycling activity.

**Table 11.1: Recycling Trends in Western Australia outlined by Industry**

Material	Trend	Reason
<b>Construction and Demolition</b>		
Sand, Concrete, Rubble	Increasing	High growth in construction sector
Whole Bricks	Static/Increasing	Demolition of older building in inner suburbs
Timber	Increasing	Increased marketing, cost reduction, landfill costs to disposer
Metals	Static	Being removed by scrap dealers
<b>Metal</b>		
Aluminium	Static	Low market value
Non-Ferrous Metals	Static/Increasing	Copper/Nickel high demand from China
Steel	Increasing	High growth in WA / Mining sector. High demand local and international
Automotive Batteries	Static/Decreasing	Low value and strict transport restrictions impacting collection rates
<b>Paper</b>		
Newsprint/Magazines	Increasing	Population growth, increased awareness, collection efficiency, increased consumption
Cardboard/Paper	Increasing	"as above"
Mixed Paper	Increasing	"as above"
Printing/Writing Paper	Increasing	"as above" and increased office recycling.
Directories	Static/ Decreasing	Low market value
<b>Glass</b>		
Container Glass	Static	Conversion to plastic products
<b>Plastic</b>		
Type 1 (PET)	Increasing	Community awareness at kerbside
Type 2 (HDPE)	Increasing	Community awareness at kerbside. Market penetration
Type 3 (PVC)	Static	Low market value
Type 4 (LDPE)	Increasing	Market penetration. Improved commercial collection
Type 5-7 (PP, PS, EPS, ABS, Nylon)	Static/Increasing	Increased market knowledge. Low availability of material.
<b>Rubber</b>		
Tyres	Varied	No legislation to divert or encourage tyres away from landfill
<b>Textiles</b>		
Clothing	Varied	Labour shortage in charity stores. Removal of charity bins
<b>Organics</b>		
Compost	Increasing	Resource Recovery of municipal waste
Shredded Greenwaste	Increasing	Residential expansion. Vergeside collections.

## 12. CONCLUSIONS AND RECOMMENDATIONS

### 12.1 Conclusions

Recycling activity in Western Australia has shown growth in a number of sectors since last years report, especially C&D. A large proportion of the increase can be attributed to the inclusion of different data sources and additional recycling companies. Industry has indicated there is a heightened awareness of recycling in the community and a strong desire by the community to increase the amount of material being recycled.

However, there are a number of barriers to further increases in recycling:

- Low landfill gate fees make it difficult for recycling companies to attract feedstock and create reluctance among recyclers to expand their businesses. Landfill gate fees in Western Australia are much lower than in the Eastern States where higher landfill levies (\$30+ per tonne) are helping to divert material to recycling companies. The increase in the landfill levy in 2006 was welcomed by the recycling industry and may have facilitated a reduction in the amount of waste that is sent to landfill. However, the recycling industry within Western Australia has indicated it needs further substantial increases to compete directly with landfill.
- The distances and the cost associated with transporting wastes from the non-metropolitan areas of the State is a significant issue that is inhibiting the recovery of materials from the regions.
- There is a lack of local markets for some lower value materials, such as glass and composites. This is reducing the potential expansion of the reprocessing capacity for these materials in the State, and therefore restricting the tonnage of material recovered. However, it is noted the DEC has commissioned a market development report to be produced for recycled organics.

In comparison to the other States, the levels of recovery per capita in Western Australia is now comparable to New South Wales (based on 2002/03 figures), but still well below the levels achieved in South Australia and Victoria (based on 2004/05 figures).

The reprocessing industry in Western Australia has had two significant facilities closed in recent years, the ACI Glass reprocessing facility and the AMCOR paper mill. The closure of these facilities has had a significant impact on the financial viability of reprocessing the associated materials due to the increased transport costs and this could present a serious barrier to the future recovery of both glass and paper in Western Australia.

There are many opportunities to increase the amount of material being recovered in Western Australia if these barriers can be addressed. When the recycling industry gains sufficient confidence about the future economic conditions for recycling in Western Australia, they will then be prepared to invest in capital to increase their capacity.

### 12.2 Recommendations

Raw (waste) materials need to be diverted from landfill to ensure further growth in recycling activity in Western Australia. There are a number of strategies to achieve this objective, including landfill bans for certain materials, increased landfill gate fees (via increased landfills levies or higher specification of landfill construction) and increased demand for recycled materials. These options should be considered to ensure there is increased diversion of material from landfill.

The prohibitive transport costs associated with the significant distances from the regions to the reprocessors needs to be addressed if the level of recycling in regional Western Australia is to increase. This is likely to be via a financial subsidy to minimise the impact of this current barrier. Improvements may be derived from the development of cost effective, small scale reprocessing technologies that can manufacture products that are marketable in the regional areas.

Particular sectors of the reprocessing industry (e.g. organics and glass) are often in the position where the supply of feedstock is in excess of market demand. Focusing upon market development for recycled products will assist in increasing demand and therefore stimulate growth of the industry. Markets can be developed using a number of approaches including; the development of product specifications and standards and by the increased procurement of recycled content products, led by government.

The level of reprocessing infrastructure within the state needs to increase if the recovery of lower value materials is to grow. Higher value materials, such as metals and some plastics can incur the higher transport costs to interstate or international reprocessing facilities; however the lower value 'bulky' materials such as organics, C&D waste, paper and glass can not justify higher transport costs. A lack of local reprocessing infrastructure and the poor accessibility to larger interstate and overseas markets for these materials could further restrict future growth in the reprocessing industry.

### **12.3 Data Collection and Future Surveys**

While it is encouraging that Western Australia is experiencing growth in recycling activity, unfortunately accurate data about the quantity of each material stream generated in landfilled in Western Australia is not available. Without this data it is not possible to determine if there has been an increase in the proportion of total waste that is now reprocessed, or if the increase in the quantity of waste reprocessed simply reflects an increase in the total quantity of waste produced.

It is envisaged by the Department of Environment and Conservation that mechanisms for better collection of landfill data will become available in the near future. This will enable a better understanding of the proportion of waste reprocessed and will give an indication of Western Australia's progress towards meeting its vision 'Towards Zero Waste'.

The 2005/06 survey used a number of different data sources when compared to last years report. The data sources include:

- Primary survey data from the reprocessors
- Compost Australia and RRRS data for organics
- PACIA data for plastics
- DEC Controlled Waste Tracking System for rubber

The changes in data sources for the 2005/06 report were made as it gave a more complete picture of the recycling activity in Western Australia, however this has presented problems when comparing data to the 2004/05 report. To maintain consistency in the future, it is recommended that the DEC stipulate the data sources that should be used for each material type in the report.

Finally, a number of reprocessors contacted commented on 'survey fatigue', as they had received up to three surveys to complete in the previous year. While these reprocessors still participated in the survey, it is worth noting that this could become an issue in the future. Efforts should be made to harmonise the collection of data between government and industry organisations to avoid the replication of surveys sent to industry.

**Table 12.1: Estimated Degree of Accuracy for Recycling Activity Data, Western Australia 2005/06**

Material	Total Recovery	Estimated degree of accuracy
<b>Construction and Demolition</b>		
Sand	232,600	High (± 5%)
Brick and Rubble	132,580	High (± 5%)
Concrete / Bitumen	102,330	High (± 5%)
Bricks (Whole)	10,860	Moderate (± 20%)
Timber	10,170	High (± 5%)
<b>Total C&amp;D</b>	<b>488,540</b>	
<b>Metal</b>		
Aluminium	13,080	High (± 5%)
Aluminium Cans	1,390	Moderate (± 20%)
Batteries (Automotive)	5,300	High (± 5%)
Non Ferrous (Other than Al)	13,030	High (± 5%)
Steel (non packaging)	304,690	High (± 5%)
Steel (packaging)	15,430	High (± 5%)
<b>Total Metal</b>	<b>352,920</b>	
<b>Paper</b>		
Newsprint & Magazines	86,470	High (± 5%)
Cardboard / paper packaging	94,460	High (± 5%)
Mixed Paper	14,040	High (± 5%)
Printing & writing paper	12,500	High (± 5%)
Directories	220	Moderate (± 20%)
<b>Total Paper</b>	<b>207,690</b>	
<b>Organics (Compost Australia)</b>		
All Organics	578,630	not applicable
<b>Total Organics</b>	<b>578,630</b>	
<b>Glass (ACI)</b>		
Container Glass	18,000	not applicable
<b>Total Glass</b>	<b>18,000</b>	
<b>Plastic (PACIA)</b>		
Domestic Packaging	10,320	not applicable
Industrial Packaging	3,040	not applicable
Non-packaging	0	not applicable
<b>Total Plastic</b>	<b>13,360</b>	
<b>Rubber</b>		
Rubber Tyres	5,000	High (± 5%)
<b>Total Rubber</b>	<b>5,000</b>	
<b>Textiles</b>		
Clothing	1,560	High (± 5%)
<b>Total Textiles</b>	<b>1,560</b>	
<b>TOTAL ALL MATERIALS</b>	<b>1,665,700</b>	<b>High (± 5%)</b>

### 13. CONTACT LIST

Outlined below are the recycling companies consulted for the 2005/06 Recycling Review

2005/06 Recycling Company Contact List										
<table border="1"> <tr> <th colspan="2">KEY</th> </tr> <tr> <td>2004/05 Report</td> <td>-----</td> </tr> <tr> <td>Extras 2005/06 Report</td> <td>- - - - -</td> </tr> <tr> <td>MRF</td> <td>=====</td> </tr> </table>			KEY		2004/05 Report	-----	Extras 2005/06 Report	- - - - -	MRF	=====
KEY										
2004/05 Report	-----									
Extras 2005/06 Report	- - - - -									
MRF	=====									
Product	Survey Returned	Company								
<u>Construction and Demolition</u>	Yes	Instant Bins								
	Yes	Veolia - Jandakot Recycling Centre								
	Yes	All Earth								
	Yes	C&D Recycling								
	Yes	Capital Demolition								
	Yes	Courtyard Recycled Bricks								
	Yes	Recycled Brick Cleaning Company								
	Yes	Projek Demolition								
	Yes	Dale Salvage								
	N	Mosman Recyclers								
	Yes	Diggers and Truckers								
	N	Midland Demolition and Recycling								
	Yes	Laminex								
	<u>Metals</u>		MRFs							
Yes		Bulk Metal								
Yes		Collins Recycling Depot								
N		Auscon								
Yes		Allied								
Yes		Laurance Scrap Metals								
N		C.D Dodd								
Yes		Bradken								
Yes		A1								
Yes		Schutz DSL								
Yes		Sims Metal								
Yes	Smorgon Steel Recycling									
<u>Paper</u>		MRFs								
	Yes	Asian Trade Supplies								
	Yes	Western Recycling								
	Yes	VISY								
	Yes	Paper Recycling Industries								
	Yes	Amcor								
	Yes	United Paper								
	Yes	JBI Recycling								
	Yes	Betta Boxes Recycling Company								
	N	Recall SDS								
	<u>Paper</u> (Insulation Companies)	N	Cool or Cosy							
Yes		BGC								
Yes		Brett Heady								
Yes		Peel Insulation								
Yes		Ultra Block								

Product	Survey Returned	Company
<b>Paper</b> <i>(Insulation Companies)</i>	Yes	Insulfibre
	Yes	Termico Insulation
<b>Plastics</b>		MRFs
	Yes	Pot Recyclers
	Yes	CLAW Environmental
	Yes	DSL Packaging
	Yes	VISY
	Yes	JoJo Plastics
	Yes	Vinidex
	Yes	RecyclePlas
	Yes	ELITE
<b>Tyres</b>	Yes	Tyre Recyclers
	N	Nilos
	Yes	Reclaim Industries
	Yes	Tyre Waste WA
<b>Glass</b>		MRFs
	N	Perth Glass Recyclers
	Yes	ACI Glass Packaging (Adelaide)
<b>Clothing</b>	Yes	Clean Cloth Cotton Traders
	Yes	Felt and Fibre
	Yes	Salvation Army
	Yes	Windsor Wiper Sales
	N	Westoz Rag Supplies
	Yes	West Coast Rag Pty Ltd
	Yes	T&M Cloth
	Yes	Perth Textiles
	N	Waikiki Rag Supplies
<b>MRFs - Metro</b>	Yes	Wanneroo / Swan / Joondalup (Wangara)
	Yes	Cleanaway (Albany, Bayswater, Mandurah)
	N	Roads and Robinson (Maddington)
	Yes	ATLAS (Mirrabooka)
	Yes	SMRC RRF (Canning Vale)
<b>MRFs - Regional</b>	Yes	Pilbara Recycling (Newman)
	N	Wickepin Recycling (Wickepin)
	Yes	Green Recycling (Bunbury)
	Yes	Kalgoorlie Boulder Recycling (Kalgoorlie)
	Yes	South-West Recycling (Bunbury)
	N	Dalwallinu Recycling (Dallwallinu)
<b>No Recycling in 05/06</b>		
Clothing		Herrington P&J

## 14. GLOSSARY

<b>Composting</b>	An organic product that has undergone controlled <b>aerobic</b> and thermophilic biological transformation to achieve pasteurisation and a specified level of maturity
<b>Commercial and Industrial (C&amp;I) Waste</b>	Solid waste arising from the activities within commercial and industrial sites, including but not limited to offices, retail outlets, restaurants, factories, and institutions. It does not include construction and demolition waste. Generally, businesses are expected to make their own arrangements for the collection, treatment and disposal of their wastes. Waste from smaller businesses where local government waste collection agreements are in place is treated as municipal solid waste.
<b>Class I landfill</b>	Inert landfill. Clean fill only (no putrescible)
<b>Class II / III landfill</b>	Clean fill and putrescible accepted (with conditions)
<b>Class IV</b>	Secure Landfill that can accept waste exhibiting certain criteria
<b>Class V</b>	Intractable waste which is a management problem by virtue of its toxicity or chemical or physical characteristics which make it difficult to dispose of
<b>Commercial Waste</b>	All material from business/commercial premises.
<b>Construction and Demolition (C&amp;D) Waste</b>	Solid waste that is created through activities associated with the construction, repair and demolition of buildings, structures and pavements or highways. Including, but not limited to sand, aggregates, plasterboard, asphalt, timber, bricks, concrete, tiles, roofing materials, electrical wiring and the packaging for these materials. This term does not include green waste arising from land clearance or material that is separated and can be used as clean fill.
<b>Controlled Waste Tracking System</b>	A system which information is collected about the transportation of certain controlled wastes (e.g. used oil and tyres).
<b>Drop off point</b>	Place where residents can bring waste from their household for disposal. This could include bulky products, garden trimmings, small scale demolition waste, and or dry recyclables.
<b>Floc</b>	Floc is the residue left after the desired material is extracted
<b>Green Organics</b>	Organic green and woody material from both public and private parks or garden areas. Green waste often includes grass clippings, tree limbs, vegetation trimmings and whole vegetation cleared for the purpose of residential development. It does not include processed wooden products such as furniture or pallets.
<b>Landfill Levy</b>	An extra charge imposed at landfill with an objective of reducing the amount of waste being sent to landfill. As of May 2007 \$6/tonne for municipal and \$3/m <sup>3</sup> for inert wastes.
<b>Landfill Site</b>	A licensed or registered facility for disposal of solid waste by burial.

<b>Mono-landfill</b>	A licenced landfill (or part of a landfill) which accepts only one type of waste. In terms of managing waste tyres, the specific feature that distinguishes monofills is that they may facilitate recovery of the tyres at a later date for processing using technologies not available at the present time or by exploiting new market opportunities.
<b>Municipal Solid Waste (MSW)</b>	(a) all kinds of rubbish, refuse, junk, garbage or scrap that originate from residential, commercial or institutional sources; and (b) discarded or abandoned materials, solid substances or objects that originate from residential, commercial or institutional sources; and (c) any other solid waste of a kind prescribed by the regulations for the purposes of this paragraph, but does not include sewage, problematic waste or waste of a kind prescribed by the regulations as excluded for the purposes of this definition.
<b>Paunch</b>	Forms the larger part of the reticulorumen, which is the first chamber in the alimentary canal of ruminant animals. It serves as the primary site for microbial fermentation of ingested feed.
<b>Putrescible</b>	Wastes that will decompose readily under microbial attack and include green waste, food waste, paper, biosolids, manures and sludges.
<b>Resource Recovery</b>	Changing waste into potentially useful products or utilities such as fuel for energy production through thermal, biological or mechanical means. This process minimises the amount of material for a mixed waste stream that is sent to landfill.
<b>Resource Recovery Rebate Scheme (RRRS)</b>	The Resource Recovery Rebate Scheme (RRRS) allows local governments and regional councils to claim a rebate for material they can demonstrate has been reused, recovered or recycled.
<b>Re-use</b>	To use a product again (whether for its original use or otherwise) without any physical 'reprocessing' rather than disposing to landfill. For example, this term applies to trading of second hand goods.

## 15. ACRONYMS

ABS	Australian Bureau of Statistics
C&D	Construction and Demolition
C&I	Commercial and Industrial
DEC	Department of Environment and Conservation
DoE	Department of Environment
MRF	Material Recovery Facility
MWAC	Municipal Waste Advisory Council
PACIA	Plastics and Chemicals Industries Association
RRRS	Resource Recovery Rebate Scheme

### Plastics

PET	Polyethylene Terephthalate
HDPE	High Density Polyethylene
PVC	Polyvinyl Chloride
LDPE	Low Density Polyethylene
PP	Polypropylene
PS	Polystyrene
EPS	Expanded Polystyrene
ABS	Acrylonitrile, Butadiene, and Styrene
SAN	Styrene Acrylonitrile

## 16. REFERENCES

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