



# REVIEW OF TOTAL RECYCLING ACTIVITY IN WESTERN AUSTRALIA

2006/07



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| Final                   | June 2008   | Robert Sim    |  | Bill Marchbank  |  |

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## EXECUTIVE SUMMARY

Cardno Pty Ltd (Cardno) has 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 2006/07 financial year.

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 69 recycling companies were identified for the study, of which 53 (82%) **submitted data**. Data was collected from written questionnaires, site visits, telephone interviews and published industry data.

During the 2006/07 financial year, Western Australia recycled in excess of 1.7 million tonnes of material. Based upon the information gathered by this survey **1,708,300 tonnes** was recycled in 2006/07 (a 6% increase over 2005/06 figures). This equates to 811kg per person based on a population of 2,105,800 people (Australian Bureau of Statistics (June qtr 2007)).

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

- The continued recovery of metals, which reported a 17% increase (72,440 tonnes) in recovered material (**Table E1**);
- Expansion of the construction and demolition recycling sector which reported a 11% increase (39,500 tonnes) in recovered material; and
- An increase in recycling activity across most sectors

**Table E1: Comparison between total recyclables recovered between 2004/05 and 2006/07 for each material type and % change between 2005/06 and 2006/07**

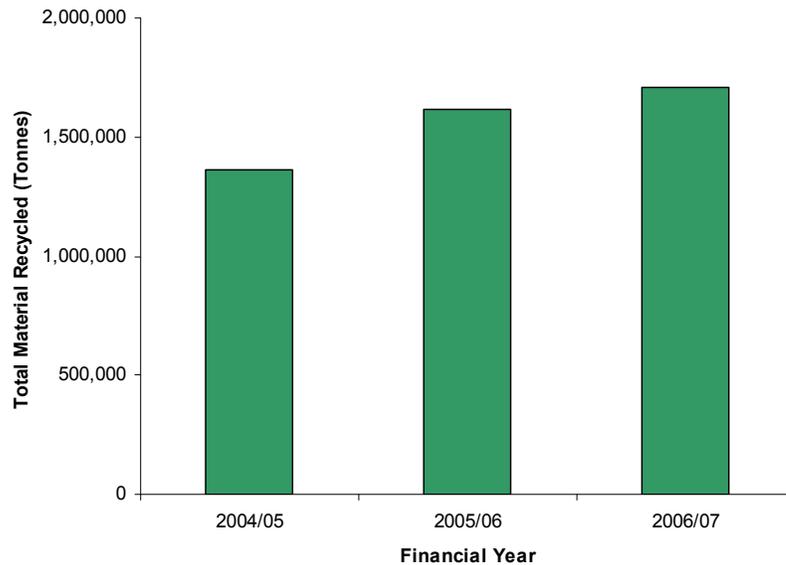
| Material Type | 2004/05          | 2005/06          | 2006/07          | % Change |
|---------------|------------------|------------------|------------------|----------|
| Organics      | 539,360          | 578,630          | 531,340          | -8       |
| Metal         | 276,500          | 428,860          | 501,300          | 17       |
| C&D           | 333,870          | 364,370          | 403,870          | 11       |
| Paper         | 185,820          | 207,690          | 225,760          | 9        |
| Glass         | 18,000           | 18,000           | 20,800           | 16       |
| Plastic       | 7,130            | 13,360           | 18,130           | 36       |
| Rubber        | 1,900            | 5,000            | 5,550            | 11       |
| Textiles      | 1,240            | 1,560            | 1,550            | -1       |
| <b>Total</b>  | <b>1,363,820</b> | <b>1,617,470</b> | <b>1,708,300</b> | <b>6</b> |

Note: Data from 2005/06 report has been amended to reflect more accurate tonnage recovery Controlled Waste Inventory data used for rubber industry in 2004/05

Whilst organics was recovered in the highest tonnage, there has been a marked decline in organics recycling of approximately 8% since 2005/06.

**Figure E1** outlines the growth trend in terms of total recycling activity in Western Australia.

**Figure E1: Total Recycling Activity in Western Australia between 2004/05 and 2006/07**

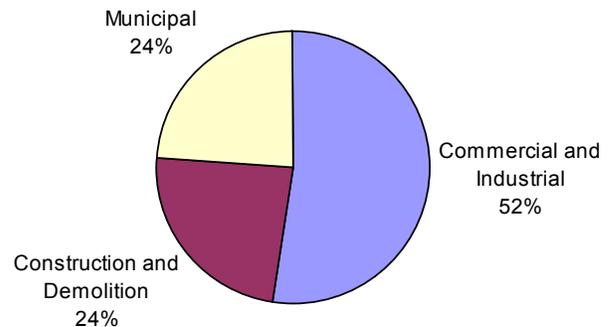


**Source Sector**

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. A number of assumptions have been made in relation to what areas/sectors make up these source sectors. This is explained further in the report (**Section 2.2**). Total tonnages for the source sectors are outlined in **Table E2** and **Figure E2**.

**Table E2 and Figure E2: Total recyclables recovered (tonnes) and percentage from each source sector 2006/07**

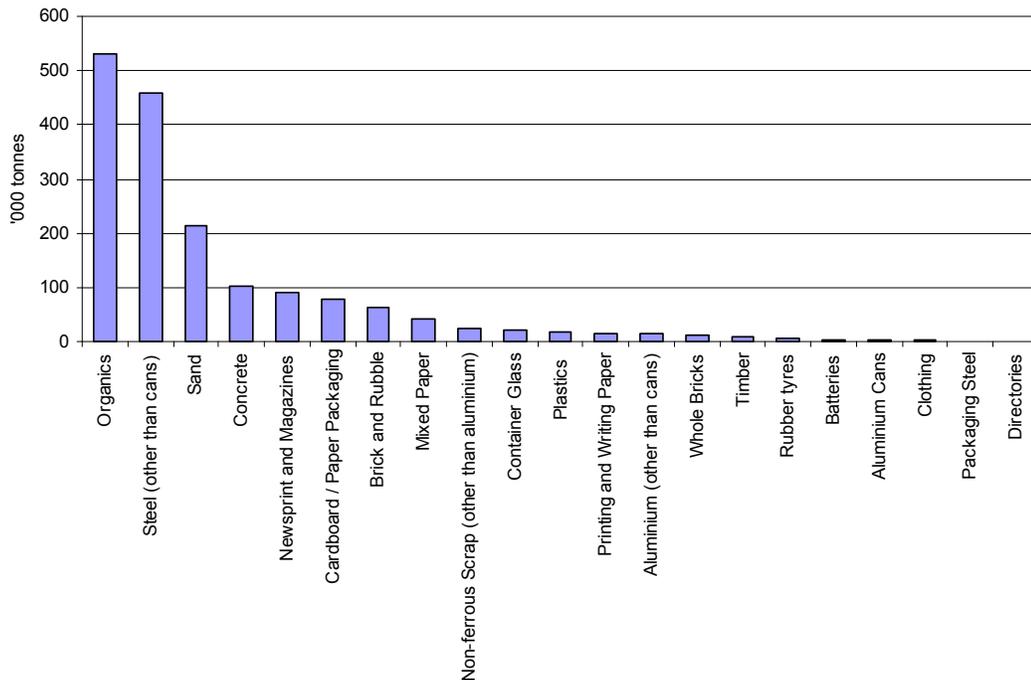
| Source Sector               | Tonnes           |
|-----------------------------|------------------|
| Commercial and Industrial   | 890,560          |
| Construction and Demolition | 409,350          |
| Municipal                   | 408,390          |
| <b>Total</b>                | <b>1,708,300</b> |



**Material Types**

Organics continued to make up the highest contribution to total recycling activity (531,340 tonnes) despite recording a decline in recycling activity during 2006/07. Other materials that contributed significantly to the overall recycling for Western Australia (quantities greater than 50,000 tonnes) were steel, sand, concrete, newspaper / magazines, cardboard / paper packaging and brick and rubble (**Figure E3**). As seen in 2005/06, steel (non-packaging) and sand showed the largest increases for a single category with a 64,270 tonne and 31,440 tonne increase respectively in 2006/07.

**Figure E3: Total tonnes recycled by material or product 2006/07**



**Reprocessing Destination**

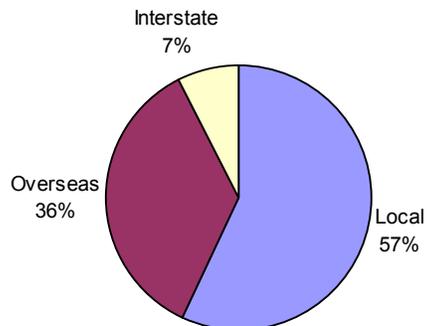
The local reprocessing sector continues to be the largest destination for recycled material (57% by weight), however during 2006/07 there was a marked decline in local reprocessing activity of 14% compared to 2005/06 (**Table E3** and **Figure E4**). This can be attributed to a decline in organics recovery, the large increase in scrap metal exports and the closure of the AMCOR paper mill. Due to the low value of organics and C&D material (when compared to other recyclables) and strong local demand, these materials continue to be utilised in the local market.

Due to the relatively small local manufacturing industry in Western Australia, approximately 36% of recycled material (predominantly metal, paper and plastic) is sent to Asian markets for reprocessing. Demand is currently very strong for raw materials to supply manufacturing industries, especially in China.

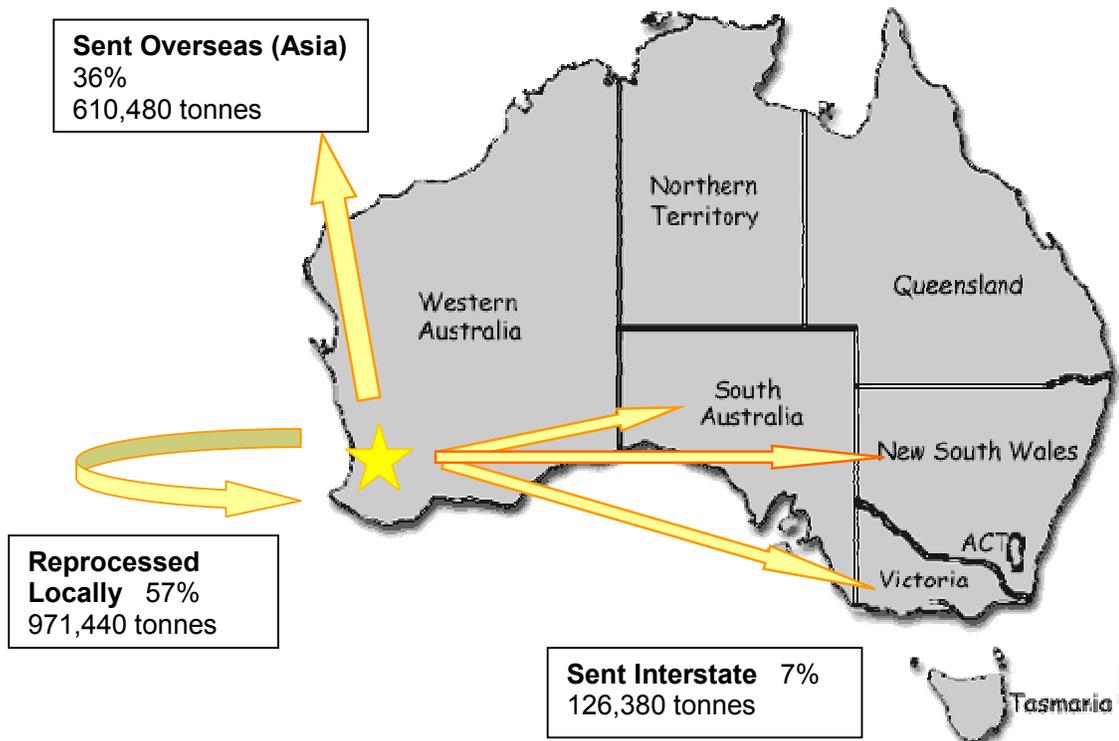
Approximately 7% of recovered material (a 4% increase from 2006/07) is now sent to the Eastern States for reprocessing. This can be attributed to the minimal local markets for recycled glass and an increased flow of Western Australian recycled paper to pulp mills in the Eastern States as a result of the closure of the AMCOR paper mill (**Figure E5**).

**Table E3 and Figure E4: Reprocessing location of Western Australia’s recyclables 2006/07**

| Destination  | Tonnes           |
|--------------|------------------|
| Local        | 971,440          |
| Overseas     | 610,480          |
| Interstate   | 126,380          |
| <b>Total</b> | <b>1,708,300</b> |



**Figure E4: Reprocessing destinations and associated tonnages of recovered materials 2006/07**



Excluding C&D and organics from local reprocessing activity, only 5% of recovered material is now reprocessed locally in Western Australia.

### **Barriers and Conclusion**

For this year's recycling review, recycling operators ranked barriers (previously identified by recyclers in the 05/06 review) that limit the amount of material being recycled or reprocessed by their organisation. Recyclers also ranked opportunities for further recycling of material in their respective recycling sector. The strength of barriers and opportunities varied between recycling sectors. Large barriers to further recycling for individual recycling companies (in no particular order) are listed below.

- Construction and Demolition
  - Low landfill gates fees restricting supply;
  - A clean supply shortage;
  - Non-compliant operators; and
  - An uneducated marketplace
- Metal recyclers
  - Competition;
  - Metal recyclers paying landfill levies;
  - Labour costs and shortage;
  - Transport costs; and
  - Recycling culture of government and industry
- Paper recyclers
  - Competition;
  - Labour costs and shortage;
  - Lack of government assistance; and

- Recycling culture of government and industry
- Plastic recyclers
  - Lack of government assistance;
  - Recycling culture of government and industry;
  - Limited space;
  - Labour costs and shortage; and
  - Transport costs
- Rubber recycling
  - Competition;
  - Labour costs and shortage;
  - Transport costs;
  - Low landfill levies in WA;
  - Local government restrictions;
  - Lack of government assistance; and
  - Market value of rubber
- Textiles
  - Labour costs and shortage;
  - Transport costs;
  - Lack of government assistance; and
  - Councils removing collections bins
- Organics
  - Site regulations;
  - Inadequate / not enforced regulation of competing products;
  - Raw material contamination;
  - Development of markets;
  - Financial incentives for growers; and
  - Oversupply of organics creating downward pressure of prices
  - Uncompetitive /non-commercial competition in service delivery from local govt facilities, driving price/quality down
- Material Recovery Facilities
  - Labour costs and shortage;
  - Transport costs;
  - Lack of government assistance;
  - Market value of recovered materials; and
  - Recycling culture of government and industry

Opportunities outlined by the recycling industry indicate that greater support from government, community and industry waste education programs and transport subsidies to remote locations would help increase the amount of material being recovered in Western Australia.

Unfortunately, accurate data about the quantity of each material stream landfilled in Western Australia is not available (with possibly now the exception of municipal waste through DEC's Zero Waste Plan Development Scheme. 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 DEC that mechanisms for better collection of landfill data will become available for the 2007/08 review. 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*'.

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## 1. INTRODUCTION

### 1.1 Strategic Context

Waste reduction is a key focus of the State and Local Governments in Western Australia. A number of policy documents relating to waste management have been published by the Department of Environment with the aim of reducing the amount of waste going to landfill by maximising waste recycling, reuse and recovery.

Key documents include the *Waste 2020* strategy and a *Strategic Direction for Waste Management in Western Australia*. Both of these documents outline the importance of waste reduction and 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.

Since the baseline of recycling activity in Western Australia was set in 2004/05, the Department of Environment and Conservation (DEC) has been eager to present recycling activity on an annual basis to assess any growth or decline in performance for particular waste streams.

### 1.2 Background

Cardno Pty Ltd (Cardno) has 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 2006/07 financial year. The format of the report is similar to previous reports 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. An exception is the Material Recovery Facility (MRF) sector which has been included in this year's report.

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

| Recycling Sector                             | Type                         |
|--|------------------------------|
| <b>Construction and Demolition (C&amp;D)</b> | Brick (whole)                |
|  | Bricks and Rubble            |
|  | Concrete                     |
|  | Sand                         |
|  | Timber                       |
| <b>Metal (including C&amp;D metals)</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               |
| <b>Material Recovery Facilities (MRF's)</b>  | Total Tonnages               |
|  | Contamination Rate           |
|  | Average Gate Fee             |
|  | Households Covered by System |

The analysis includes the following:

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

As part of the State's obligations as a signatory to the National Packaging Covenant, for this year's review additional information has been collected from both private Material Recovery Facility (MRF) operators and Local Government if the Local Government operates a MRF or Resource Recovery Facility (RRF). This information is required by

recycling organisations under the '*Environmental Protection (NEPM-UPM) Regulations 2007*'.

The following information was collected:

- The percentage of premises covered by the system and the number of premises participating in the system (including a breakdown of whether premises are residential or non-residential);
- The fee (if any) charged in relation to each premise for the system;
- The total weight of recyclable material collected by the system by material type and, if the material is then sorted,
  - The total weight of each material type sold or sent for reuse, recycling or energy recovery, and;
  - The total weight of the residual fraction of each material type then disposed to landfill.

In total 65 recycling companies were identified for the study (four companies have subsequently closed down in the past financial year). 53 companies or **82% of recycling companies submitted data**. 95% of companies that submitted data in last year's report have been included in this year's report. Data was collected from written questionnaires, site visits, telephone interviews and published industry data. A number of recycling companies were omitted from this year's survey due to their operations sending material directly to larger recycling companies for reprocessing or distribution (e.g. Pilbara Recycling sends material to AMCOR, VISY and Smorgon Steel in Perth).

As 12 companies did not submit data, the total tonnage reported in this review is less than the actual tonnage recycled; however the companies that did not submit data were of a relatively small size and therefore would not have affected the results significantly. Cardno is confident that due to the high participation rate and integrity of the data, the totals in this report are  $\pm 10\%$  of the actual reprocessed tonnages for Western Australia.

To obtain data, a written questionnaire was posted, emailed or faxed to each of the identified recyclers in W.A. Follow-up telephone calls were made to ensure the highest possible response rate was achieved. A number of key recyclers from recycling sectors 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 Plastics and Chemicals Industry Association (PACIA) and Compost Australia 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 2006/07 financial year, Western Australia recycled in excess of 1.7 million tonnes of material. Based upon the information gathered by this survey **1,708,300 tonnes** was recycled in 2006/07. This equates to 811kg per person per year based on a population of 2,105,800 people (ABS (June qtr 2007)).

As outlined in **Table 2.1** and **Figure 2.1**, organics has continued to account for the highest tonnage of recovered material at 531,340 tonnes. Metal (501,300 tonnes), C&D material (403,870 tonnes) and paper (225,760 tonnes) were also recovered in high tonnages. Whilst organics was recovered in the highest tonnage, there has been a notable decline in organics recycling of approximately 8% since the previous financial year. It is difficult to determine the reason for the decline as there are a number of different organic sectors with different circumstances in terms of ability to recycle organics.

All other sectors (with the exception of textiles) have also reported an increase in tonnages since 2005/06. The largest increase by percentage has been from the plastics recycling industry with an approximate increase of 36%. Metals, C&D, glass and rubber have also experienced an increase in excess of 10% during 2006/07.

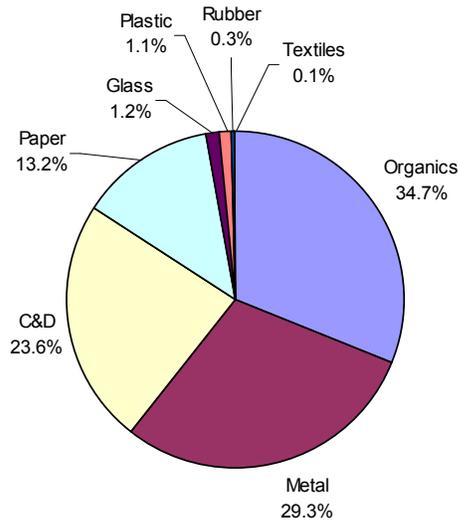
**Table 2.1: Total tonnage of material recycled from each recycling sector between 2004/05 and 2006/07 and percentage increase since 2005/06**

| Material Type | 2004/05          | 2005/06          | 2006/07          | % Change |
|---------------|------------------|------------------|------------------|----------|
| Organics      | 539,360          | 578,630          | 531,340          | -8       |
| Metal         | 276,500          | 428,860          | 501,300          | 17       |
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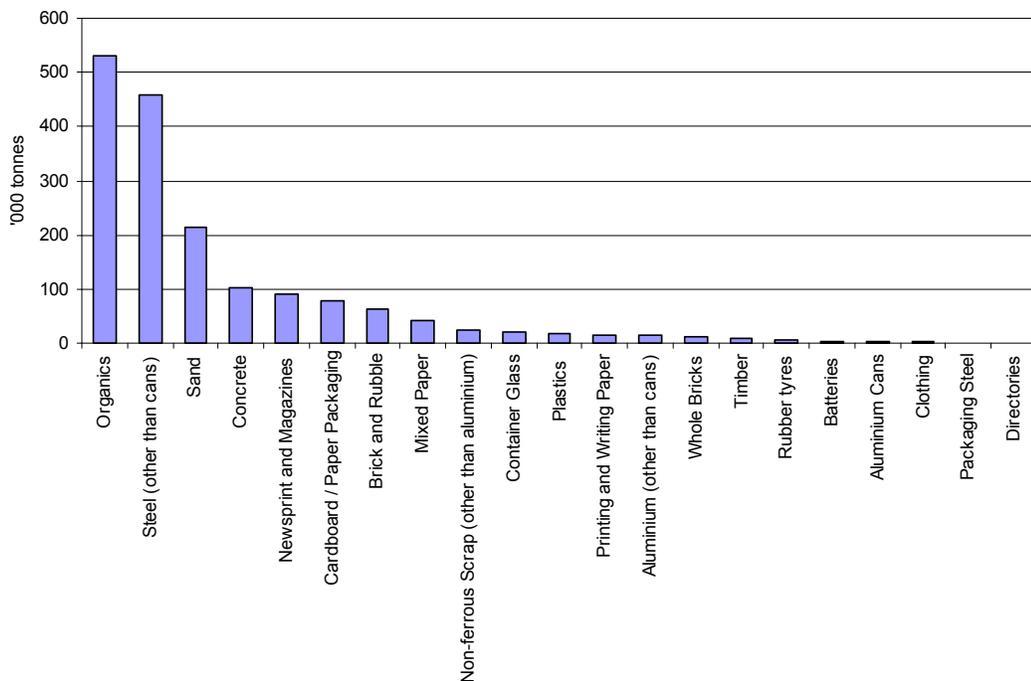
Percentage composition of materials is outlined in **Figure 2.1**. Composition has remained relatively unchanged from 2005/06 with the exception of organics, whilst metals and paper has increased its overall share. Organics, metal, C&D and paper continue to dominate the proportion of recycling activity in Western Australia.

**Figure 2.1: Percentage composition of materials recycled in Western Australia for 2006/07**



**Figure 2.2** shows the tonnages of each material type recovered in Western Australia during 2006/07. The recycled organics category had the highest recovery at 578,630 tonnes. Steel (other than cans), sand, concrete, newsprint and magazines, cardboard and paper packaging and brick and rubble were all recycled in large quantities (i.e. in excess of 50,000 tonnes). Steel (other than cans) and sand continued to show the strongest growth in recycling activity with increases of 64,270 and 31,440 tonnes respectively. Other material experiencing high growth include concrete / bitumen (13,220 tonne increase), non-ferrous metal (other than aluminium) (11,650 increase) and mixed paper (28,730 tonne increase). As outlined in **Section 5** the increase in mixed paper is a result of other paper products being categorised as mixed paper instead of their individual paper type (e.g printing paper, and newspaper).

**Figure 2.2: Total tonnes recycled by material or product 2006/07**



## 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 questionnaire provided to recyclers requested tonnages that were sourced from specific source areas. For the purposes of this study source areas have been designated certain source sectors (i.e. C&D, C&I or municipal).

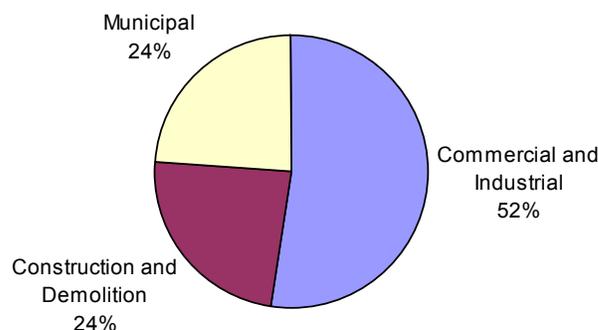
**Table 2.2: Assumptions made in relation source sector**

| Material Type | Source Sector   |                      |                              |
|---------------|---|----------------------|------------------------------|
|               | C&I   | C&D                  | Municipal                    |
| C&D           | Government Bodies   | Commercial Operators | Municipal<br>Public Drop-Off |
| Metal         | Engineering<br>Scrap Metal Recyclers<br>Automotive<br>Mining  | C&D                  | Municipal<br>Public Drop-Off |
| Paper         | Charities, Schools  | C&D                  | Municipal                    |
| Glass         | Commercial Operators  | Commercial Operators | Municipal                    |
| Plastic       | N/A (PACIA Report)  |                      |                              |
| Rubber        | Tyre Retailers<br>Tyre Collectors<br>Mining   |                      |                              |
| Textiles      | Commercial Operators  |                      | Charity Outlets              |
| Organics      | Compost Australia data<br>(garden + MSW) minus<br>municipal ZWPDS<br>Phase 1 data plus<br>other Compost<br>Australia categories |                      | ZWPDS Phase 1<br>Data (DEC)  |

The C&I sector was the highest contributor (by weight) to Western Australia's total recycling tonnage in 2006/07 with approximately 890,560 tonnes (52%) of material being recovered (**Table 2.3 / Figure 2.3**). Material was also recovered in high tonnages from the C&D and municipal sectors with 409,350 tonnes and 408,390 tonnes recovered respectively. The high recovery weight from the C&I sector can be attributed to the high tonnages recovered from metal and organics industries. There is a relatively low recovery (by weight) in Western Australia from the C&D sector. Eastern States recycling reports generally indicate that around 50% of their recyclables are recovered from the C&D sector. Higher C&D recycling activity in the Eastern States inflates their recycling total considerably.

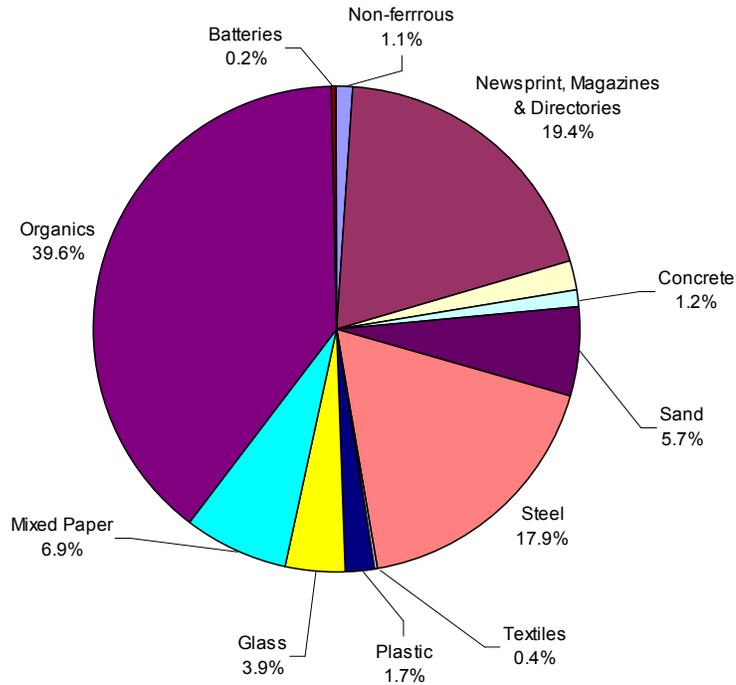
**Table 2.3 and Figure 2.3: Source of material (tonnes) that was recycled in 2006/07 and its associated percentage**

| Source Sector               | Tonnes           |
|-----------------------------|------------------|
| Commercial and Industrial   | 890,560          |
| Construction and Demolition | 409,350          |
| Municipal                   | 408,390          |
| <b>Total</b>                | <b>1,708,300</b> |

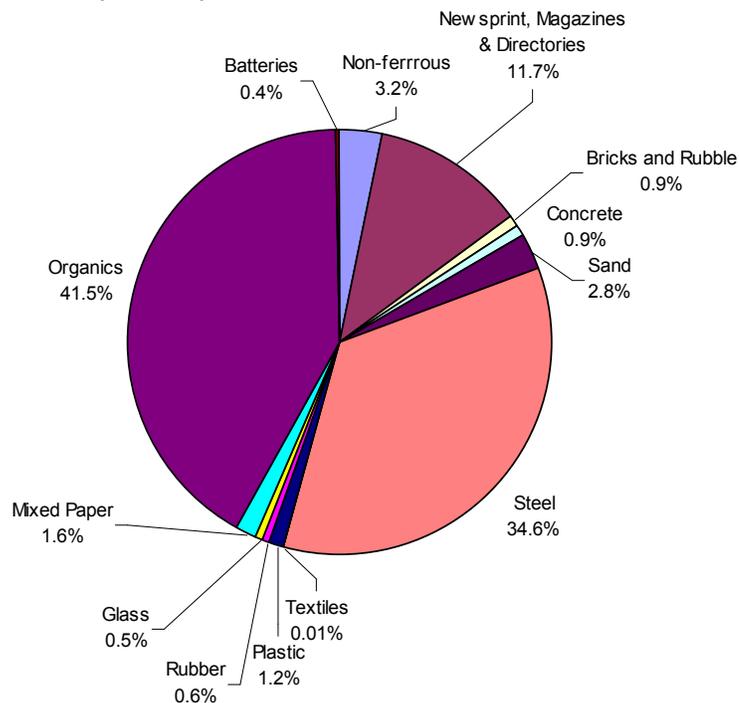


The recyclables recovered from each source sector and their associated percentage is shown in **Figures 2.4, 2.5 and 2.6.**

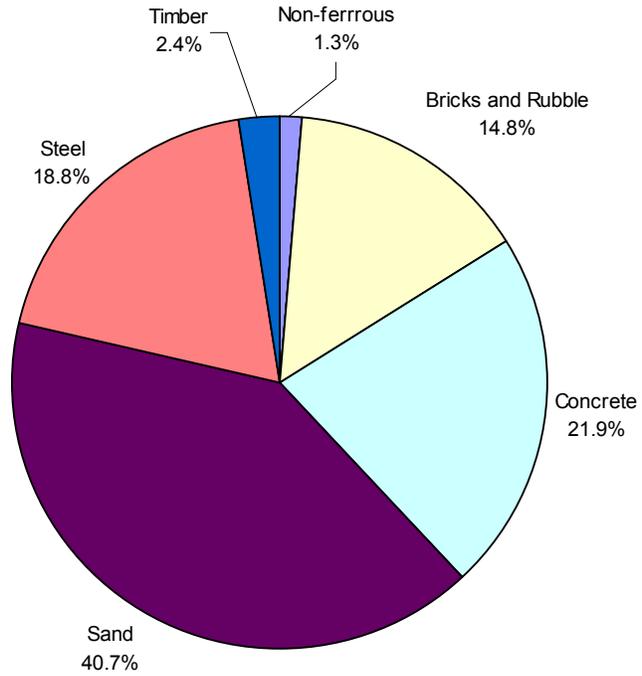
**Figure 2.4: Composition of material recovered for reprocessing from the municipal sector (2006/07)**



**Figure 2.5: Composition of material recovered for reprocessing from the commercial and industrial sector (2006/07)**



**Figure 2.6: Composition of material recovered for reprocessing from the construction and demolition sector (2006/07)**



## 2.3 Destination of Recovered Material

The materials recovered in Western Australia are reprocessed at local, national and international facilities (Table 2.4 and Figure 2.7).

The local reprocessing sector continues to be the largest destination for recycled material (57% by weight), however during 2006/07 there was a marked decline in local reprocessing activity of 14% compared to 2005/06. This can be attributed to a decline in organics recovery, the large increase in scrap metal exports and the closure of the AMCOR paper mill in 2006. Due to the low value of organics and C&D material (when compared to other recyclables) and strong local demand, these materials are utilised in the local market.

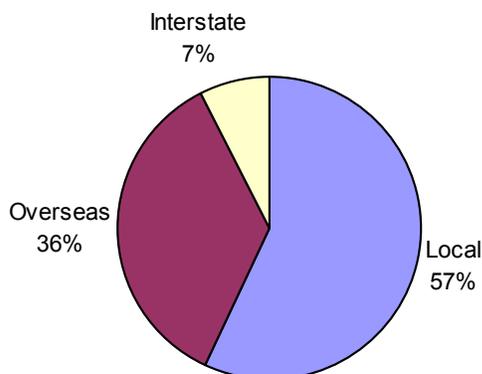
As a result of the relatively small local manufacturing industry in Western Australia, approximately 36% of recycled material (predominantly metal, paper and plastic) is sent to Asian markets for reprocessing. Demand is currently very strong for raw materials to feed manufacturing industries, particularly in China.

Approximately 7% of recovered material is sent to the Eastern States for reprocessing. All glass recovered is currently sent to South Australia for reprocessing. There has also been a large increase in the flow of Western Australian recycled paper to pulp mills in the Eastern States since the closure of the AMCOR paper mill.

**Table 2.4: Destination of materials recovered by weight (tonnes) for reprocessing, Western Australia 2006/07**

| Material     | Destination    |           |                |          |                |           | Total            |
|--------------|----------------|-----------|----------------|----------|----------------|-----------|------------------|
|              | Local          | %         | Interstate     | %        | Overseas       | %         |                  |
| C&D          | 403,870        | 100       | 0              | 0        | 0              | 0         | 403,870          |
| Metal        | 16,620         | 3         | 7,760          | 2        | 476,920        | 95        | 501,300          |
| Paper        | 3,200          | 1         | 94,900         | 42       | 127,660        | 57        | 225,760          |
| Organics     | 531,340        | 100       | 0              | 0        | 0              | 0         | 531,340          |
| Glass        | 0              | 0         | 20,800         | 100      | 0              | 0         | 20,800           |
| Plastic      | 9,310          | 51        | 2,920          | 16       | 5,900          | 33        | 18,130           |
| Rubber       | 5,550          | 100       | 0              | 0        | 0              | 0         | 5,550            |
| Textiles     | 1,550          | 100       | 0              | 0        | 0              | 0         | 1,550            |
| <b>Total</b> | <b>971,440</b> | <b>57</b> | <b>126,380</b> | <b>7</b> | <b>610,480</b> | <b>36</b> | <b>1,708,300</b> |

**Figure 2.7: Destination of materials for reprocessing, Western Australia 2006/07**



Excluding C&D and organics from local reprocessing activity, only 5% of recovered material is now reprocessed locally in Western Australia. 79% of materials are exported internationally and 16% are sent to the Eastern States for reprocessing.

**Table 2.5: Breakdown of recovered material (tonnes) and destination for reprocessing in 2006/07.**

| Material                            | Destination    |                |                | Total Recovery<br>(2006/07) | Previous Year<br>(2005/06) |
|-------------------------------------|----------------|----------------|----------------|-----------------------------|----------------------------|
|                                     | Local          | Interstate     | Overseas       |                             |                            |
| (Tonnes)                            |                |                |                |                             |                            |
| <b>Construction and Demolition</b>  |                |                |                |                             |                            |
| Sand                                | 214,720        | 0              | 0              | 214,720                     | 183,280                    |
| Brick and Rubble                    | 64,770         | 0              | 0              | 64,770                      | 71,020                     |
| Concrete / Bitumen                  | 102,260        | 0              | 0              | 102,260                     | 89,040                     |
| Bricks (Whole)                      | 12,120         | 0              | 0              | 12,120                      | 10,860                     |
| Timber                              | 10,000         | 0              | 0              | 10,000                      | 10,170                     |
| <b>Total C&amp;D</b>                | <b>403,870</b> | <b>0</b>       | <b>0</b>       | <b>403,870</b>              | <b>364,370</b>             |
| <b>Metal</b>                        |                |                |                |                             |                            |
| Aluminium                           | 0              | 850            | 13,060         | 13,910                      | 13,270                     |
| Aluminium Cans                      | 0              | 200            | 1,500          | 1,700                       | 1,390                      |
| Batteries                           | 0              | 4,300          | 0              | 4,300                       | 5,300                      |
| Non Ferrous (Other than Al)         | 6,570          | 2,410          | 13,950         | 22,930                      | 11,280                     |
| Steel (non packaging)               | 10,050         | 0              | 447,410        | 457,460                     | 393,190                    |
| Steel (packaging)                   | 0              | 0              | 1,000          | 1,000                       | 3,430                      |
| <b>Total Metal</b>                  | <b>16,620</b>  | <b>7,760</b>   | <b>476,920</b> | <b>501,300</b>              | <b>427,860</b>             |
| <b>Paper</b>                        |                |                |                |                             |                            |
| Newsprint & Magazines               | 3,200          | 26,500         | 61,310         | 91,010                      | 86,470                     |
| Cardboard / paper packaging         | 0              | 39,500         | 38,060         | 77,560                      | 94,460                     |
| Mixed Paper                         | 0              | 19,400         | 23,370         | 42,770                      | 14,040                     |
| Printing & writing paper            | 0              | 9,500          | 4,700          | 14,200                      | 12,500                     |
| Directories                         | 0              | 0              | 220            | 220                         | 220                        |
| <b>Total Paper</b>                  | <b>3,200</b>   | <b>94,900</b>  | <b>127,660</b> | <b>225,760</b>              | <b>207,690</b>             |
| <b>Organics (Compost Australia)</b> |                |                |                |                             |                            |
| All Organics                        | 531,340        | 0              | 0              | 531,340                     | 578,630                    |
| <b>Total Organics</b>               | <b>531,340</b> | <b>0</b>       | <b>0</b>       | <b>531,340</b>              | <b>578,630</b>             |
| <b>Glass (ACI)</b>                  |                |                |                |                             |                            |
| Container Glass                     | 0              | 20,800         | 0              | 20,800                      | 18,000                     |
| <b>Total Glass</b>                  | <b>0</b>       | <b>20,800</b>  | <b>0</b>       | <b>20,800</b>               | <b>18,000</b>              |
| <b>Plastic (PACIA)</b>              |                |                |                |                             |                            |
| Domestic Packaging                  | n.a            | n.a            | n.a            | 13,970                      | 10,320                     |
| Industrial Packaging                | n.a            | n.a            | n.a            |                             |                            |
| Non-packaging                       | n.a            | n.a            | n.a            | 4,160                       | 3,040                      |
| <b>Total Plastic</b>                | <b>9,310</b>   | <b>2,920</b>   | <b>5,900</b>   | <b>18,130</b>               | <b>13,360</b>              |
| <b>Rubber</b>                       |                |                |                |                             |                            |
| Rubber Tyres                        | 5,550          | 0              | 0              | 5,550                       | 5,000                      |
| <b>Total Rubber</b>                 | <b>5,550</b>   | <b>0</b>       | <b>0</b>       | <b>5,550</b>                | <b>5,000</b>               |
| <b>Textiles</b>                     |                |                |                |                             |                            |
| Clothing                            | 1,550          |                |                | 1,550                       | 1,560                      |
| <b>Total Textiles</b>               | <b>1,550</b>   | <b>0</b>       | <b>0</b>       | <b>1,550</b>                | <b>1,560</b>               |
| <b>TOTAL ALL MATERIALS</b>          | <b>971,440</b> | <b>126,380</b> | <b>610,480</b> | <b>1,708,300</b>            | <b>1,616,470</b>           |
|                                     |                |                |                | 2006/07                     | 2005/06                    |

Please take care in the interpretation of this data.

Data submitted by industry can vary to an extent each financial year due to information required by the DEC being inconsistent with the recycling company's material classification databases. This can result in some recycling companies making estimates in regards to certain material type recycling.

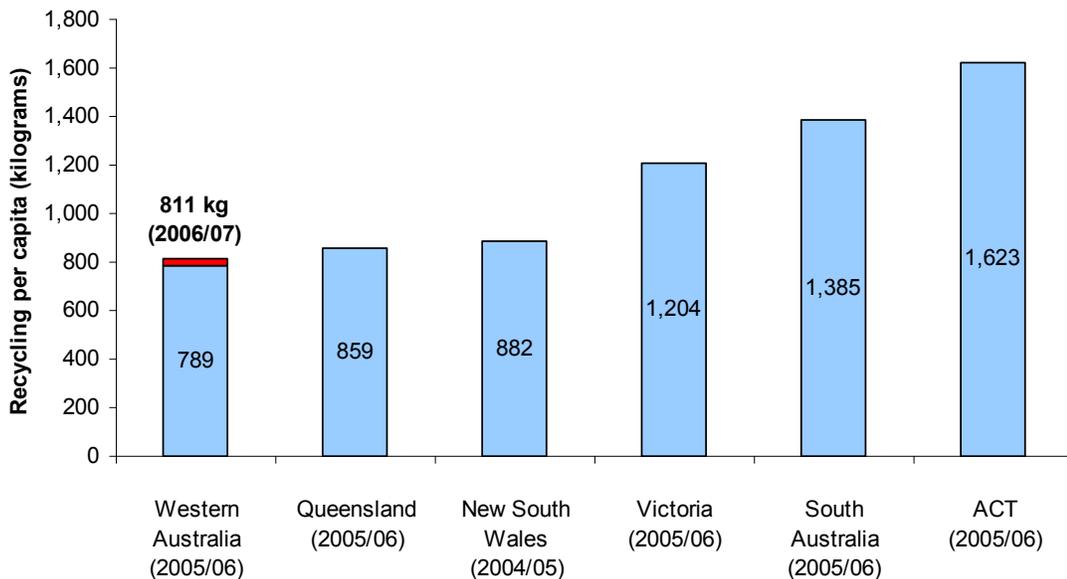
## 2.4 Benchmarking of Recycling Activity

Based on 2006/07 recycling performance figures, the average Western Australian annually recycles approximately 811kg of material. This is an increase of approximately 23kg per person compared to 2005/06 figures. This increase can be largely attributed to increased recycling activity in the C&D and metal recycling industries during 2006/07. The result would have been higher if not for the decline in organics recycling by approximately 47,290 tonnes.

When benchmarked against other states (New South Wales, Queensland, Victoria, South Australia and ACT), Western Australia can be considered to have the lowest recycling activity per capita (**Figure 2.8**). As outlined last year the relatively lower yields of the Western Australian recycling sector may be a result of a number of reasons including the small manufacturing sector, high number of strategically placed putrescible and inert landfills, low landfill gate fees, sparse population, relatively underdeveloped C&D recycling sector, long distance to markets and the poor education amongst government and the commercial sector compared to the Eastern States.

The ACT, South Australia and Victoria are the recycling leaders at present in Australia. Whilst these figures show Western Australia is improving its recycling activity for all material types, much more effort is required.

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



**Note:**

Source: State Annual Recycling Reports (QLD, VIC, SA, ACT), Department of Environment and Conservation (NSW)

Year - NSW - only 2004/05 available  
- QLD, VIC, SA and ACT – only 2005/06 available

Population - WA, QLD, VIC, SA and ACT (2005/06) - June 2006 quarter (ABS)  
- NSW (2004/05) – June 2005 quarter (ABS)  
- WA (2006/07) – June 2007 quarter (ABS)

Omitted - Fly Ash / Foundry sands from SA total, Used Oils, Salvage/Reuse, Motor Oil and “Other” 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 yard (see **Photo 3.1**). 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 screened to remove undesired materials. 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 scrap metal dealers.

In June 2006, Midland Brick announced a brick recycling initiative aimed at reducing the amount of material being sent to landfill. Midland Brick in association with Pindan Construction formed a partnership that would see all waste bricks from a number of Pindan construction sites be returned to Midland Brick for recycling. Midland Brick has also set up recycle centres at a number of their yards throughout the metropolitan area (Cannington, Jandakot, Joondalup, Osborne Park and Middle Swan) that can be used by the general public for brick disposal. Commercial loads can be disposed at the Middle Swan yard. Plastic strapping from the brick and paver packs can also be recycled.

Another recent success story is the opening of the Eastern Metropolitan Regional Council's (EMRC) Hazelmere Recycling Facility in March 2008. This facility recovers and processes industrial timber into woodchip that can be utilised by the Laminex group in the manufacture of particleboard. It is projected by the EMRC that approximately 10,000 – 15,000 tonnes of waste timber will be processed annually, increasing to 50,000 tonnes within three years. Examples of timber that can be recovered include pallets, wooden boxes and crates. These totals will be included in the 2007/08 report.

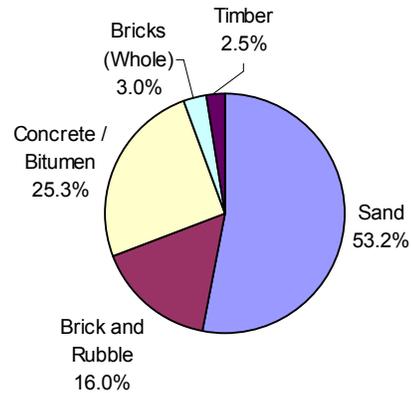
#### 3.2 Total Recovery of C&D

Approximately 403,870 tonnes of C&D material was recovered from the waste stream in 2006/07 (**Table 3.1**). The majority of material recovered in the C&D sector (53% or 214,720 tonnes) was sand (**Figure 3.1**). This is followed by concrete / bitumen (25% or 102,260 tonnes and brick / rubble (16% or 64,770 tonnes). As Laminex did not respond to this year's survey it has been assumed that timber recycling has remained static at approximately 10,000 tonnes.

For the purposes of this study Cardno have targeted companies that are producing value adding products (Roadbase, quality fill ect). A number of demolition companies in the Perth Metropolitan area are now crushing material and marketing the product for free to simply escape landfill costs. If these companies were included, overall C&D recycling totals may be much higher. For future reviews, a determination should be made by the DEC in regards to the inclusion of these companies.

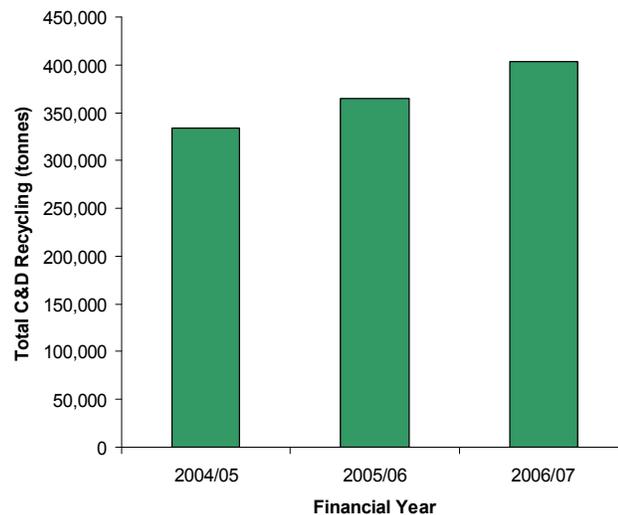
**Table 3.1 / Figure 3.1: Breakdown of C&D tonnages recovered and their proportions in the C&D waste stream.**

| C&D Material       | Tonnes         |
|--------------------|----------------|
| Sand               | 214,720        |
| Brick and Rubble   | 64,770         |
| Concrete / Bitumen | 102,260        |
| Bricks (Whole)     | 12,120         |
| Timber             | 10,000         |
| <b>Total</b>       | <b>403,870</b> |



When compared to the previous financial year, there has been a significant increase in total recovery of C&D material of approximately 39,500 tonnes. C&D recycling activity has shown steady growth since the first survey was conducted in 2004/05 (Figure 3.2).

**Figure 3.2: Trends in total C&D recycling activity in Western Australia by weight (tonnes)**

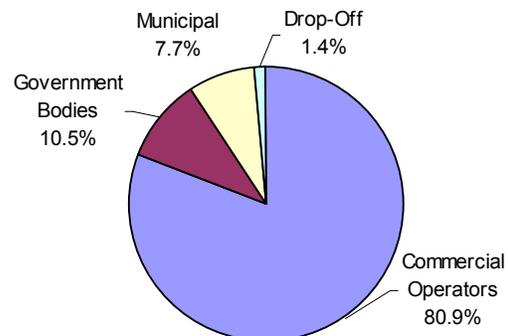


### 3.3 Source Sector of Recovered C&D Material

The majority of recovered C&D material was sourced from the commercial sector (326,930 tonnes or 81%) in 2006/07. Government bodies are the next largest source of recovered C&D material (40,360 tonnes or 11%) (Table 3.2 / Figure 3.2).

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

| Source Sector        | Tonnes         |
|----------------------|----------------|
| Commercial Operators | 326,930        |
| Government Bodies    | 40,360         |
| Municipal            | 31,080         |
| Drop-Off             | 5,500          |
| <b>Total</b>         | <b>403,870</b> |



### 3.4 Destination of Recovered C&D Material

All recovered C&D material is reprocessed in Western Australia, with the exception of recovered metals which are sold to scrap metal dealers (**Section 4**). All reprocessed material is sold within Western Australia for use in the construction industry. **Figure 3.3** outlines the flow of recovered C&D material from its source sector through to the reprocessor.

The main markets for recovered C&D products are for subbase, roadbase, hardstands, drainage aggregate and fill, where the reprocessed material competes directly with virgin aggregates. Waste bricks can be crushed and refired to produce new bricks.

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

Barriers and their associated rank outlined by C&D recyclers which limit the amount of material being reprocessed are outlined in **Table 3.3**. As businesses operate under different circumstances, barriers to further recycling can vary. Therefore, an average rank has been set.

**Table 3.3: Barriers and rank outlined by the C&D recycling industry**

| BARRIER                                  | Very Low | Low | Medium | High | Very High |
|--|----------|-----|--------|------|-----------|
| Limited space                            |          |     |        |      |           |
| Contamination                            |          |     |        |      |           |
| Competition                              |          |     |        |      |           |
| Low landfill gate fees in WA             |          |     |        |      |           |
| Your organisation paying landfill levies |          |     |        |      |           |
| Labour shortage                          |          |     |        |      |           |
| Local government restrictions            |          |     |        |      |           |
| Transport costs                          |          |     |        |      |           |
| Lack of government assistance            |          |     |        |      |           |
| Supply shortage                          |          |     |        |      |           |
| Lack of markets                          |          |     |        |      |           |
| Uneducated marketplace                   |          |     |        |      |           |
| Running costs                            |          |     |        |      |           |
| Limited DEC policing at landfills        |          |     |        |      |           |
| Close proximity of virgin quarries       |          |     |        |      |           |
| Non-compliant operators                  |          |     |        |      |           |
| DEC licence conditions                   |          |     |        |      |           |
| DEC material testing regimes             |          |     |        |      |           |

\* Contamination is ranked as 'low' as a number of recyclers' source clean material from their vertically integrated operations. The majority of C&D loads generated are mixed / contaminated and are sent directly to landfill.

Key barriers outlined by the C&D recycling industry as inhibiting further growth include low landfill gate fees in WA, a shortage of supply, an uneducated marketplace and non-compliant operators currently in operation in Western Australia. Interestingly markets for recycled material were listed as being a 'low' barrier for increased recycling. Demand for building product material, including recycled building products in the Perth metropolitan area is currently very high, with many recycling companies being unable to meet demand due to a shortage of supply. This can mainly be attributed to the low landfill gate fees in the Perth metropolitan region diverting potentially recyclable material to landfill and an uneducated marketplace.

Feedback from C&D recyclers has suggested that the information requested by the DEC is inconsistent with their database systems, which makes it difficult to submit accurate figures. Most C&D recyclers record input as 'grades' (clean load, mixed load ect) and then market

material as product type such as roadbase, drain aggregates. Therefore not concentrating greatly on exact types of materials (e.g. concrete, bitumen, brick) being recycled. As such, care should be taken in the interpretation of the data.

Potential opportunities for further increases in C&D recycling activity in Western Australia ranked by C&D recyclers is outlined in **Table 3.4**. Opportunities outlined in italics are additional barriers identified by C&D recyclers.

**Table 3.4: Opportunities and rank outlined by the C&D recycling industry**

| OPPORTUNITY  | Very Low         | Low | Medium | High | Very High |
|--|------------------|-----|--------|------|-----------|
| Continual increase of landfill levy                              |                  |     |        |      |           |
| Support of companies that separate waste streams                 |                  |     |        |      |           |
| JVs with major manufacturing companies similar to eastern states |                  |     |        |      |           |
| Allocated zones for C&D recyclers                                |                  |     |        |      |           |
| Compulsory submission of waste management plan for contract      |                  |     |        |      |           |
| Increase levy for mixed waste                                    |                  |     |        |      |           |
| Market education   |                  |     |        |      |           |
| <i>Joint Venture with Local Councils</i>                         | No rank provided |     |        |      |           |
| <i>Landfill Ban (Concrete / Sand / Bricks)</i>                   |                  |     |        |      |           |

Opportunities for further C&D recycling outlined by industry include a continual increase of the landfill levy, support for waste producers that separate their waste stream into material type, a compulsory submission of a waste management plan when tendering for contracts, an increased landfill levy for mixed waste streams and greater market education. One recycler nominated a complete ban on clean construction materials to landfill.

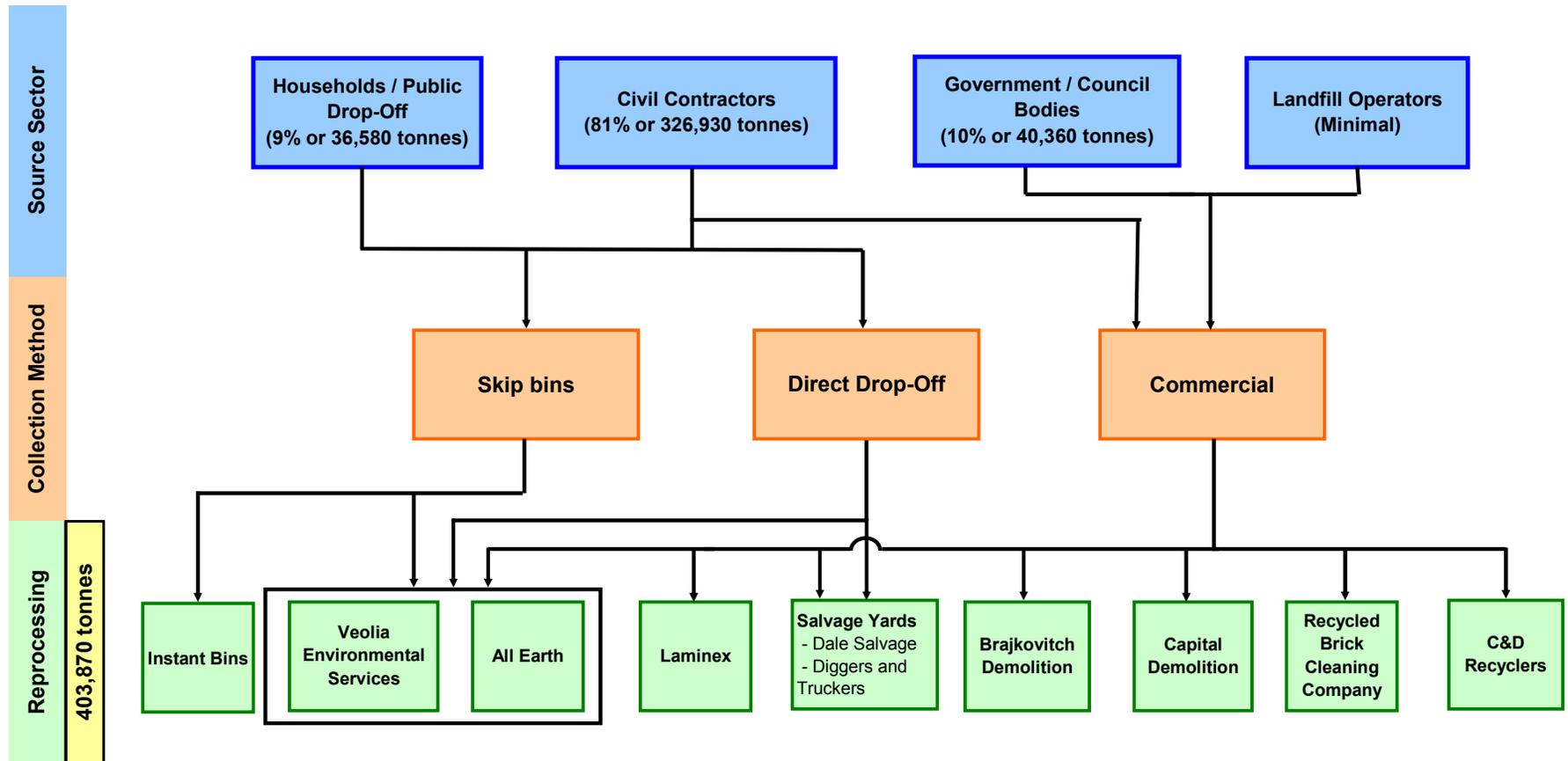
As outlined in last year's review it is often far more economical to send C&D waste material to an inert landfill for disposal rather than to a C&D recycling facility. Provided disposal remains a lower cost option to recovery, material will continue to be sent to these cheaper options unless either economic or regulatory factors are changed.

Approximately **1.9 million tonnes** of C&D material was dumped into Perth metropolitan landfills in 2006/07.

**Photo 3.1 – All Earth C&D recycling operation in Maddington**



Figure 3.3 – Flow of C&D recovered for reprocessing from sector of origin through to recycling destination (2006/07)



## 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 / 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, although other methods are available to separate materials. 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 material from the municipal sector.

To prepare metal for reprocessing, all items must be reduced to a uniform 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. 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 (**Photo 4.1**).

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

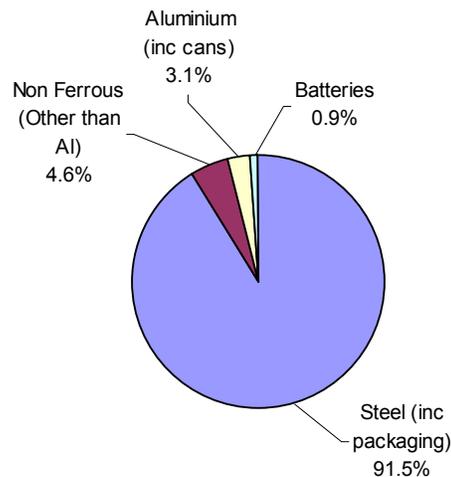
Automotive battery recyclers crush batteries into pieces and separate the plastic and lead components. The plastic is sent to a reprocessor for manufacture into new plastic products whilst the purified lead is sent to battery manufacturers and other industries. A typical automotive lead-acid battery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

### 4.2 Total Recovery of Metal

Approximately 501,300 tonnes of metal was recycled in Western Australia during the 2006/07 financial year. This is an increase of 72,440 tonnes from 2005/06 figures. Non-packaging steel was again recovered in the highest tonnages (457,460 tonnes), followed by non-ferrous (other than aluminium) (22,930 tonnes) (**Table 4.1 / Figure 4.1**)

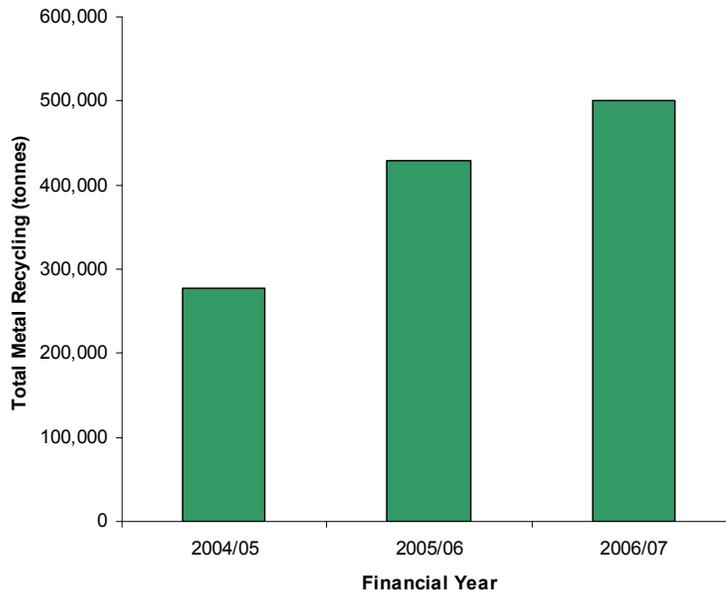
**Table 4.1 / Figure 4.1: Composition of metals recovered by weight (tonnes) for reprocessing, Western Australia 2006/07**

| Metal Composition           | Tonnes         |
|-----------------------------|----------------|
| Steel (non-packaging)       | 457,460        |
| Non-Ferrous (Other than Al) | 22,930         |
| Aluminium                   | 13,910         |
| Batteries (Automotive)      | 4,300          |
| Aluminium Cans              | 1,700          |
| Steel (packaging)           | 1,000          |
| <b>Total</b>                | <b>501,300</b> |



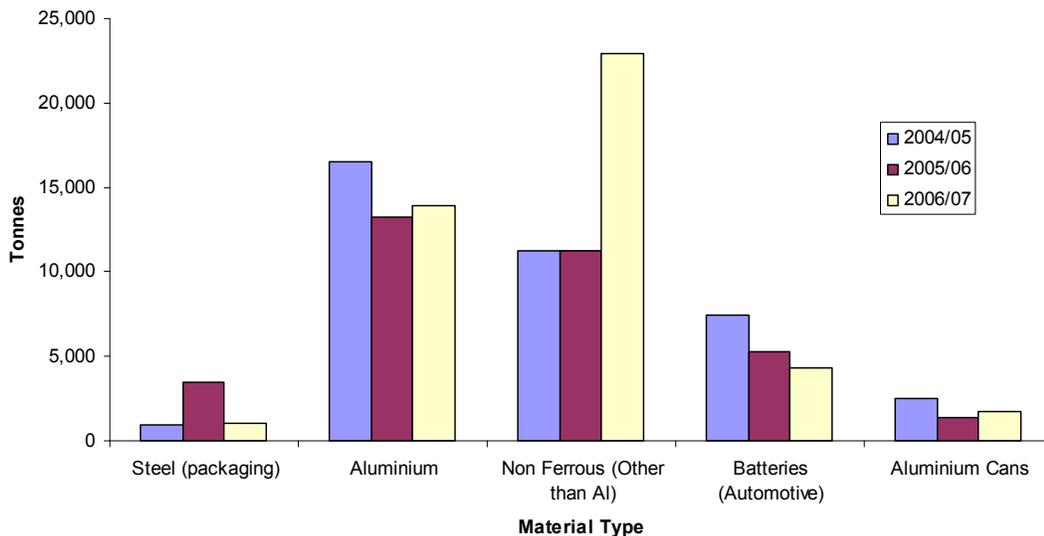
There has been strong growth in metal recycling activity in Western Australia since the first Recycling Activity Review in 2004/05 (**Figure 4.2**). The strong growth has been driven by the demand for scrap metal in Asia to supply their large manufacturing industries.

**Figure 4.2: Trends in total metal recycling activity in Western Australia by weight (tonnes)**

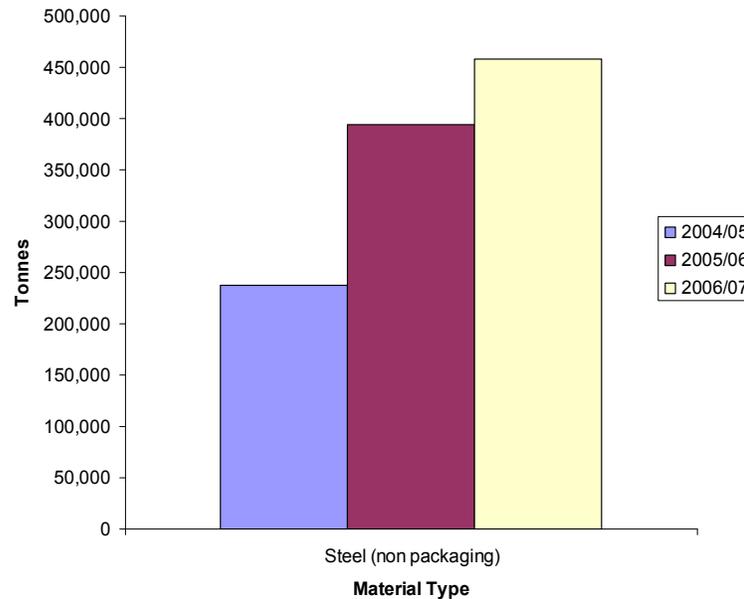


Whilst there has been a strong increase in the recycling of non-packaging steel scrap and non-ferrous (other than aluminium), other materials such as steel packaging, aluminium cans, batteries and scrap aluminium have remained steady or have exhibited some decline in recycling activity. Recyclers have indicated the continued decline in market prices for aluminium and automotive batteries may be a cause of this observed trend. The breakdown of trends in recycling of metal materials is outlined in **Figures 4.3** and **4.4**

**Figure 4.3: Trends in metal type recovered by weight (tonnes) excluding steel (non-packaging)**



**Figure 4.4: Trends in steel (non-packaging) recovered by weight (tonnes)**



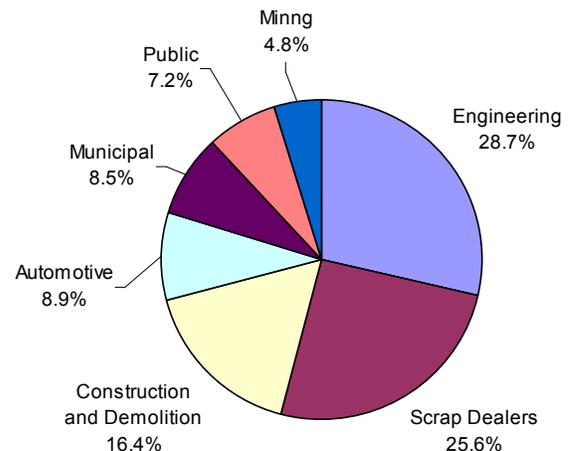
### 4.3 Source Sector of Recovered Metals

As outlined in last year's report the largest source sectors of recovered metals are from the engineering industry (29%) and scrap metal dealers (26%). Scrap metal dealers are not specifically a source sector, however due to the numerous small players in the market and the difficulty in determining the source sector totals from each organisation it was decided that scrap metal dealers should be seen as a separate entity. **Table 4.2** and **Figure 4.5** outline the source sector of material and gives a general proportion of the source sector scrap metal dealers accept material from.

The largest source sector increases were in C&D (35,500 tonnes), mining (12,560 tonnes) and scrap metal dealers (36,310 tonnes). These can be attributed to the high mining and residential / commercial activity in the State. The high commodity price of scrap metal has also increased competition into the scrap metal market. This has resulted in scrap metal that traditionally was sent directly to large scrap metal companies such as Sims Metal or Smorgon Steel being sought after by smaller players. The material is then sold to the larger scrap metal companies for export to Asia.

**Table 4.2 / Figure 4.5: Proportion of metal products recovered by weight (tonnes) for reprocessing, Western Australia 2006/07**

| Source Sector               | Tonnes         |
|-----------------------------|----------------|
| Engineering                 | 143,780        |
| Scrap Dealers               | 128,360        |
| Construction and Demolition | 82,380         |
| Automotive                  | 44,580         |
| Municipal                   | 42,410         |
| Public                      | 35,900         |
| Minng                       | 23,890         |
| <b>Total</b>                | <b>501,300</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 services to pots and pans, car bodies and alloy wheels.

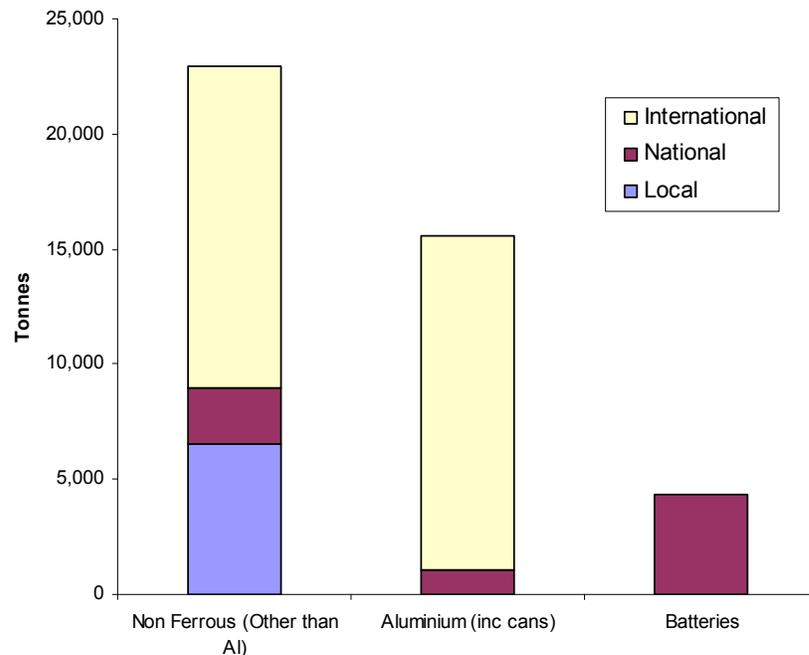
#### 4.4 Destination of Recovered Metals

The majority (95%) of recovered metals in Western Australia in 2006/07 were exported into Asia. Approximately 16,620 tonnes of metal were sent to local foundries (mostly non-packaging steel and non-ferrous metals) and approximately 7,760 tonnes (mostly automotive batteries and non-ferrous metals) were sent interstate for reprocessing. Tonnages recovered and their destinations are outlined in **Table 4.3** and **Figure 4.6**.

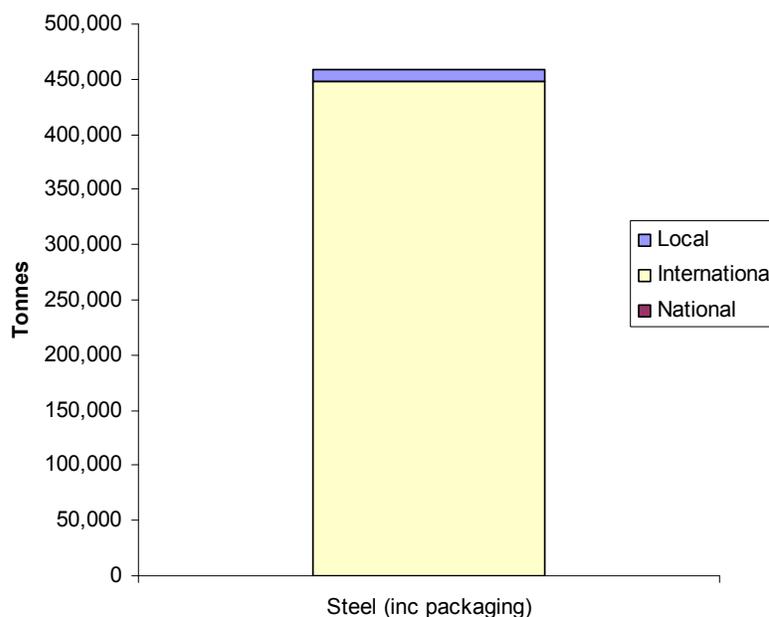
**Table 4.3: Destination of metals recovered by weight (tonnes) for reprocessing (2006/07)**

| Destination   | Tonnes         | %  |
|---------------|----------------|----|
| Local         | 16,620         | 3  |
| National      | 7,760          | 2  |
| International | 476,920        | 95 |
| <b>Total</b>  | <b>501,300</b> |    |

**Figure 4.6: Type of metal recovered by weight (tonnes) and destination for reprocessing (2006/07)**



**Figure 4.7:** Steel (inc packaging) recovered by weight (tonnes) and destination for reprocessing (2006/07)



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

Barriers and their associated rank outlined by metal recyclers which limit the amount of material being recycled or reprocessed is outlined in **Table 4.4**. As businesses operate under different circumstances, barriers to further recycling can vary. Therefore, an average rank has been set.

**Table 4.4: Barriers and rank outlined by the metal recycling industry**

| BARRIER                                      | Very Low | Low | Medium | High | Very High |
|--|----------|-----|--------|------|-----------|
| Limited space                                | █        |     |        |      |           |
| Competition                                  |          |     |        | █    |           |
| Contamination                                |          | █   |        |      |           |
| Low landfill levies in WA                    | █        |     |        |      |           |
| Your organisation paying landfill levies     |          |     |        | █    |           |
| Labour shortage                              |          |     |        | █    |           |
| Local government restrictions                |          | █   |        |      |           |
| Transport costs                              |          |     |        | █    |           |
| Lack of government assistance                |          | █   |        |      |           |
| Supply shortage                              |          | █   |        |      |           |
| Lack of markets                              | █        |     |        |      |           |
| Recycling culture of government and industry |          |     |        | █    |           |

Barriers outlined by the metal recycling industry as having the greatest impact on their operations include competition, the current labour shortage, transport costs, the recycling culture of government and industry and the impact of landfill levies on unmarketable waste material from operations.

As outlined in last year’s report, many products containing metal 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. This results in a high quantity of unmarketable material being sent to landfill. Rural landfills on the outskirts of the metropolitan area are now attracting these waste streams due to their lower gate fees even with higher transport distances. As such, the additional disposal and treatment costs are now restricting the viability of recycling some products such as fridges and material with high floc components.

The lack of markets, the low landfill levies and limited space are of a lesser concern for metal recycling companies due to the high demand for metal products. Low landfill levies, whilst encouraging landfilling rather than recycling is of a lesser concern to metal recyclers due to the reasons discussed above.

The metal recycling industry has indicated that there are opportunities for greater recovery of metal products with incentives to collect metal from regional areas and a community / business education program (**Table 4.5**)

**Table 4.5: Opportunities and rank outlined by the metal recycling industry**

| OPPORTUNITY  | Very Low | Low | Medium | High | Very High |
|--|----------|-----|--------|------|-----------|
| Incentives to collect metal from remote locations e.g. freight subsidies |          |     |        |      |           |
| Increase recycling programs at landfill facilities                       |          |     |        |      |           |
| Assistance with landfill levies  |          |     |        |      |           |
| Community / business education programs                                  |          |     |        |      |           |

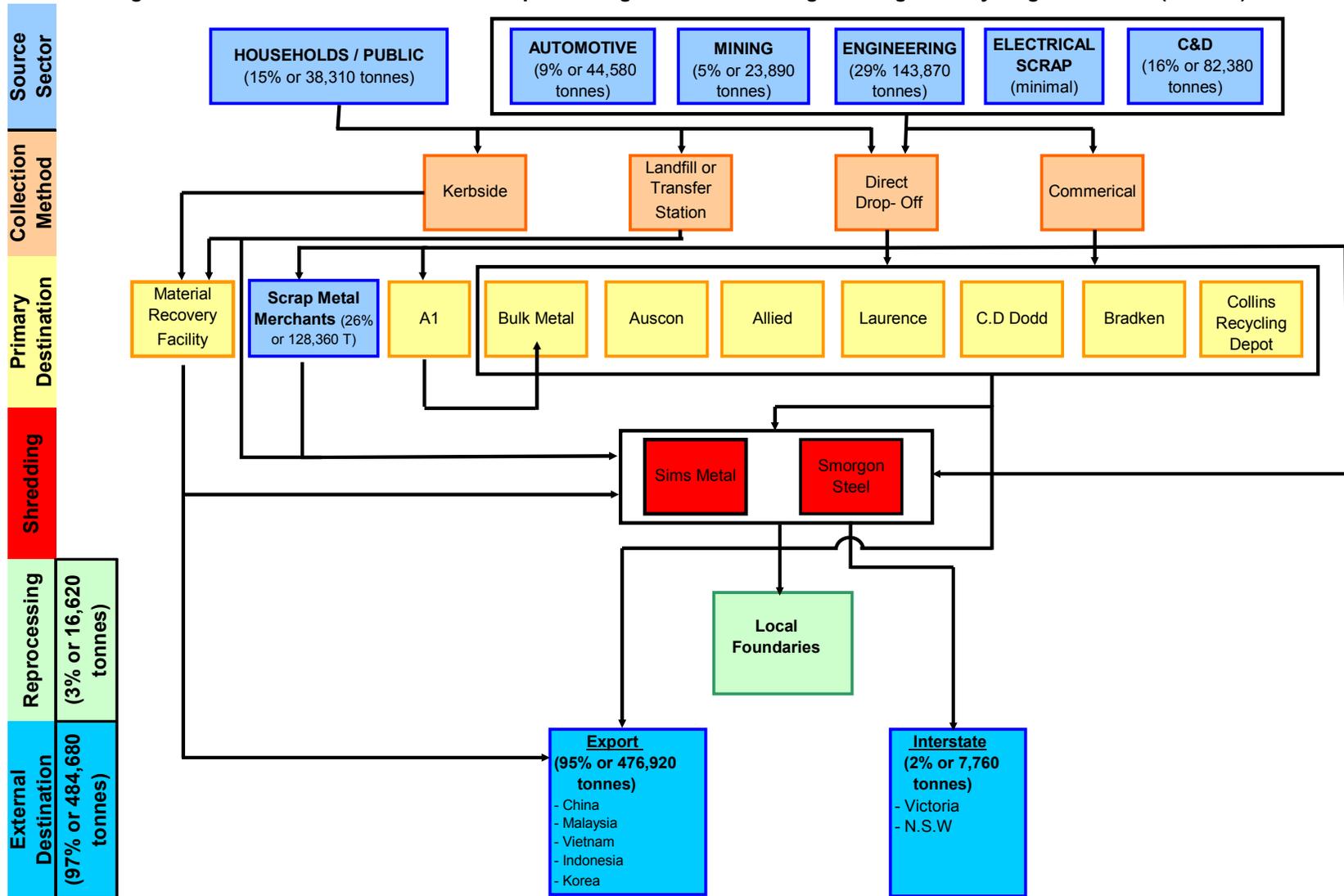
**Photo 4.1: Baled Aluminium Cans at Sims Metal in Spearwood**



**Figure 4.7** on 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.



Figure 4.8 – Flow of metal recovered for reprocessing from sector of origin through to recycling destination (2006/07)



## 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 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. The only local reprocessors operating in 2006/07 were insulation companies (e.g. Cool or Cosy, Insul fibre Ultra Block). The paper mill operated by AMCOR ceased its operations in 2006.

Reprocessing of paper at paper mills in Asia and the Eastern States involves the waste paper being mixed with water in a pulping process to enable separation of the paper fibres. Contaminants (i.e. inks and adhesives) are removed during this process. Some types of materials such as juice cartons require shredding prior to pulping to enable easier reprocessing and the removal of plastic and metal contaminants. The recycled paper is 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.

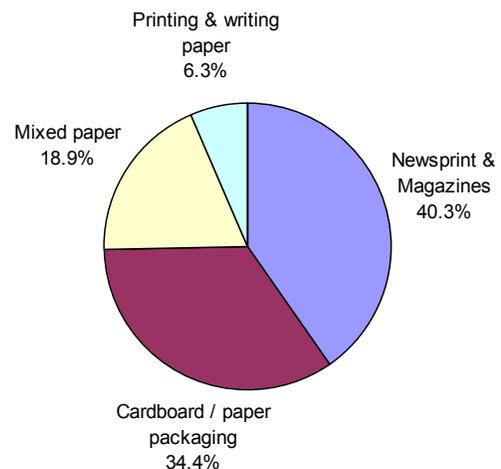
Pulped newspaper is an excellent insulator. Insulation companies source newspaper from paper recycling companies, pulp it and combine it with fire retardants. The product can then be easily installed in buildings to save on heating and cooling costs.

### 5.2 Paper Recovery by Product

Approximately 225,760 tonnes of paper was recycled in Western Australia during the 2006/07 financial year. This is an increase of 18,070 tonnes over the 2005/06 figures. Newsprint and Magazines had the largest tonnage of material recovered for a single paper grade, with a total of 91,010 tonnes. The next largest tonnage was cardboard / paper packaging grade with 77,560 tonnes. The breakdown of paper grades recovered is outlined in **Table 5.1** and **Figure 5.1**

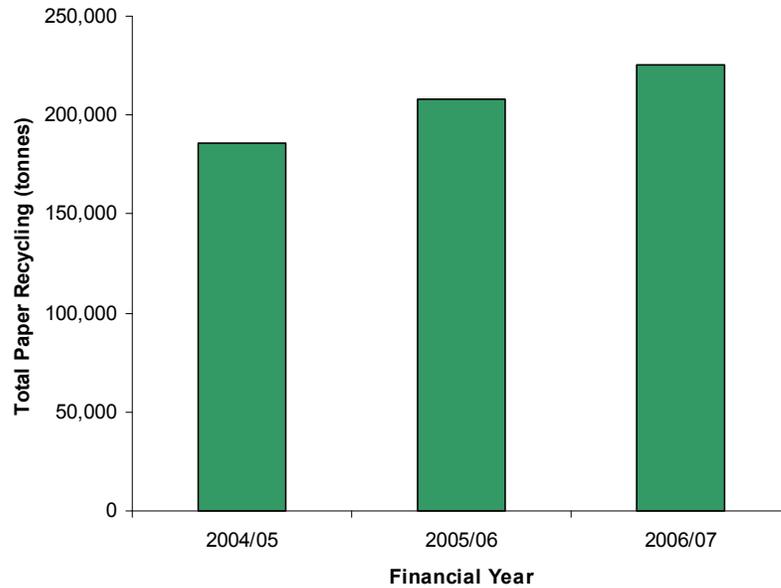
**Table 5.1 / Figure 5.1: Composition of paper products recovered by weight (tonnes for reprocessing (2006/07))**

| Paper Composition           | Tonnes         |
|-----------------------------|----------------|
| Newsprint & Magazines       | 91,010         |
| Cardboard / paper packaging | 77,560         |
| Mixed paper                 | 42,770         |
| Printing & writing paper    | 14,200         |
| Directories                 | 220            |
| <b>Total</b>                | <b>225,760</b> |



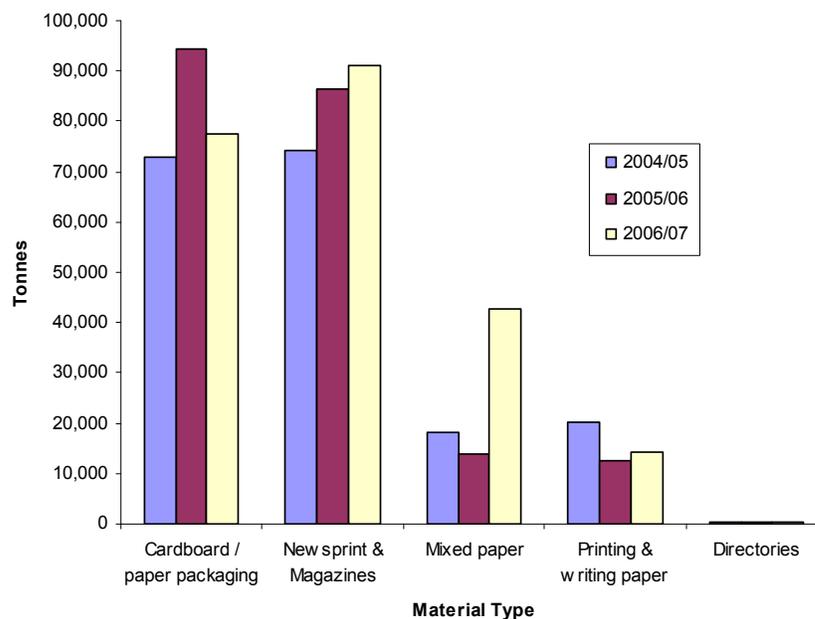
There has been growth in paper recycling activity in Western Australia since the first Recycling Activity Review in 2004/05 (**Figure 5.2**). This strong growth has been driven by increased paper recovery and demand for paper in Asia to supply their large pulp mills.

**Figure 5.2: Trends in total recovery of paper in Western Australia by weight (tonnes)**



Cardboard / paper packaging and newsprint / magazines continue to be the recycled in the highest quantities in Western Australia (**Figure 5.2**). Whilst newsprint / magazines have shown growth in recovery over time, there has been an apparent decline in the recovery of cardboard / paper packaging. This can be attributed to paper recyclers marketing a proportion of this paper type as “mixed paper”. As paper recycling companies market their product in grades, rather than specific types of paper this makes accurate tonnages difficult to determine. Therefore caution should be used in the interpretation of data.

**Figure 5.2: Trends in paper type recovered by weight (tonnes)**



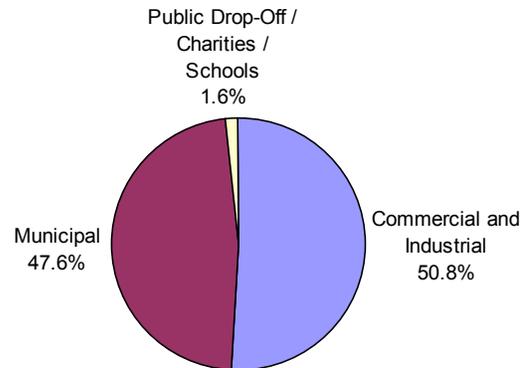
\* Caution should be used in the interpretation of this data

### 5.3 Source Sector of Paper

The majority of paper recovered in 2006/07 was sourced from the C&I sector (approximately 114,660 tonnes or 51%) (Table 5.2 and Figure 5.2). 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 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 2006/07**

| Source Sector                         | Tonnes         |
|---------------------------------------|----------------|
| Commercial and Industrial             | 114,660        |
| Municipal                             | 107,440        |
| Public Drop-Off / Charities / Schools | 3,660          |
| <b>Total</b>                          | <b>225,760</b> |

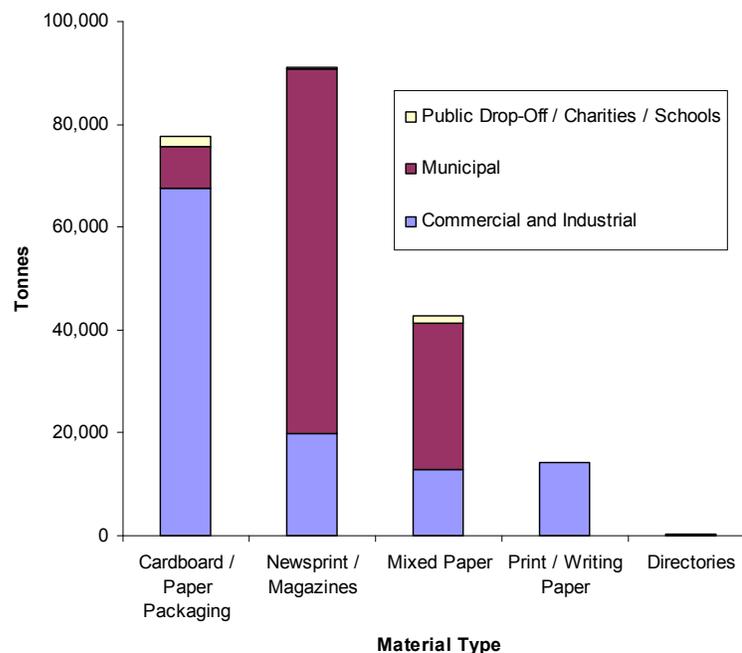


Assumptions: C&I – C&D, Office and Retail, Public Buildings, Manufacturing  
Municipal – Kerbside Collections

Note: The "source sector" is very difficult to accurately quantify due to material moving through a range of stakeholders before end reprocessor / exporter. Therefore data should be used with caution.

Cardboard / paper packaging and print / writing paper is recovered in the greatest quantities from the C&I sector with 67,500 tonnes and 14,200 tonnes being recycled respectively. The majority of newsprint / magazines (71,010 tonnes), mixed paper (28,370 tonnes) and directories (220 tonnes) are sourced from the municipal sector (Figure 5.5).

**Figure 5.5: Source of paper products recovered by weight (tonnes) in regards to paper grade for reprocessing in 2006/07**



The source of recycled paper grade has remained consistent over time with an approximate 50/50 split between the municipal sector and C&I sector. A small amount of paper is also recovered from public drop off and charities.

## 5.4 Destination of Recovered Paper

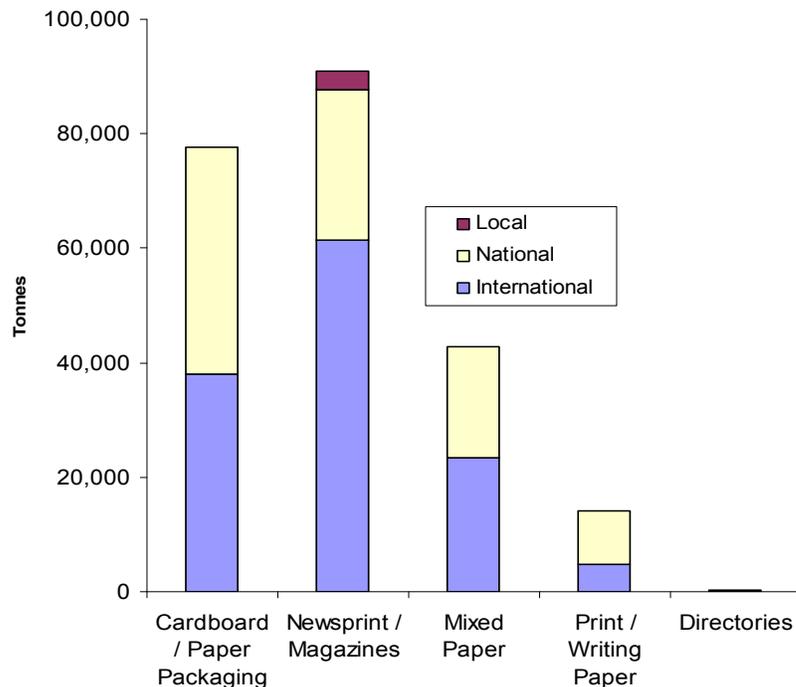
The closure of the AMCOR paper mill in 2006, has resulted in a significant decline in local reprocessing capability within Western Australia. Insulation companies are now the only companies that have a capability to reprocess paper. Paper from AMCOR and other paper recyclers is now predominantly being sent to Eastern States or overseas markets.

Approximately 56% or 127,660 tonnes of paper was exported overseas and approximately 42% or 94,900 tonnes sent to the Eastern States for reprocessing in 2006/07 (Table 5.3). Only approximately 3,200 tonnes of newsprint / magazines is now utilised locally for the insulation market. Cardboard / paper, mixed paper and printing / writing paper is distributed in a similar proportion internationally and nationally, however due to higher demand a higher proportion of newsprint / magazines is exported. At present there is high demand for West Australian waste paper in Asian pulp mills (Figure 5.6).

**Table 5.3 – Destination of paper products recovered by weight (tonnes) from all sectors for reprocessing in 2006/07**

| Destination   | Cardboard / Paper Packaging | Newsprint / Magazines | Mixed Paper   | Print / Writing Paper | Directories | Total          |
|---------------|-----------------------------|-----------------------|---------------|-----------------------|-------------|----------------|
| International | 38,060                      | 61,310                | 23,370        | 4,700                 | 220         | 127,660        |
| Local         | 0                           | 3,200                 | 0             | 0                     | 0           | 3,200          |
| National      | 39,500                      | 26,500                | 19,400        | 9,500                 | 0           | 94,900         |
| <b>Total</b>  | <b>77,560</b>               | <b>91,010</b>         | <b>42,770</b> | <b>14,200</b>         | <b>220</b>  | <b>225,760</b> |

**Figure 5.6 – Destination of paper products recovered by weight (tonnes) from all sectors for reprocessing in 2006/07**



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

Barriers and their associated rank outlined by paper recyclers which limit the amount of material being recycled or reprocessed is outlined in **Table 5.4**. As businesses operate under different circumstances, barriers to further recycling can vary. Therefore, an average rank has been set.

**Table 5.4: Barriers and rank outlined by the paper recycling industry**

| BARRIER   | Very Low | Low | Medium | High | Very High |
|---|----------|-----|--------|------|-----------|
| Limited space   |          |     |        |      |           |
| Competition   |          |     |        |      |           |
| Low landfill levies in WA                                 |          |     |        |      |           |
| Your organisation paying landfill levies                  |          |     |        |      |           |
| Labour shortage   |          |     |        |      |           |
| Local government restrictions                             |          |     |        |      |           |
| Transport costs   |          |     |        |      |           |
| Lack of government assistance                             |          |     |        |      |           |
| Supply shortage   |          |     |        |      |           |
| MRF's not set up correctly to prepare marketable material |          |     |        |      |           |
| Lack of markets   |          |     |        |      |           |
| Recycling culture of government and industry              |          |     |        |      |           |

Barriers outlined by the paper recycling industry as having the greatest impact on their operations include competition, the current labour cost associated with the labour shortage, a lack of government assistance and the poor recycling culture of government and industry in Western Australia. The lack of markets, landfill levies and limited space are of a lesser concern for paper recycling companies due to the high demand for paper products and minimal material that is required to be sent to landfill from paper recycling operations.

The paper recycling industry has indicated that there are opportunities for greater recovery of paper products (**Table 5.5**) with incentives to collect paper from regional areas, an increase in recycling programs at landfills a community / business education program and greater promotion by government in the use of locally made cellulose products for insulation.

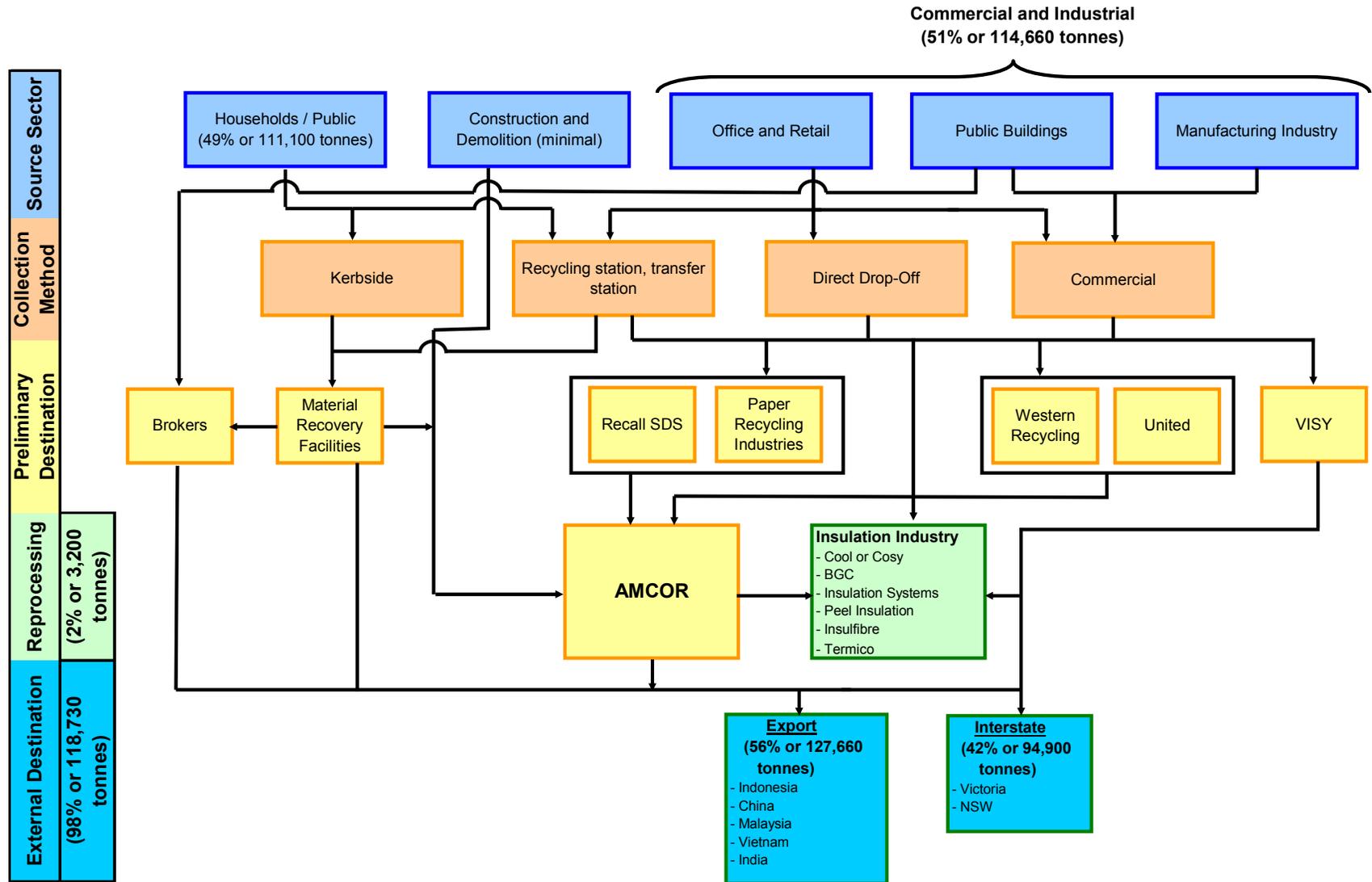
**Table 5.5: Opportunities and rank outlined by the paper recycling industry**

| OPPORTUNITY  | Very Low | Low | Medium | High | Very High |
|--|----------|-----|--------|------|-----------|
| Incentives to collect paper from remote locations e.g. freight subsidies |          |     |        |      |           |
| Increase recycling programs at landfills                                 |          |     |        |      |           |
| Assistance with landfill levies  |          |     |        |      |           |
| Community / business education programs                                  |          |     |        |      |           |
| Govt promote use of recycled paper products and cellulose                |          |     |        |      |           |

The diagram on the following page (**Figure 5.7**) outlines the flow of materials from source sector through to the reprocessor.



Figure 5.7 – Flow of paper recovered for reprocessing from sector or origin through to recycling destination (2006/07)



## **6. CONTAINER GLASS**

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

Glass has not been 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) transport the material interstate by freight train operated by Railroad Transport (**Figure 6.1**).

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 has 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 largely remained static over the past two financial years (2004/05 and 2005/06) with approximately 18,000 tonnes being recycled each financial year. However, in 2006/07 ACI Glass estimated that approximately 20,800 tonnes of material was recycled. ACI has indicated that the recovery of glass may have increased due to higher yields being recovered from kerbside collections.

### **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 significant contributor to the overall recycling of glass in Western Australia. Data from commercial recycling (Perth Glass) activities has not been included due to confidentiality.

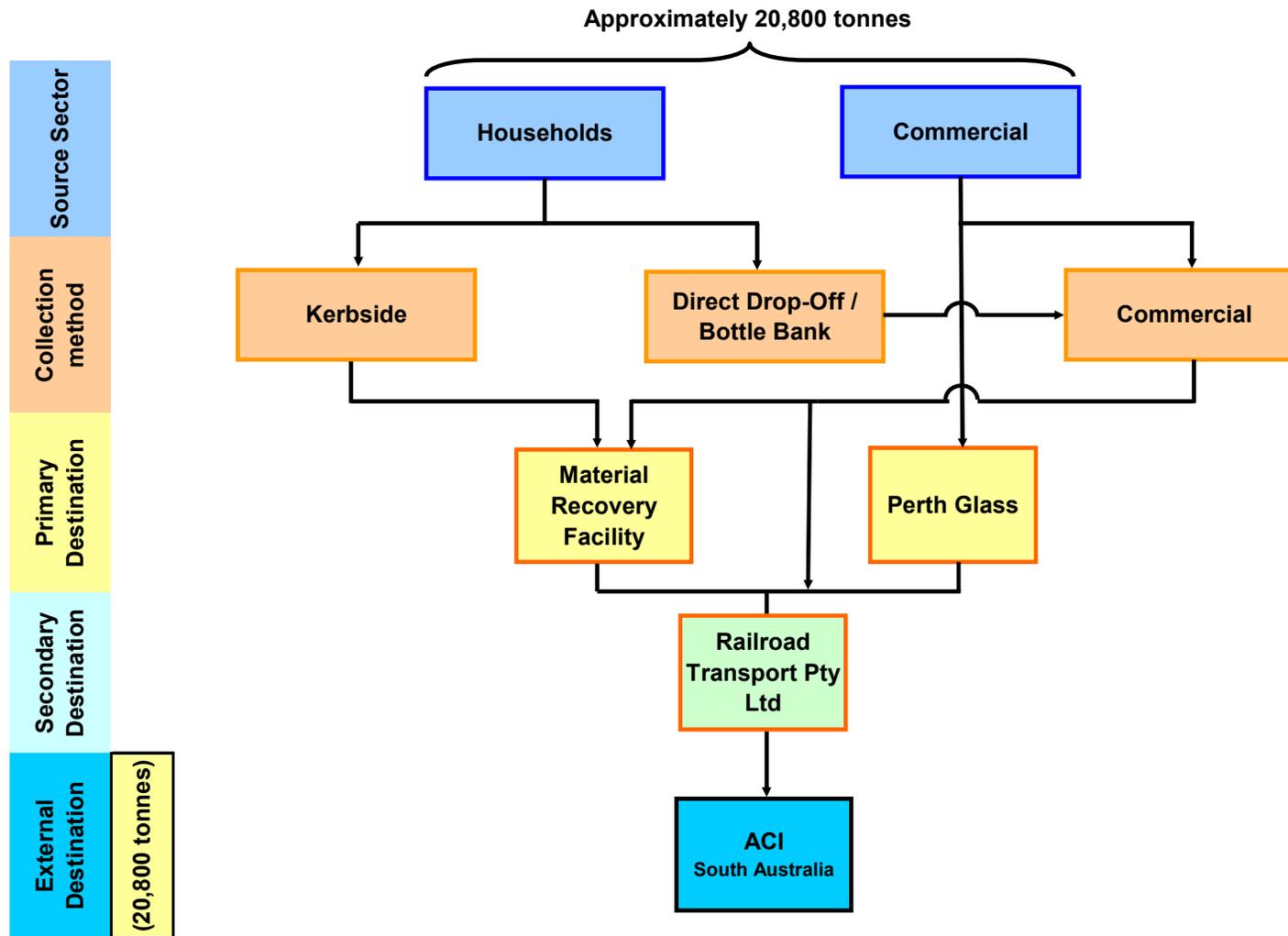
### **6.4 Barriers / Opportunities Outlined by the Glass Recycling Industry**

One of the key barriers to glass recycling is the high incidence of glass breakage and its associated contamination of other recyclables especially paper. Glass breakage is reported along the entire recycling chain, from breakage when in recycling bins, breakage when disposed into the recycling truck, breakage when truck is compacted (this is reduced in recycling trucks by having a lower compaction ratio compared to rubbish trucks), breakage when tipped at the MRF, breakage during the sorting process and breakage in stockpiling. The smaller broken pieces of glass or glass shards need to be disposed to landfill after the process along with other material contaminated by the glass.

As outlined in last year's report, ACI identified that the main reason for the closure of the bottling 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. 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 South Australia for reprocessing at high cost.

Opportunities for increased recycling of glass would be through the establishment of local West 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 (2006/07)



## 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 compared to separated materials. Commercial operators such as CLAW, Recycla Plas, JoJo Plastics and Repeat Plastic 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, plastics separation 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 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.

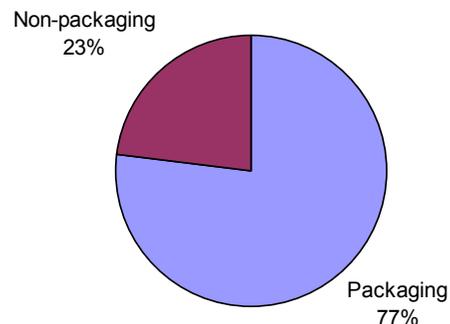
### 7.2 Total Plastics Recovery

In order to maintain consistency with the previous Review of Total Recycling Activity in Western Australia reports, the plastics data has been obtained from the 2006 Plastics and Chemical Industries Association (PACIA) report. While the PACIA report represents the 2006 calendar year rather than the 2006/07 financial year, it does give an indication of the recycling activity over a similar time period.

Overall recycling activity for the 2006 calendar year was 18,130 tonnes, an increase of 4,770 tonnes over the PACIA 2005 calendar year report (**Table 7.1**). 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. PET, HDPE and LDPE were recovered in the largest quantities (Cardno survey). Total plastics recovered by packaging type have been published by PACIA and are outlined below.

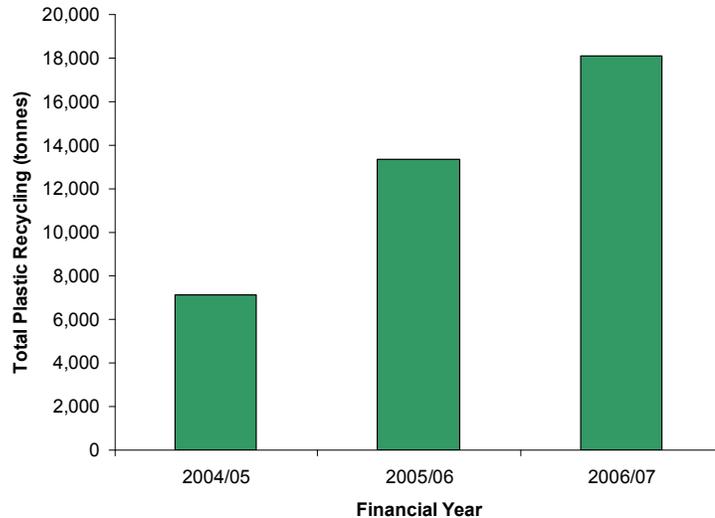
**Table 7.1 / Figure 7.1 – Total plastic recovery by packaging type (PACIA 2006)**

| Packaging Type | Tonnes        |
|----------------|---------------|
| Packaging      | 13,970        |
| Non-packaging  | 4,160         |
| <b>Total</b>   | <b>18,130</b> |



PACIA has indicated that there has been a general increase in the total recovery of plastics being recovered in Western Australia since 2004/05 (**Figure 5.2**).

**Figure 5.2: Trends in total recovery of plastic in Western Australia by weight (tonnes) - PACIA**

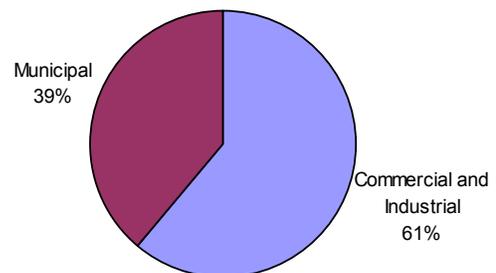


### 7.3 Source Sector of Plastics

Approximately 61% (11,060 tonnes) of recovered plastics were sourced from the commercial and industrial sector, whilst the remaining 39% (7,070 tonnes) was sourced from the municipal sector.

**Table 7.2 / Figure 7.2 – Source Sector of plastics recovered by weight (tonnes) for reprocessing (PACIA 2006)**

| Source Sector             | Tonnes        |
|---------------------------|---------------|
| Commercial and Industrial | 11,060        |
| Municipal                 | 7,070         |
| <b>Total</b>              | <b>18,130</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. C&I 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 2006/07.

**Table 7.3: Examples of plastics accepted at various W.A recyclers in 2006/07**

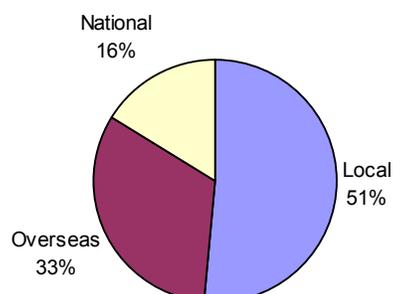
| Plastic | Type | Products Recycled Examples              |
|---------|------|---|
| PET     | 1    | Bottles                                 |
| HDPE    | 2    | Drums, Pipes, Bottles                   |
| PVC     | 3    | Pipes, Food Packaging, Wires Insulation |
| LDPE    | 4    | Film, Water Tanks, 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 (2006) a large proportion of plastics were reprocessed locally (51%), followed by exportation overseas (33%) and finally interstate / national destinations (16%). It must be noted that reprocessing in the 2006 PACIA calendar year report defines 'reprocessing' as shredding or granulating of the material (**Table 7.4 / Figure 7.3**).

**Table 7.4 / Figure 7.3: Destination of plastics recovered by weight (tonnes) for reprocessing (PACIA 2006)**

| Destination  | Tonnes        |
|--------------|---------------|
| Local        | 9,310         |
| Overseas     | 5,900         |
| National     | 2,920         |
| <b>Total</b> | <b>18,130</b> |



Most 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**).

**Table 7.5: Recovered polymers reprocessing destination (2006/07)**

| 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                   | Y               | Y             |
| PP                    | 5             | Y                   | Y               | Y             |
| PS                    | 6             | N                   | N               | Y             |
| EPS                   | 6             | N                   | N               | Y             |
| ABS/SAN               | 7             | Y                   | N               | Y             |
| PU                    | 7             | Y                   | N               | N             |
| Nylon                 | 7             | Y                   | N               | Y             |
| Mixed                 | All           | Y                   | Y               | Y             |
| <b>Total (tonnes)</b> | <b>All</b>    | <b>9,310</b>        | <b>2,920</b>    | <b>5,900</b>  |

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

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

Barriers and their associated rank outlined by plastic recyclers which limit the amount of material being recycled or reprocessed are outlined in **Table 7.6**. As businesses operate under different circumstances, barriers to further recycling can vary. Therefore, an average rank has been set.

**Table 7.6: Barriers and rank outlined by the rubber recycling industry**

| BARRIER   | Very Low | Low | Medium | High | Very High |
|---|----------|-----|--------|------|-----------|
| Limited space   |          |     |        |      |           |
| Competition   |          |     |        |      |           |
| Low landfill levies in WA                                 |          |     |        |      |           |
| Your organisation paying landfill levies                  |          |     |        |      |           |
| Labour shortage   |          |     |        |      |           |
| Local government restrictions                             |          |     |        |      |           |
| Transport costs   |          |     |        |      |           |
| Lack of government assistance                             |          |     |        |      |           |
| Supply Shortage   |          |     |        |      |           |
| MRF's not set up correctly to prepare marketable material |          |     |        |      |           |
| Lack of markets   |          |     |        |      |           |
| Willingness of products to be made from recycled plastic  |          |     |        |      |           |
| Market value of plastic                                   |          |     |        |      |           |
| Recycling culture of government and industry              |          |     |        |      |           |

The greatest barriers facing the plastics recycling industry in 2006/07 outlined by plastics recycling industry are the lack of government assistance, the recycling culture of government and industry, labour and transport costs and space limitations. The plastics recycling industry has indicated that a supply shortage, lack of markets, landfill levies and MRF efficiency are not large inhibitors to the functioning of their businesses.

The plastics recycling industry indicated that the opportunities presented in the survey were considered medium (**Table 7.7**). One recycler nominated that there should be greater barriers to the landfilling of plastics in Western Australia (outlined in italics).

**Table 7.7: Opportunities and rank outlined by the rubber recycling industry**

| OPPORTUNITY  | Very Low         | Low | Medium | High | Very High |
|--|------------------|-----|--------|------|-----------|
| Incentives to collect plastic from remote locations e.g. freight subsidies |                  |     |        |      |           |
| Increase recycling programs at landfills                                   |                  |     |        |      |           |
| Assistance with landfill levies  |                  |     |        |      |           |
| Community / business education programs                                    |                  |     |        |      |           |
| Govt promote use of recycled plastic products                              |                  |     |        |      |           |
| Make it easier for recycling companies to obtain grants                    |                  |     |        |      |           |
| <i>Barriers to landfilling of plastics</i>                                 | No rank provided |     |        |      |           |

Opportunities identified by industry to increase plastics recycling 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 programs, 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.

**Photo 7.1: Baled Plastic E-Waste from Sims E-Waste at CLAW Environmental**

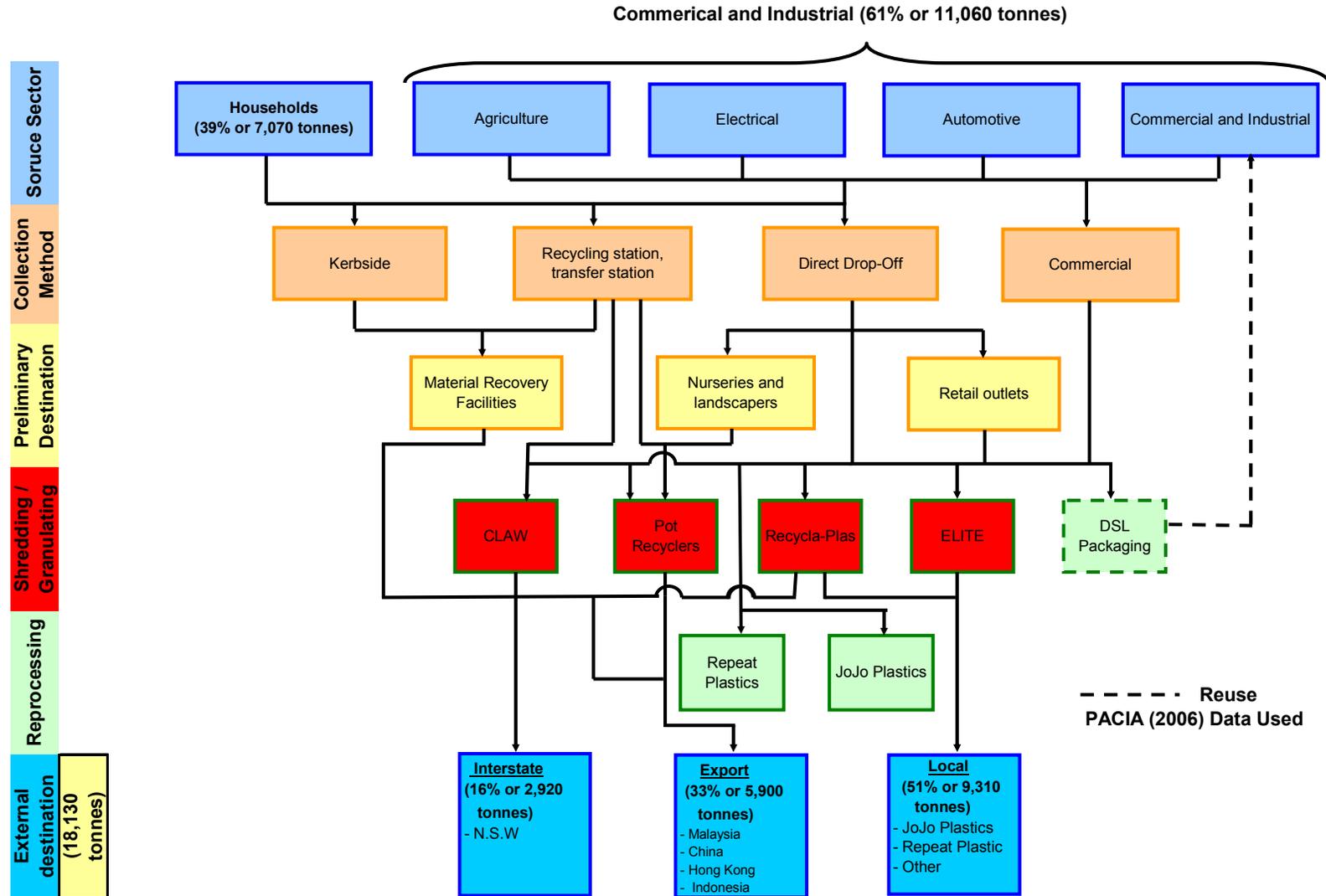


**Photo 7.2: Baled plastic film ready for market at CLAW Environmental**





**Figure 7.4: Flow of plastics recovered for reprocessing from sector of origin through to recycling destinations (2006)**



## 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. The granulated material is then reprocessed to create new products.

Reclaim Industries, based in Spearwood is Western Australia's only tyre reprocessing facility. Reclaim use post-consumer truck 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**). These companies did not recycle rubber in 2006/07, rather they baled and mono-filled (temporary landfill) passenger tyres for possible recovery in the future. Recently during 2007/08, both companies have begun exporting baled tyres overseas instead of sending them to landfill. For the purpose of this report 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.

G&F Beltline Services specialise in recycling used steel cord conveyor belts for the mining industry. The process renews the worn conveyor belt, so it can be re-installed for a second service life. Unfortunately, the innovative practice has been showing some decline in recent years, and now many belts are landfilled by mining companies.

### 8.2 Source Sector and Total Recovery Rubber

Tyre collectors and tyre retailers are the main source of material. A small amount is also recovered from the mining industry and from household drop-off facilities. In total, approximately 5,550 tonnes of rubber was recycled in Western Australia during 2006/07, an increase of 550 tonnes from 2005/06. Tonnages recorded in 2004/05 were from the controlled waste inventory which has been deemed unreliable, therefore trends in tyre recycling is difficult to determine. All material recycled is sourced from the commercial and industrial sector.

### 8.3 Destination of Recovered Rubber

Reclaim Industries and G&F Beltline reprocess their material locally in Western Australia. The reprocessed material has a variety of local, national and / or international markets.

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

Barriers and their associated rank outlined by rubber recyclers which limit the amount of material being recycled or reprocessed are outlined in **Table 8.1**. Rubber monofillers were also included in this survey as they are now (in 2007/08) exporting rubber for reprocessing overseas. As businesses operate under different circumstances, barriers to further recycling can vary. Therefore, an average rank has been set.

**Table 8.1: Barriers and rank outlined by the rubber recycling industry**

| BARRIER                                      | Very Low | Low | Medium | High | Very High |
|--|----------|-----|--------|------|-----------|
| Limited space                                |          |     |        |      |           |
| Competition                                  |          |     |        |      |           |
| Contamination                                |          |     |        |      |           |
| Low landfill levies in WA                    |          |     |        |      |           |
| Your organisation paying landfill levies     |          |     |        |      |           |
| Labour shortage / reliable staff             |          |     |        |      |           |
| Efficiency of machinery                      |          |     |        |      |           |
| Local government restrictions                |          |     |        |      |           |
| Transport costs                              |          |     |        |      |           |
| Lack of government assistance                |          |     |        |      |           |
| Supply shortage                              |          |     |        |      |           |
| Lack of markets                              |          |     |        |      |           |
| Market value of rubber                       |          |     |        |      |           |
| Recycling culture of government and industry |          |     |        |      |           |

Key barriers outlined by the rubber recycling industry include a high competition with landfill for material, the current labour shortage and transportation costs. Other barriers include the low landfill levies in Western Australia, lack of government assistance and the market value of rubber.

Opportunities and their associated rank outlined by rubber recyclers which have the potential to increase the amount of rubber being recycled or reprocessed are outlined in **Table 8.2**.

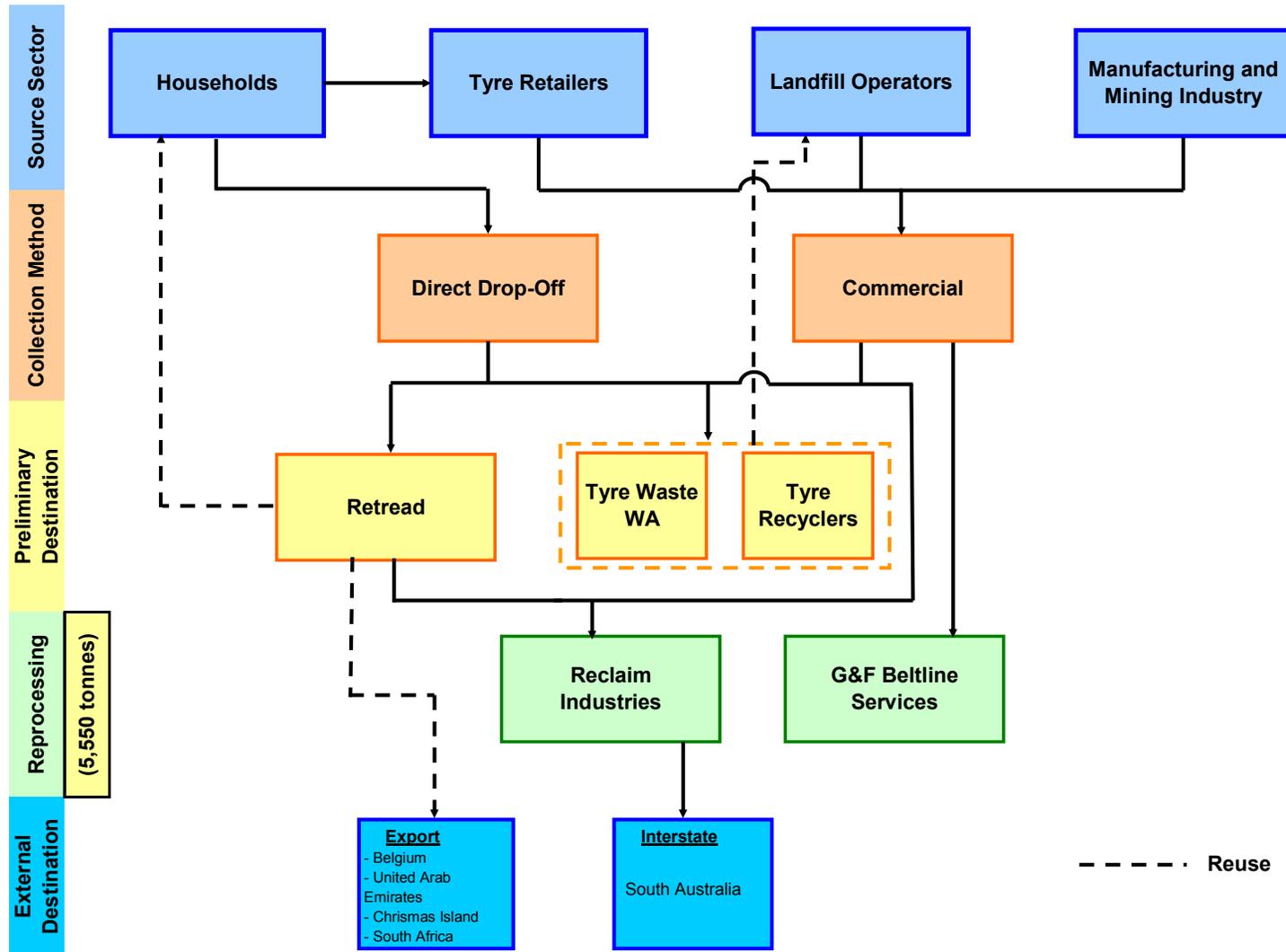
**Table 8.2: Opportunities and rank outlined by the rubber recycling industry**

| OPPORTUNITY   | Very Low | Low | Medium | High | Very High |
|---|----------|-----|--------|------|-----------|
| Incentives to collect rubber from remote locations e.g. freight subsidies |          |     |        |      |           |
| Increase recycling programs at landfills                                  |          |     |        |      |           |
| Assistance with landfill levies   |          |     |        |      |           |
| Community / business education programs                                   |          |     |        |      |           |
| Support from government   |          |     |        |      |           |

The greatest opportunity for increased recycling outlined by the rubber recycling industry, other than the breaking of barriers (**Table 8.1**) are incentives to collect rubber from remote locations, increased recycling at landfills and greater support from government.

Last financial year Reclaim Industries identified that the 'environment' for rubber recycling in Western Australia is not sufficiently attractive for further investment in reprocessing capacity. This environment is set to change, with an announcement by the State Government of a total ban on the landfilling of used tyres in the Perth metropolitan area and larger regional centres by 2011. As of January 2008 no used tyres can be dumped in putrescible landfills, rather all used tyres must be baled and placed into monofills. As outlined in **Section 8.1**, during 2007/08, instead of sending used tyres to monofill, tyre baling companies are now beginning to export waste rubber to Asia.

Figure 8.1: Flow of rubber recovered for reprocessing from sector of origin through to recycling destinations (2006/07)



## 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.

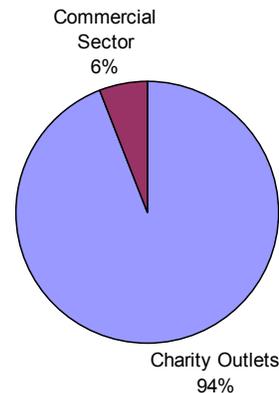
Shredding is a labour intensive process that involves the removal of button, zips and cuffs and cutting of the material into a standard size. Depending on the 'rag company' the material is then put through a scanning process to ensure no metal contaminants are present in the material. The material is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

### 9.2 Clothing Recovery and Source Sector

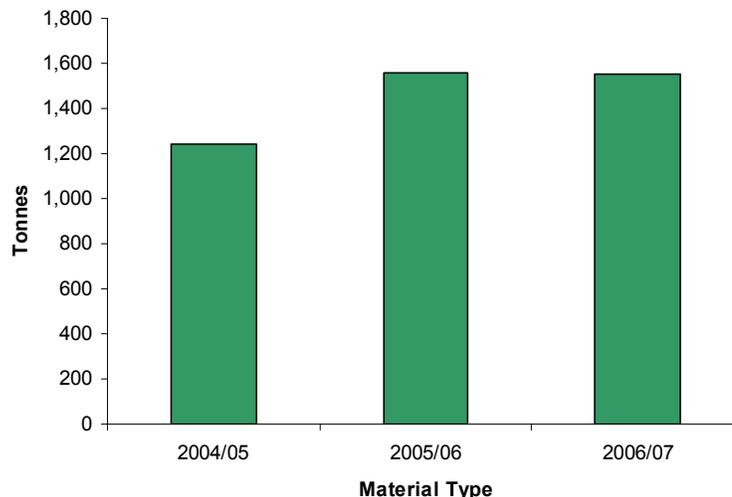
The total amount of textile material recovered during the 2006/07 financial year totalled 1,550 tonnes (a slight decrease of 10 tonnes over 2005/06) (Table 9.1 / Figure 5.2). The source sector of textiles was consistent with the previous reporting period with 90% (1,460 tonnes) being sourced from charity outlets. 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 (2006/07)**

| Source Sector     | Tonnes       |
|-------------------|--------------|
| Charity Outlets   | 1,460        |
| Commercial Sector | 90           |
| <b>Total</b>      | <b>1,550</b> |



**Figure 5.2: Trends in total recovery of textiles in Western Australia by weight (tonnes)**



### 9.3 Destination of Recovered Clothing

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

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

Barriers and their associated rank outlined by textile recyclers which limit the amount of material being recycled or reprocessed are outlined in **Table 9.2**. Barriers in italics are additional barriers identified by textile recyclers. As businesses operate under different circumstances, barriers to further recycling can vary. Therefore, an average rank has been set.

**Table 9.2: Barriers and rank outlined by the textile recycling industry**

| BARRIER                                      | Very Low | Low | Medium | High | Very High |
|--|----------|-----|--------|------|-----------|
| Limited space                                |          |     |        |      |           |
| Competition                                  |          |     |        |      |           |
| Contamination                                |          |     |        |      |           |
| Low landfill levies in WA                    |          |     |        |      |           |
| Your organisation paying landfill levies     |          |     |        |      |           |
| Labour shortage / reliable staff             |          |     |        |      |           |
| Efficiency of machinery                      |          |     |        |      |           |
| Local government restrictions                |          |     |        |      |           |
| Transport costs                              |          |     |        |      |           |
| Lack of government assistance                |          |     |        |      |           |
| Supply shortage                              |          |     |        |      |           |
| Lack of markets                              |          |     |        |      |           |
| Market value of textiles                     |          |     |        |      |           |
| Councils removing collection bins            |          |     |        |      |           |
| Recycling culture of government and industry |          |     |        |      |           |
| <i>Cheap imports</i>                         |          |     |        |      |           |
| <i>Labour costs</i>                          |          |     |        |      |           |

Similar to last financial year the major barriers to further recycling within the textile recycling industry are the availability of staff at charity stores and within the recycling company itself. Other major barriers are the removal of charity bins by local government due to vandalism and dumping of unwanted material, transport costs and a lack of government assistance.

Opportunities and their associated rank outlined by textiles recyclers which have the potential to increase the amount of textiles being recycled or reprocessed are outlined in **Table 9.3**.

**Table 9.3: Opportunities and rank outlined by the textile recycling industry**

| OPPORTUNITY   | Very Low | Low | Medium | High | Very High |
|---|----------|-----|--------|------|-----------|
| Incentives to collect textiles from remote locations e.g. freight subsidies |          |     |        |      |           |
| Increase recycling programs at landfills                                    |          |     |        |      |           |
| Assistance with landfill levies   |          |     |        |      |           |
| Community / business education programs                                     |          |     |        |      |           |
| Make it easier for recycling companies to obtain grants                     |          |     |        |      |           |
| Recycling of mattress materials   |          |     |        |      |           |
|   |          |     |        |      |           |
| <i>Reducing cheap imports</i>   |          |     |        |      |           |

The greatest opportunity for increased recycling outlined by the textile recycling industry, other than the breaking of barriers, are education programs that focus on increased recycling by the community and business and making it easier for textile recycling companies to obtain grants from government.

Overall, demand for recycled textiles or “rags” is high and is outstripping supply, however potential customers are being lost due to the barriers currently in place. The shortage of supply is now requiring the importation of textiles from overseas to keep up with demand. These cheaper imports are consequently making it difficult for some textile recycling companies to compete in the marketplace.

**Photo 9.1: Worker at a textile recycling company slicing used clothing into rags for market**

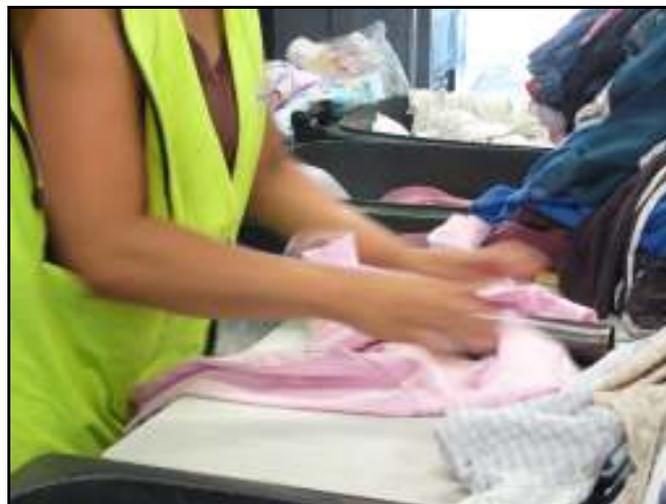
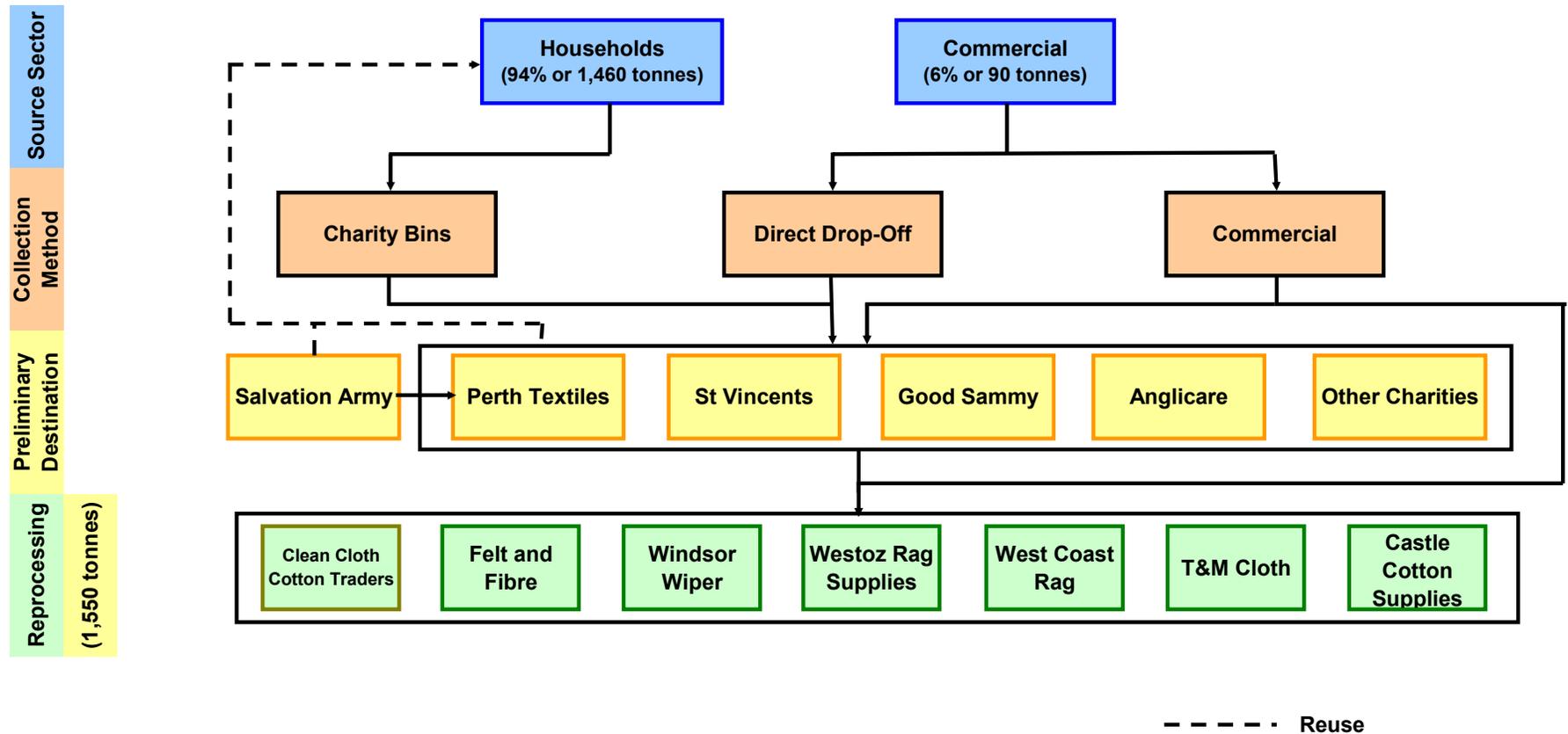


Figure 9.2: Flow of textiles recovered for reprocessing from sector of origin through to recycling destinations (2006/07)



## 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. 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

According to Compost Australia, organics recovery in Western Australia totalled approximately 531,340 tonnes in 2006/07. 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 (115,320 tonnes), barks (108,110 tonnes) and Municipal Solid Waste (MSW) (83,100 tonnes) have the highest recovery rate (**Table 10.1**).

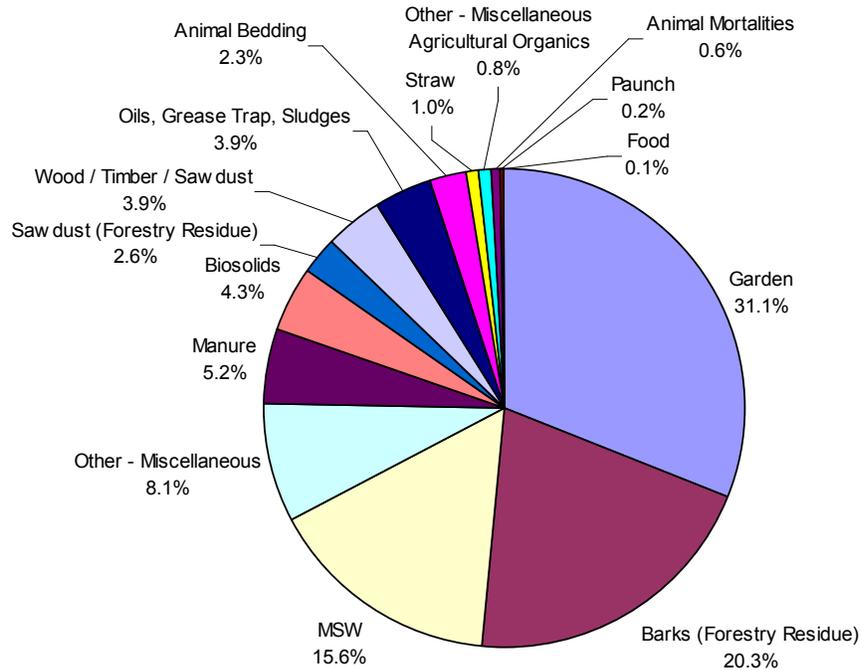
**Table 10.1 – Source sector of organics recovered by weight for reprocessing and comparison with 2005/06 figures (Compost Australia 2006/07) in tonnes**

| Source Sector                               | Tonnes         |                | Change (%) |
|---|----------------|----------------|------------|
|   | 2006/07        | 2005/06        |            |
| Garden                                      | 165,320        | 159,380        | 4          |
| Barks (Forestry Residue)                    | 108,110        | 101,720        | 6          |
| MSW   | 83,100         | 95,180         | -13        |
| Other - Miscellaneous                       | 42,780         | 69,610         | -39        |
| Manure                                      | 27,550         | 38,000         | -28        |
| Biosolids                                   | 23,080         | 23,000         | 0          |
| Sawdust (Forestry Residue)                  | 13,840         | 20,590         | -33        |
| Wood / Timber / Sawdust                     | 20,900         | 17,630         | 19         |
| Oils, Grease Trap, Sludges                  | 20,700         | 20,350         | 2          |
| Animal Bedding                              | 12,000         | 12,350         | -3         |
| Straw                                       | 5,500          | 4,500          | 22         |
| Other - Miscellaneous Agricultural Organics | 4,080          | 9,500          | -57        |
| Animal Mortalities                          | 3,000          | 3,010          | 0          |
| Paunch                                      | 800            | 800            | 0          |
| Biowaste                                    | 0              | 2,000          | N/A        |
| Food  | 580            | 1,010          | -43        |
| <b>Total</b>                                | <b>531,340</b> | <b>578,630</b> | <b>-8</b>  |

Overall there has been a decline in organic recycling activity since 2005/06. Significant declines have been reported in MSW, manure, sawdust (residue), food and “miscellaneous” organic categories, however there has been improvement for garden waste, barks (forestry residue), wood / timber / sawdust and straw.

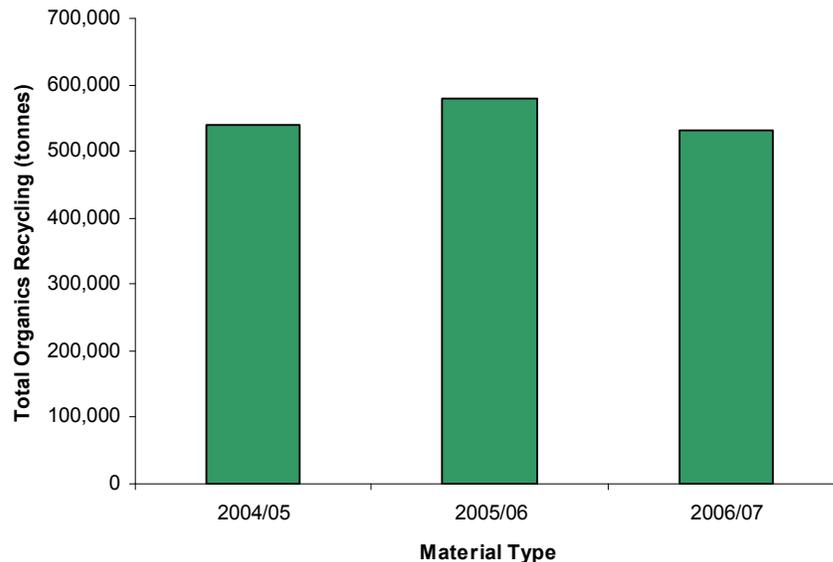
A breakdown of recovered materials by material type is outlined below in **Figure 10.1**.

**Figure 10.1: Recovered organics by material type (Compost Australia 2006/07)**



Total organic recycling activity has also declined compared to 2004/05 figures (**Figure 5.2**)

**Figure 5.2: Trends in total recovery of organics in Western Australia by weight (tonnes) – Compost Australia**



A number of the organic categories reported by Compost Australia can be characterised as by-product processing. These are activities that have long been integrated into business practices for economic/operational reasons. Consequently, these are organics categories that are not likely to become a part of the waste stream and hence can be excluded from consideration from a waste policy perspective. . **Table 10.2** outlines organic recycling categories assumed by the DEC which omits barks (forestry residue), manure, biosolids, sawdust, oil / grease traps / sludge, animal bedding and straw.

**Table 10.2 – Source sector of organics recovered by weight for reprocessing and comparison with 2005/06 figures (Compost Australia 2006/07) in tonnes**

| Source Sector                               | 2006/07        | 2005/06        | Change (%) |
|---|----------------|----------------|------------|
| Garden                                      | 165,320        | 159,380        | 4          |
| MSW   | 83,100         | 95,180         | -13        |
| Other - Miscellaneous                       | 42,780         | 69,610         | -39        |
| Wood / Timber / Sawdust                     | 20,900         | 17,630         | 19         |
| Other - Miscellaneous Agricultural Organics | 4,080          | 9,500          | -57        |
| Animal Mortalities                          | 3,000          | 3,010          | 0          |
| Paunch                                      | 800            | 800            | 0          |
| Biowaste                                    | 0              | 2,000          | N/A        |
| Food  | 580            | 1,010          | -43        |
| <b>Total</b>                                | <b>320,560</b> | <b>358,120</b> | <b>-10</b> |

Note: These categories have been assumed by the DEC to be 'true' organics recycling categories

When 'by-product processing' organic recycling categories are omitted there has been a 10% decline in organics recycling activity since 2005/06. Reasons for this decline are difficult to determine, however the temporary closure of the Southern Metropolitan Regional Council (SMRC) Resource Recovery Facility (RRF) in 2006 may have contributed to a decline in recovered MSW totals. Reductions in 'miscellaneous' totals are unknown.

### 10.3 Source Sector

The Zero Waste Plan Development Scheme (ZWPDS), initiated by the DEC in 2007 was developed to assist local governments in the development of strategic waste management plans (SWMP) for their region. Phase 1 of the two-phase scheme aimed to establish baseline waste and recycling data from local governments across the State. The ZWPDS specifically concentrated on the municipal sector however limited data was collected from the C&I and C&D sectors.

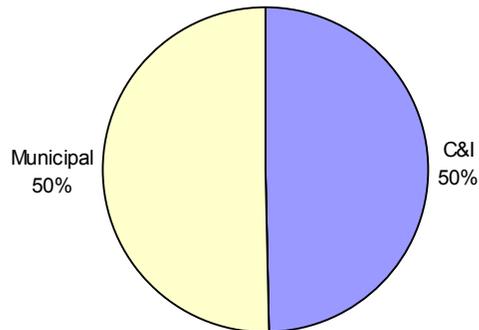
Data gathered from 91% of Western Australia's local governments that participated in Phase 1 of the scheme enabled DEC to gather an accurate picture of the state of municipal waste recycling in Western Australia. Approximately 109,630 tonnes of green waste was recovered across the State (89,840 tonnes metro / 19,790 tonnes regional) (DEC 2008).

Organics diverted through Alternate Waste Technology (AWT) or resource recovery recovered approximately 51,900 tonnes of organics from the municipal sector during 2006/07 (DEC 2008). RRF's currently in operation are the SMRC facility in Canning Vale and the ATLAS facility in Mirrabooka. These facilities allow the organic waste disposed in residential garbage bins to be recovered. These facilities can also, to an extent, recover recyclables from the waste stream. The ATLAS facility covers residents throughout the City of Stirling, whilst the SMRC facility processes waste for all residents in the Cities of Cockburn, Canning, Fremantle, Melville, South Perth and Town of East Fremantle and Rottneest. Approximately 50 - 60% of the total waste stream accepted can be recovered for recycling from these facilities.

Using ZWPDS Phase 1 municipal data provided by the DEC and data provided by Compost Australia, a split between C&I and municipal source sectors can be predicted. Assumptions used for this approach are outlined in **Section 2.2**. Approximately 70%

(369,810 tonnes) of organics recovered in Western Australia during 2006/07 was from the C&I sector and approximately 30% (161,530 tonnes) was from the municipal sector. If DEC assumptions are used in regards to 'true' organics recycling (Table 10.2) then there is an approximate 50 / 50 split between organics recycling in the municipal (161,530 tonnes) and C&I (159,030 tonnes) sectors.

**Figure 5.3: Source sector of organics recovered in Western Australia during 2006/07**



Note: Material type source sectors included have been assumed by the DEC to be 'true' organics recycling categories (see Table 10.2). The inclusion of all sectors would give a 70/30 split in favour of C&I

### 10.3.1 Expected Increase

Confirmed resource recovery facilities in the Western Metropolitan Regional Council (WMRC) and Mindarie Regional Council (MRC) will increase the recovery of the organic waste stream from MSW in the near future. RRF's are also proposed for the Rivers Regional Council (formerly the South-Eastern Metropolitan Regional Council (SEMRC)) and the EMRC. The Anaeco facility at the Brockway Transfer Station (set to process 55,000 tonnes annually) is scheduled to open in late 2008, whilst the Biovision 2020 facility (set to process 100,000 tonnes) is scheduled to open in early 2009 in Neerabup. Therefore, the recovery of organic material from the municipal waste stream is likely to increase over the coming years.

In terms of expected increases in C&I activity, timber recycling through shredding of disused material has emerged as a viable option. As discussed in Section 4.1 the EMRC has taken the first steps in reducing this waste stream in the Eastern Regions of the Metropolitan Area with the Hazelmere Timber Recycling Facility commencing operations in early 2008. There are opportunities for the expansion of this facility in the near future and the development of additional timber recycling facilities in other regions of the Metropolitan Area.

## 10.4 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 relative 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. Recovered municipal organics from resource recovery facilities are transported onto farmland, returning organics back to the soil.

## 10.5 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 most 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. Development of new products / markets (particularly agriculture)
5. Financial incentives for growers (e.g. rebate)
6. Downward pressures on prices/quality from increasing supply (oversupply)
7. Uncompetitive / non-commercial competition in service delivery from local govt facilities, driving price / quality down

The barriers listed above are almost identical to the barriers identified in the previous financial year in terms of priority. The exception is the development of new products / markets (particularly agriculture) which was given a higher ranking in 2006/07.

There are a number of opportunities for increased recovery of organics from the municipal and C&I organics recycling industries. In terms of municipal waste, current RRF's can only process a proportion of total municipal wastes in each region due to input constraints, however future phases are proposed for each of the RRF's in each Regional Council with the vision of processing all waste in each region.

Whilst recycling of a number of C&I organics waste categories has been successful, large amounts of organics from the sector are still being sent to landfill. Golder Associates and Waste Audit in 2007 (using a qualitative assessment) approximated that 53% of all C&I material sent to landfill is kitchen waste (27%), wood/timber (15%) and cardboard (11%). The high proportion of these material continuing to be sent to landfill is possibly the result of relatively low disposal costs, difficulty in separating waste streams and the absence of technologies (unlike the municipal sector) in terms of MRF's and RRF's.

Whilst there are opportunities for the C&I sector to mimic the municipal sector in terms of recovery of these waste streams, the recycling of kitchen, timber and cardboard and other C&I waste streams (and the technology used for recovery) is dependant on the economics and current regulations in place. Without these cost drivers and / or regulations by Government it is likely a large proportion of waste will continue to be sent to landfill.

## 11. RECYCLING TRENDS

Based on feedback provided by the recycling industry, recycling trends have remained fairly similar to those observed during the previous financial year. A number of industries, namely paper and organics, have reported static growth in terms of recyclables received, whilst other industries such as plastics have reported an increase in volume of material being received. Overall the trend is for increased recycling of material in Western Australia in the future. This is mostly being driven by population increases, increased economic activity, increasing commodity prices and increased awareness about recycling. 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 (2005/06)    | Trend (2006/07)     | Reason   |
|------------------------------------|--------------------|---------------------|--|
| <b>Construction and Demolition</b> |                    |                     |  |
| Sand, Concrete, Rubble             | Increasing         | Increasing          | High growth in commercial and residential construction sector          |
| Whole Bricks                       | Static/Increasing  | Static/Increasing   | Demolition of older building in inner suburbs                          |
| Timber                             | Increasing         | Increasing          | Increased policing at inert landfills by the DEC                       |
| Metals                             | Static             | Increasing          | High construction and demolition activity. Higher value                |
| <b>Metal</b>                       |                    |                     |  |
| Aluminium                          | Static             | Static              | Low market value   |
| Non-Ferrous Metals                 | Static/Increasing  | Static/Increasing   | High demand from China   |
| Steel                              | Increasing         | Increasing          | High growth in WA / Mining sector. High demand local and international |
| Steel and Aluminium Cans           | Static             | Static / Decreasing | Possible greater use of glass in products                              |
| Automotive Batteries               | Static/Decreasing  | Static/Increasing   | Increasing value   |
| <b>Paper</b>                       |                    |                     |  |
| Newsprint/Magazines                | Increasing         | Static              | N/A  |
| Cardboard/Paper                    | Increasing         | Increasing          | High economic activity   |
| Mixed Paper                        | Increasing         | Static              | N/A  |
| Printing/Writing Paper             | Increasing         | Static              | Poor access to city and high labour costs                              |
| Directories                        | Static/ Decreasing | Static              | Low market value   |
| <b>Glass</b>                       |                    |                     |  |
| Container Glass                    | Static             | Increasing          | Possible greater use of glass in products                              |
| <b>Plastic</b>                     |                    |                     |  |
| Type 1 (PET)                       | Increasing         | Static              | Industrial increase, municipal decrease                                |
| Type 2 (HDPE)                      | Increasing         | Increasing          | Accessing regional areas   |
| Type 3 (PVC)                       | Static             | Increasing          | Community / industry awareness   |
| Type 4 (LDPE)                      | Increasing         | Increasing          | Community / industry awareness   |
| Type 5-7 (PP, PS, EPS, ABS, Nylon) | Static/Increasing  | Increasing          | Increased market knowledge.  |
| <b>Rubber</b>                      |                    |                     |  |
| Tyres                              | Varied             | Increasing          | Greater community awareness  |
| <b>Textiles</b>                    |                    |                     |  |
| Clothing                           | Varied             | Varied / Static     | Varies with climate, Labour shortage. Removal of charity bins          |
| <b>Organics</b>                    |                    |                     |  |
| Compost                            | Increasing         | Static              | Over supply in the marketplace   |
| Shredded Greenwaste                | Increasing         | Static              | Over supply in the marketplace   |

## 12. MATERIAL RECOVERY FACILITIES

### 12.1 Introduction

A Material Recovery Facility (MRF) is a transfer station for the separation of recyclables into material types. Material recovery is achieved through conveyor systems, manual handling and mechanical sorting systems. Packaging waste from households including aluminum cans, steel cans, glass, plastics (type 1, 2 and 3), cardboard, newspaper and liquid paperboard cartons are generally accepted, however, Type 4, 5, 6 and 7 plastics may also be recovered depending on the marketability of the material. Recovered products are bailed and then sent to local, national or international markets to be reprocessed into new products. Any non-recyclable material or residual material sent to the MRF is removed and sent to landfill

MRF's generally source their material from local government weekly or fortnightly kerbside collections. Collection containers used can vary from mobile garbage bins (240L or 140L), to crates or calico bags. A few local governments (e.g. City of Subiaco) offer residents a two bin system to source separate paper products and co-mingled recyclables at the kerbside.

MRF's are currently located in a number of metropolitan and regional locations throughout Western Australia and can either be operated by the local government solely, by a private operator or in a joint venture. Details of MRF's currently in operation in Western Australia are outlined in **Table 12.1**.

**Table 12.1 MRF's currently in operation in Western Australia**

| Facility                  | Owner                             | Location   |
|---------------------------|-----------------------------------|------------|
| <b>Metropolitan</b>       |                                   |            |
| Bayswater MRF             | Cleanaway                         | Bayswater  |
| Wangara MRF               | City of Swan, Wanneroo, Joondalup | Wangara    |
| Roads and Robinson        | Roads and Robinson                | Maddington |
| Mandurah MRF              | Cleanaway / City of Mandurah      | Mandurah   |
| Australian Paper Recovery | Australian Paper Recovery         | Bibra Lake |
| <b>Regional</b>           |                                   |            |
| Albany MRF                | Cleanaway                         | Albany     |
| Pilbara MRF               | Shire of East Pilbara             | Newman     |
| Esperance MRF             | Shire of Esperance                | Esperance  |
| Greens Recycling          | Greens Recycling                  | Bunbury    |
| South West Recycling      | South West Recycling              | Bunbury    |
| Broome MRF                | Shire of Broome                   | Broome     |
| Wickepin MRF              | Shire of Wickepin                 | Wickepin   |
| York MRF                  | Avon Waste                        | York       |
| Katanning MRF             | Shire of Katanning                | Katanning  |
| Kalgoorlie MRF            | Cleanaway                         | Kalgoorlie |

As part of the State's obligations as a signatory to the National Packaging Covenant, for this year's review additional information has been collected from both private MRF operators and local governments if, in its district under the Local Government Act 1995, the local government operates a MRF/RRF.

The following information was collected:

- The percentage of premises covered by the system and the number of premises participating in the system (including a breakdown of whether premises are residential or non-residential);
- The fee (if any) charged in relation to each premises for the system;

- The total weight of recyclable material collected by the system by material type and, if the material is then sorted,
  - The total weight of each material type sold or sent for reuse, recycling or energy recovery; and
  - The total weight of the residual fraction of each material type then disposed to landfill.

## 12.2 Premises Covered by System

Local government areas (LGAs) which provide a kerbside recycling system at present include all LGA's in the Perth Metropolitan Area, a number of LGAs in coastal and wheatbelt areas of the south-west and some regional centres. LGAs covered by the system and an approximation of the total number of households covered by the system is outlined in **Table 12.2**. Approximations have been prepared from DEC's ZWPDS phase 1 data and Cardno's infrastructure knowledge of Western Australia.

**Table 12.2: Premises in Western Australia covered by a recycling kerbside collection system, 2006/07**

|                          | Local Governments | Households     | Coverage (%) |
|--------------------------|-------------------|----------------|--------------|
| <b>Metropolitan Area</b> | 30                | 589,690        | 100*         |
| <b>Regional Area</b>     | 30                | 123,840        | 51           |
| <b>TOTAL</b>             | <b>60</b>         | <b>713,530</b> | <b>84</b>    |

Source: ZWPDS Phase 1 Data and ABS 2006 census data  
 Note:
 

- For LGA's that did not submit household data in Phase 1, ABS Census 2006 data has been used
- City of Stirling has a 1-bin RRF system (composting + co-mingled recycling). It has been assumed this is classified as a kerbside recycling system
- It has been assumed all metropolitan households have access to a kerbside recycling service. It is possible some households in isolated areas may not receive a service

During 2006/07 there were approximately 849,010 households in Western Australia. Of these households, approximately 84% are provided with a kerbside recycling collection service.

There is currently 100% coverage of households in the Perth metropolitan area with a kerbside recycling system. Approximately 51% of households in regional areas are also provided with a kerbside recycling system. These systems can vary amongst local government from 240L co-mingled recycling bins to crate systems.

The number of commercial premises covered by the system is limited as kerbside recycling collection systems generally target the municipal sector. However, depending on the LGA, a kerbside collection service may be provided. As the collections are conducted in conjunction with the municipal sector collections the number of commercial premises covered by the system and their potential tonnage recovery is uncertain.

## 12.3 Fees charged for the system

Processing fees charged for a recycling system can vary due to a number of variables. These include labour costs, disposal of residue, commodity prices and transport costs and may include MRF advancement costs and capital costs.

Processing fees charged in the metropolitan area can range between \$30 - \$60 per tonne. If an average collection of 14 kilograms / household / fortnight is assumed then the annual household cost is approximately \$10 – 20 per year. The cost in regional areas can vary depending on the collection area (e.g. regional centre or small town). Based on feedback from MRF's the processing component of a recycling service can range vary between \$35 - \$220 per tonne or \$12 - \$80 / household / year.

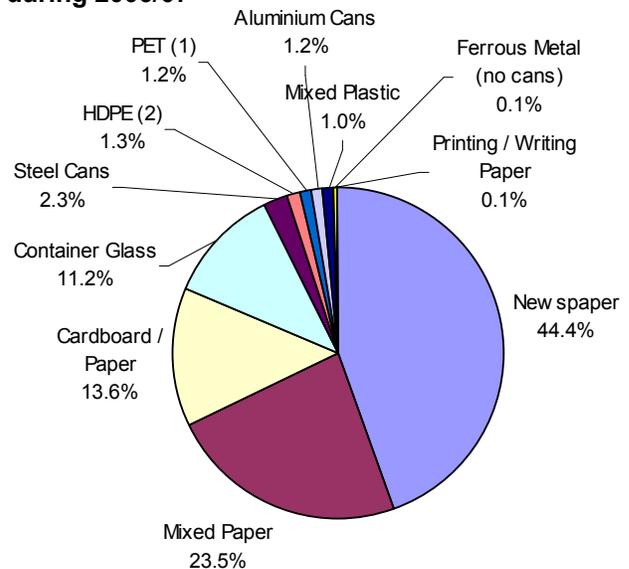
## 12.4 Total Recovery of Materials

Approximately 106,870 tonnes of material was reported to be recycled through Western Australia's MRF's during the 2006/07 financial year. This total includes all metropolitan MRF's, however totals from a number of regional MRF's were not attained (namely Wickpin, Broome, Pilbara, Kalgoorlie, Katanning and the York MRF). If these totals were included the total would be higher.

Paper product grades such as newspaper, mixed paper and cardboard / paper represent over 81% of the total material recovered by MRF's by weight from kerbside recycling collection systems during 2006/07. Container glass also represents a significant proportion of total recovered material (11,970 tonnes or 11%). Approximately 3,790 tonnes of plastics and 3,870 tonnes of metals were also recovered. It must be noted that the tonnages represented in **Table 12.3** are the tonnages recovered by MRF's that are marketable.

**Table 12.3 / Figure 12.1: Total recovery and composition of materials recovered (in tonnes) from MRF's in Western Australia during 2006/07**

| Material Type               | Tonnes         |
|-----------------------------|----------------|
| Newspaper                   | 47,420         |
| Mixed Paper                 | 25,100         |
| Cardboard / Paper           | 10,030         |
| Container Glass             | 11,970         |
| Directories                 | 4,550          |
| Steel Cans                  | 2,430          |
| HDPE (2)                    | 1,440          |
| PET (1)                     | 1,270          |
| Aluminium Cans              | 1,270          |
| Mixed Plastic               | 1,080          |
| Ferrous Metal (no cans)     | 160            |
| Printing / Writing Paper    | 100            |
| Waxed Paper                 | 40             |
| Non-ferrous Metal (no cans) | 10             |
| <b>TOTAL</b>                | <b>106,870</b> |



Note: - This is not an exhaustive reflection of total municipal kerbside recycling activity in Western Australia. Please use data with caution  
- Compostable material (i.e. newspaper and cardboard) from the SMRC / ATLAS plant has not been included in the total above.

All marketable materials recovered by MRF's are sent to local, interstate or international markets for reprocessing into new materials.

## 12.5 Residual Fraction Disposed at Landfill

Due to the recycling practices of the West Australian population and processes involved in the recycling of kerbside municipal material, an unmarketable residual fraction of material, known as contamination, is generated from MRF's. This unmarketable material requires landfilling at the end of the process. Approximately 40,420 tonnes, or 28% of total material received was required to be sent to landfill from MRF operators in 2006/07 (**Table 12.4**).

**Table 12.4: Total tonnages of material received, recycled and disposed to landfill and proportion residual in percentage during 2006/07**

|                   | Tonnes    |
|-------------------|-----------|
| Received          | 146,790   |
| Recycled          | 106,870   |
| Landfilled        | 40,420    |
| <b>% Residual</b> | <b>28</b> |

An audit of residual material was conducted by APrince Consultants for three MRF's in the EMRC during 2004 (Cleanaway Bayswater, Roads and Robinson Maddington and Wangara MRF). The composition of the residual waste streams is as follows:

- 46% broken bottles and glass fines;
- 20% paper and cardboard;
- 8% recyclable containers;
- 8% non recyclable plastics and containers;
- 3% organics; and
- 16% "other" materials

Therefore the greatest amount of material requiring to be sent to landfill from MRF's is broken glass / glass fines and paper and cardboard. The high amount of paper and cardboard in the residual fraction can be attributed again to glass fines contaminating the paper product and making it unmarketable. As outlined in **Section 6** glass breakage occurs in many areas of the recycling process. The low value of glass, limited markets, breakage and contamination of other recyclables make glass a problematic material in kerbside recycling systems.

**Photo 12.1: Typical example of the residual fraction from the Cleanaway MRF in Mandurah**



## 12.6 Barriers / Opportunities outlined by Material Recovery Facilities

Barriers and their associated rank outlined by MRF's which limit the amount of material being recycled or reprocessed are outlined in **Table 12.5**. As businesses operate under different circumstances, barriers to further recycling can vary. Therefore, an average rank has been set.

**Table 12.5: Barriers and rank outlined by Material Recovery Facilities**

| BARRIER                                      | Very Low | Low | Medium | High | Very High |
|--|----------|-----|--------|------|-----------|
| Limited space                                |          |     |        |      |           |
| Competition                                  |          |     |        |      |           |
| Contamination                                |          |     |        |      |           |
| Low landfill levies in WA                    |          |     |        |      |           |
| Your organisation paying landfill levies     |          |     |        |      |           |
| Labour shortage / reliable staff             |          |     |        |      |           |
| Efficiency of machinery                      |          |     |        |      |           |
| Local government restrictions                |          |     |        |      |           |
| Transport costs                              |          |     |        |      |           |
| Lack of government assistance                |          |     |        |      |           |
| Supply shortage                              |          |     |        |      |           |
| Lack of markets                              |          |     |        |      |           |
| Market value of recovered material           |          |     |        |      |           |
| Bin configurations of LGA's                  |          |     |        |      |           |
| Recycling culture of government and industry |          |     |        |      |           |

MRF's, unlike other recycling industries have not identified any very high barriers to increased recycling. The largest barriers to increased recycling include the current shortage of labour / reliable staff, transport costs, lack of government assistance, market value of recovered materials and the recycling culture of government and industry.

Opportunities and their associated rank outlined by MRF's which have the potential to increase the amount of recyclables being recycled or reprocessed are outlined in **Table 12.6**. Opportunities in italics are additional opportunities outlined by MRF's

**Table 12.6: Opportunities and rank outlined by Material Recovery Facilities**

| OPPORTUNITIES   | Very Low         | Low | Medium | High | Very High |
|---|------------------|-----|--------|------|-----------|
| Implementation of a container deposit system (CDS)*     |                  |     |        |      |           |
| Subsidies for transport                                 |                  |     |        |      |           |
| Commercial company collection                           |                  |     |        |      |           |
| Move from bag/crate to MGB                              |                  |     |        |      |           |
| Assistance with landfill levies                         |                  |     |        |      |           |
| Community / business education programs                 |                  |     |        |      |           |
| Make it easier for recycling companies to obtain grants |                  |     |        |      |           |
| <i>Removal of glass from kerbside</i>                   | No rank provided |     |        |      |           |

Note: Implementation of a CDS had a very wide range response from MRF operators from very low to very high

Opportunities outlined by MRF's for greater recovery of recyclables include LGA's moving away from bags / crates and towards mobile garbage bins (MGBs) and making it easier for recycling companies to obtain grants from government.

## 13. CONCLUSIONS AND RECOMMENDATIONS

### 13.1 Conclusions

There has been a continued increase in the amount of recycling activity in Western Australia during 2006/07. A number of recycling sectors, in particular plastics (36% increase), metals (17% increase) and glass (16% increase) have shown strong growth during 2006/07.

Organics has continued to account for the highest tonnage of recovered material at 531,340 tonnes. Metal (501,300 tonnes), C&D material (403,870 tonnes) and paper (225,760 tonnes) were also recovered in high tonnages. Whilst organics was recovered in the highest tonnage, there has been a marked decline in organics recycling of approximately 8% since 2005/06.

Whilst a number of major barriers outlined by recyclers limiting further growth in recycling activity in Western Australia are largely being felt across industry in general (increased transport costs, labour costs and running costs and the availability of staff) there are a number of specific barriers that relate directly to the recycling industry. These barriers include the low landfill gate fees and levies at present (especially in regional areas), contamination of material and an uneducated marketplace.

The marketability of recycle products varies widely depending on the product. For example the market for glass is currently very poor, whereas the market for recycled C&D and metal products is currently very high with demand currently outstripping supply. Whilst demand is very strong for some products, very large quantities of potentially recyclable product are continuing to be disposed to landfill.

As outlined in last year's report, despite the high demand for some products, there is reluctance among recyclers to expand their businesses due to low landfill gate fees in Western Australia making it difficult to attract feedstock. Landfill costs in Western Australia fall well below those in the Eastern States where high landfill levies (\$30+ per tonne) are driving material to recycling companies.

Ironically, whilst recyclers are requesting an increase in the landfill levy to attract feedstock, increases in putrescible landfill gate fees are now forcing industry and recyclers to transport putrescible residues outside the metropolitan area where landfill gate fees are lower. Theoretically regional landfills should charge waste producers from the metropolitan area the landfill levy, however proving loads are from the metropolitan area can be problematic. It is likely that a number of waste producers are avoiding paying the landfill levy.

During 2006/07, Western Australia had a significant closure, the AMCOR reprocessing paper mill in Spearwood. The closure of this facility has had a significant impact on the amount of recovered material Western Australia now reprocesses locally. Collected paper products are now being baled and either sent to pulp mills in the Eastern States or exported to Asia. This recent closure of the AMCOR paper mill attests that the reprocessing market in Western Australia at present is not strong enough, especially with the emergence of major manufacturing hubs in Asia. With the exception of low value materials such as C&D material, organics and textiles most material is now being exported out of the State for reprocessing into new materials.

In comparison to the other States, Western Australia continues to have the lowest recovery per capita basis (811 kg / person / year). Western Australia is still well below the levels achieved in South Australia, Victoria and the ACT with these States now recycling in excess of 1.2 tonne / person / year.

Whilst Western Australia still lags behind other States in terms of recycling activity and waste reduction, there have been a number of announcements made by the State Government over the past year in regards to waste minimisation. These include a ban on used tyres to landfill in the metropolitan area and some regional centres by 2011, enforcement of the landfill guidelines in regards to timber waste being accepted at inert landfills and a gradual increase in the landfill levy for putrescible and inert landfills until 2010. The State Parliament also passed the Waste Avoidance and Resource Recovery (WARR) Bill in 2007. This legislation has already established a new statutory WasteSmart WA Authority and will also allow for the possibility of Extended Producer Responsibility (EPR) and Container Deposit Systems (CDS) to be established in the State. These measures are likely to drive recycling activity in Western Australia and reduce the amount of waste material disposed to landfill.

Finally, unfortunately, accurate data about the quantity of each material stream landfilled in Western Australia (with possibly now the exception of municipal waste through the ZWPDS) 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.

### **13.2 Recommendations**

As discussed throughout the document, there are many opportunities to increase the amount of material being recovered in Western Australia if the barriers can be overcome.

For recycling activity to increase raw (waste) materials obviously need to be diverted from landfill. There are a number of strategies to achieve this objective, including landfill bans for certain materials, increased landfill gate fees (via increased landfills levies), increased demand for recycled materials and empowering industry and the community with knowledge in regards to waste management.

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 will allow the increased demand for recycled products to stimulate growth of the industry. Markets can be developed and expanded using a number of approaches including market research, the development of product specifications and standards and by the increased procurement of recycled content products, led by government.

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 or synergies with logistics companies through backloading of recyclable material onto trucks heading back to Perth. Currently, the only container port in Western Australia is in Fremantle which limits recyclable material in northern regional areas from being able to be directly exported.

Whilst higher value materials, such as metals and plastics can incur the higher transport costs to interstate or international reprocessing facilities to make recycling viable, the level of local reprocessing infrastructure needs to increase if the recovery of lower value materials is to grow. Lower value materials such as organics, C&D waste and glass cannot justify higher transport costs to interstate or international locations. The Eastern States at present, especially Victoria and South Australia, currently have an environment which makes it much more attractive to recycle, especially in regards to recycling of high tonnage C&D materials. If Western Australia could divert 50% of C&D material from landfill, Western Australia would then be comparable with the Eastern States with a recovery per capita in excess of 1 tonne per person. This could be easily achievable with a push from government

and industry towards the recycling and uptake of recycled building products in construction activities in conjunction with an increase in the cost of Class I inert landfills.

The estimated degree of accuracy for the recovery of material types is outlined below in **Table 12.1**

**Table 12.1: Estimated Degree of Accuracy for Recycling Activity Data, Western Australia 2006/07**

| Material                            | Total Recovery   | Estimated degree of accuracy |
|-------------------------------------|------------------|------------------------------|
| <b>Construction and Demolition</b>  |                  |                              |
| Sand                                | 214,720          | High ( $\pm 5\%$ )           |
| Brick and Rubble                    | 64,770           | High ( $\pm 5\%$ )           |
| Concrete / Bitumen                  | 102,260          | High ( $\pm 5\%$ )           |
| Bricks (Whole)                      | 12,120           | Moderate ( $\pm 10\%$ )      |
| Timber                              | 10,000           | Moderate ( $\pm 10\%$ )      |
| <b>Total C&amp;D</b>                | <b>403,870</b>   |                              |
| <b>Metal</b>                        |                  |                              |
| Aluminium                           | 13,910           | High ( $\pm 5\%$ )           |
| Aluminium Cans                      | 1,700            | Moderate ( $\pm 10\%$ )      |
| Batteries                           | 4,300            | Moderate ( $\pm 10\%$ )      |
| Non Ferrous (Other than Al)         | 22,930           | High ( $\pm 5\%$ )           |
| Steel (non packaging)               | 457,460          | High ( $\pm 5\%$ )           |
| Steel (packaging)                   | 1,000            | Moderate ( $\pm 10\%$ )      |
| <b>Total Metal</b>                  | <b>501,300</b>   |                              |
| <b>Paper</b>                        |                  |                              |
| Newsprint & Magazines               | 91,010           | Moderate ( $\pm 10\%$ )      |
| Cardboard / paper packaging         | 77,560           | Moderate ( $\pm 10\%$ )      |
| Mixed Paper                         | 42,770           | Moderate ( $\pm 10\%$ )      |
| Printing & writing paper            | 14,200           | Moderate ( $\pm 10\%$ )      |
| Directories                         | 220              | Moderate ( $\pm 10\%$ )      |
| <b>Total Paper</b>                  | <b>225,760</b>   |                              |
| <b>Organics (Compost Australia)</b> |                  |                              |
| All Organics                        | 531,340          | not applicable               |
| <b>Total Organics</b>               | <b>531,340</b>   |                              |
| <b>Glass (ACI)</b>                  |                  |                              |
| Container Glass                     | 20,800           | High ( $\pm 5\%$ )           |
| <b>Total Glass</b>                  | <b>20,800</b>    |                              |
| <b>Plastic (PACIA)</b>              |                  |                              |
| Domestic Packaging                  | 13,970           | not applicable               |
| Industrial Packaging                | 0                | not applicable               |
| Non-packaging                       | 4,160            | not applicable               |
| <b>Total Plastic</b>                | <b>18,130</b>    |                              |
| <b>Rubber</b>                       |                  |                              |
| Rubber Tyres                        | 5,550            | High ( $\pm 5\%$ )           |
| <b>Total Rubber</b>                 | <b>5,550</b>     |                              |
| <b>Textiles</b>                     |                  |                              |
| Clothing                            | 1,550            | Moderate ( $\pm 10\%$ )      |
| <b>Total Textiles</b>               | <b>1,550</b>     |                              |
| <b>TOTAL ALL MATERIALS</b>          | <b>1,708,300</b> |                              |

## 14. CONTACT LIST

Outlined below are the recycling companies consulted for the 2006/07 Recycling Review

| 2006/07 Recycling Company Contact List |                 |                                    |
|--|-----------------|------------------------------------|
| KEY                                    |                 |                                    |
| 2005/06 Report                         |                 |                                    |
| Extras 2006/07 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                 |
|  | Closed Down     | Courtyard Recycled Bricks          |
|  | Yes             | Recycled Brick Cleaning Company    |
|  | No              | Laminex                            |
|  | No              | Brajkovitch Demolition             |
|  | No              | Red Sands                          |
| Yes                                    | Midland Brick   |                                    |
| <u>Metals</u>                          |                 | MRFs                               |
|  | Yes             | Bulk Metal                         |
|  | Yes             | Collins Recycling Depot            |
|  | No              | Auscon                             |
|  | Yes             | Allied                             |
|  | Yes             | Laurance Scrap Metals              |
|  | No              | C.D Dodd                           |
|  | Yes             | Bradken                            |
|  | Yes             | A1                                 |
|  | 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                       |
|  | Closed Down     | JBI Recycling                      |
|  | No              | Recall SDS                         |
|  | No              | Cool or Cosy                       |
| <u>Paper</u><br>(Insulation Companies) | Yes             | BGC                                |
|  | Yes             | Brett Heady                        |
|  | Yes             | Peel Insulation                    |
|  | Yes             | Ultra Block                        |
|  | Yes             | Insulfibre                         |
|  | Yes             | Termico Insulation                 |

|                        |                    |   |
|------------------------|--------------------|---|
| <b>Plastics</b>        | Yes                | MRFs                                      |
|                        | Yes                | Pot Recyclers                             |
|                        | Yes                | CLAW Environmental                        |
|                        | Yes                | VISY                                      |
|                        | Yes                | JoJo Plastics                             |
|                        | Yes                | Vinidex                                   |
|                        | Yes                | RecyclePlas                               |
| <b>Closed Down</b>     | ELITE              |   |
| <b>Tyres</b>           | Yes                | Tyre Recyclers                            |
|                        | Yes                | G&F Beltline Services                     |
|                        | Yes                | Reclaim Industries                        |
|                        | Yes                | Tyre Waste WA                             |
| <b>Glass</b>           | No                 | MRFs                                      |
|                        | Yes                | 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                       |
|                        | No                 | Westoz Rag Supplies                       |
|                        | Yes                | West Coast Rag Pty Ltd                    |
|                        | Yes                | T&M Cloth                                 |
|                        | No                 | Perth Textiles                            |
| <b>MRFs - Metro</b>    | Yes                | Wanneroo / Swan / Joondalup (Wangara)     |
|                        | Yes                | Cleanaway (Albany, Bayswater, Mandurah)   |
|                        | Yes                | Roads and Robinson (Maddington)           |
|                        | Yes                | ATLAS (Mirrabooka)                        |
|                        | Yes                | SMRC RRF (Canning Vale)                   |
|                        | Yes                | Australian Paper Recovery (Bibra Lake)    |
| <b>MRFs - Regional</b> | No                 | Pilbara Recycling (Newman)                |
|                        | No                 | Wickepin Recycling (Wickepin)             |
|                        | Yes                | Green Recycling (Bunbury)                 |
|                        | <b>Closed Down</b> | Kalgoorlie Boulder Recycling (Kalgoorlie) |
|                        | Yes                | Esperance Recycling (Esperance)           |
|                        | Yes                | South-West Recycling (Bunbury)            |

## 15. GLOSSARY

|  |   |
|--|---|
| <b>Composting</b>                                  | Composting is the controlled breakdown or decomposition of organic materials under aerobic (i.e. with air) or anaerobic (i.e. without air) conditions.  |
| <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>Material Recovery Facility</b>                  | Facility that receives and separates co-mingled recyclables by material type for baling and transfer  |
| <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.

**Municipal Solid Waste (MSW)**

(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.

**Paunch**

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.

**Putrescible**

Wastes that will decompose readily under microbial attack and include green waste, food waste, paper, biosolids, manures and sludges.

**Resource Recovery**

Changing waste into potentially useful products (such as compost or 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.

**Resource Recovery Facility**

Facility that receives, separates and processes waste into potentially useful products (such as compost or fuel for energy production) through thermal, biological or mechanical means

**Resource Recovery Rebate Scheme (RRRS)**

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.

**Re-use**

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.

## 16. 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                     |
| LGA   | Department of Environment                     |
| MRF   | Material Recovery Facility                    |
| MWAC  | Municipal Waste Advisory Council              |
| PACIA | Plastics and Chemicals Industries Association |
| RRF   | Resource Recovery Facility                    |
| RRRS  | Resource Recovery Rebate Scheme               |
| ZWPDS | Zero Waste Plan Development Scheme            |

### Plastics

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

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