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Zero Waste SA

Stage 1 Final Report – Study on the South Australian Plastics Packaging Resource Recovery Sector

April 2012

- IMPORTANT NOTES-

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Executive Summary

Zero Waste SA is seeking to improve its understanding of the waste plastics packaging sector in South Australia with a view to developing strategies to support implementation of the Environmental Protection (Waste-to-Resources) Policy 2010 (W2REPP).

This study is the first stage in achieving this objective.

This study has:

- Identified and described the key attributes of plastic packaging and its life cycle, including how it becomes a waste material and is recovered for recycling in South Australia.
- Provided a detailed picture and understanding of current and future quantities of plastic packaging being consumed, resource recovered, re-processed and disposed of to landfill in South Australia.
- Through consultation with industry stakeholders, including brand owners and packaging manufacturers, identified and described the key challenges and opportunities for South Australia in improving current resource and recovery rates for plastic packaging.

The main conclusions of this study are as follows.

- South Australia recovers 13,000-15,000tonnes/yr of plastic packaging for recycling from 40,000-50,000tonnes/yr of plastic packaging material consumed – a recovery rate of about 25-30% for this material.
    - Over the next 10yrs these volumes of recovered plastic packaging may increase substantially (e.g. nearly double) because of the W2REPP requirement that all metropolitan Commercial & Industrial waste is subject to resource recovery before disposal to landfill.
    - Imported plastic packaging could be a growing contributor to waste plastics packaging quantities being collected in South Australia, which may not be reflected in current national survey statistics for plastics consumption and recycling.
- This recovery rate for plastics packaging in South Australia, whilst considered low, is relatively good when compared with the performance of most other Australian states and territories.
- The recovery rates in South Australia between different packaging polymers, however, vary widely.
    - For some polymers, such as PVC and PS, there is almost negligible resource recovery being achieved.
- About 30-40% (i.e. *ca.* 5,000tonnes/yr) of the recovered plastic packaging is re-processed in South Australia, with the remainder exported for re-processing interstate or overseas.

Thus, there is considerable scope for South Australia to improve its recovery rate of plastic packaging, as well as expand its local re-processing capability.

However, there are number challenges confronting South Australia in achieving this outcome. These challenges can be overcome by exploiting opportunities identified by this study.

Both the challenges and opportunities are extensively detailed in Table 5.1 of this report.

Also recognised in this table are potential ‘change agents’ or stakeholders that could be involved in initiating, developing, funding, supporting and/or participating in the implementation of the identified opportunities.

For some of the identified opportunities, these potential ‘change agents’ or stakeholders may involve collaborations bridging multiple aspects of plastic packaging life cycle; and thus, could involve brand owners, packaging manufacturers, manufacturing businesses, consumers, government agencies, waste collectors, recycling depots, resource recovery facility operators and/or re-processors.

In this respect, the role of the consumer in making a correct decision about what can be recycled, and then disposing of it properly so it can be recovered for recycling, is vitally important.

Several opportunities identified offer potentially new approaches for improving resource recovery and re-processing of plastic packaging; such as ‘Life Cycle’ Product Stewardship initiatives which would involve supply chain integration of disposal and reuse of recycled plastics products by the organisations that generate this waste plastic packaging material. Other opportunities identified could significantly encourage innovation by the local industry, and help to support adoption and commercial application of emerging or cutting-edge technologies for resource recovery and re-processing of waste plastic packaging.

This information provides wide scope for Zero Waste SA to commence development of successful strategies and industry assistance programs for improving the resource recovery and re-processing of waste plastic packaging in South Australia, to support implementation of the W2REPP.

Contents

1 Introduction

Zero Waste SA has commissioned this study with the objectives of*:*

(1) *"Obtaining an in-depth understanding of the current and potential future plastics packaging sector in South Australia (SA), with a view to developing strategies to support implementation of the Waste to Resources EPP";*

And through this understanding being able to identify and develop policy strategies and industry support programs which could:

(2) *"Encourage innovation by identifying cutting-edge plastics technologies and opportunities for the potential commercial application of these technologies in SA (and/or Australia)."*

The study has been divided by Zero Waste SA into several stages.

- This report addresses Stage 1 of the study, which is focussed on the first objective (1) above: "*Develop an in-depth understanding of the South Australian situation."*
    - The specific goals for Stage 1 were to assess and understand:
        (a) Current and future SA consumption of plastic packaging by polymer type
        (b) Current and future SA industry material flows by polymer type
        (c) Consider the impact of the W2REPP[1] on the fate of the aggregated plastic packaging to be banned from landfill
        (d) Describe existing and planned SA plastic packaging resource recovery capacity and capability by polymer type
        (e) Identify current barriers/constraints for the recovery of plastic packaging.
    - In essence, Stage 1 was intended to allow Zero Waste SA to better understand and identify the main challenges and opportunities for SA in improving current recovery and recycling rates of waste plastics packaging.
- These challenges and opportunities identified in Stage 1 may be evaluated during Stage 2 of the study and used to develop preferred future strategies and practical policy and project initiatives to achieve the study's second objective (2).
- Subsequent stages in the study would then support implementation of proposed future strategies and policy and project initiatives.

This summary report sets out the key findings from Stage 1 of this study as follows.

[1] The W2REPP is the Environment Protection (Waste to Resources) Policy 2010 which was implemented by the South Australian Government under the Environmental Protection Act 1993. This policy has introduced landfill bans for certain waste materials, and new requirements for resource recovery of waste material before its disposal to landfill.

- Section 2: Background and context – gives the reader an introduction to plastics packaging and relevant context behind why this study has been commissioned.
- Section 3: Current and future industry performance – overviews the key findings from desktop analysis of current and future-projected plastic packaging resource recovery rates and recycling performance for SA.
- Section 4: Industry views and perspectives – summarises the result of consultation with the industry to obtain their viewpoints and perspectives on how SA could improve waste plastic packaging resource recovery and recycling rates.
- Section 5: Challenges and opportunities – provides a concise listing of the challenges and opportunities identified during Stage 1 of the study. Also recognized are potential 'change agents' or stakeholders that could be involved in initiating, developing, funding and/or participating in the implementation of the identified opportunities.
- Section 6: Conclusions and Stage 2 Recommendations – suggests how the identified opportunities could be further considered and evaluated during Stage 2.
- Sections 7 to 8 – provide a reference list and glossary of terms and acronyms commonly used in this report.
- Appendices –contain the:
    - Data Analysis Report developed during this stage of the study
    - List of questions which were used during industry consultations.

2 Background and context

2.1 Introduction

This section gives a brief introduction to key concepts and background behind this study.

- It is designed to inform readers at a high level of basic information about plastics packaging and its end-of-life disposal, which could assist them in interpreting the key Stage 1 findings presented later in this report.
- Where more detailed background or context information is sought, readers may wish to refer to the Data Analysis Report in Appendix A and referenced sources therein.

2.2 Plastics packaging

2.2.1 What is plastic packaging?

"Plastics packaging" may be defined as plastic material used for the containment, protection, marketing or handling of product (PACIA, 2011) – see Figure 2.1 for some practical examples.

Plastics packaging is used widely for many applications and in products we take for granted and use in our everyday lives. For instance, a simple visit to the supermarket will reveal that nearly all food, beverage, health and cleaning products of one sort or another will use some type of plastic packaging. Even when we open a box containing any type of consumer goods, we are likely to find plastic packaging inside.

Plastic packaging is generally a single use item, after which it is disposed of – and therefore it immediately finds its way into a waste stream. As a consequence, plastics packaging is considered different to "durable" plastic items or product, such as consumer electronics, furniture, and automobiles, which are used for many years before reaching 'end-of-life' and requiring disposal.

In 2009-10, a national survey of plastics consumption by the Plastics and Chemical Industries Association (PACIA, 2011) found that 27% of all plastics products manufactured in Australia were for plastics packaging[2] – refer Figure 2.2 – which was equivalent to over 0.5million tonnes of plastic packaging each year [SA's share of this national plastics packaging consumption can be inferred (on a per capita basis) from this survey at about 41,000tonnes/yr of packaging material].

[2] This national survey by PACIA did not include imported plastic packaging materials, which could substantially add to the plastic consumption occurring in Australia and South Australia.

Figure 2.1: Examples of some plastics packaging; Source: http://www.zerowaste.sa.gov.au/resource-centre/image-gallery/recycling-images, accessed 28/22012

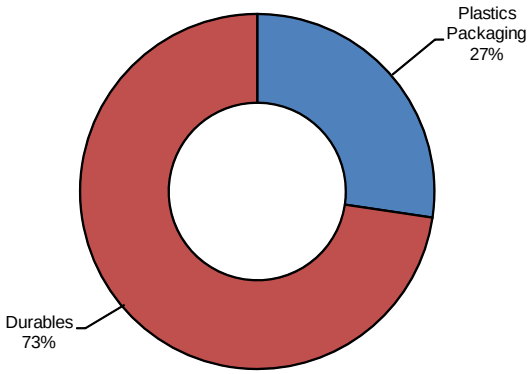

Figure 2.2: 2009-10 PACIA national survey results for plastics consumption: Durables vs. packaging (PACIA, 2011)

2.2.2 Which plastic materials are used?

Plastic packaging can be made using different types of plastics or polymers, which are based on different chemical sub-units. The most frequently used polymers are listed below. Australian packaging manufacturers usually identify the polymer on a packaging item by its Plastics Identification Code (PIC) number (PACIA, 2005). The relevant PIC No. for each polymer is included in the list below.

Polymer	PIC No.	Common packaging use(s)
Polyethylene Terephthalate (PET)	1	Plastic drink containers, e.g. soft-drink bottles, and also some film-type materials
High Density Polyethylene (HDPE)	2	Bottles and containers, e.g. milk bottles, bleach containers, and flexible bags, e.g. bread bags
Polyvinyl Chloride (PVC)	3	Bottles, e.g. cordial bottles, and some types of flexible bags
Low Density Polyethylene (LDPE)	4	Film, flexible or soft plastic packaging, e.g. blister packs, film wrap, shopping bags, garbage bags
Polypropylene (PP)	5	Bottles and containers, e.g. yoghurt container, flavoured milk bottle, and in film-type packaging
Polystyrene (PS) (inc. Expanded Polystyrene (EPS))	6	Meat and poultry trays, yoghurt and dairy containers, disposable vending cups and protective packaging for fragile items

Besides the above plastics there are also a range of other less common polymers found in plastic packaging, e.g. polycarbonates, nylon, acrylonitrile, butadiene and styrene. These other polymers also have their own individual PIC Nos. but it is common to instead find these packaging items marked with a combined PIC No. of 07-19.

As can be seen above, many of the polymers can be used for similar types of plastic packaging, and selection depends on the particular packaging properties that are required.

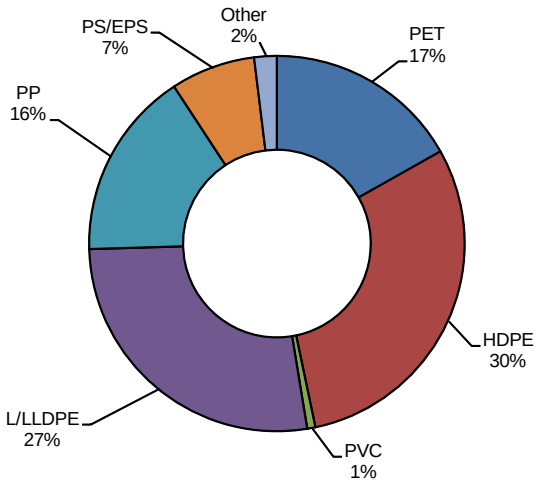

Figure 2.3: Packaging consumption in Australia by polymer as derived from 2009-10 PACIA national survey results (PACIA, 2011)

2.2.3 Recent plastic packaging trends

During the past decade there have been some important trends in how packaging is designed and manufactured[3].

- **Light weighting** – where plastics packaging is produced with the same performance properties but thinner material, meaning lighter packaging weight and less plastic material per packaging item.
- **Multi-layer (or laminated) plastics** – blended plastics, primarily films, are being increasingly produced with different types of plastics to create different barrier properties (e.g. UV protection, O_2,/H_2O/CO_2 barrier) for improved food preservation and product protection.
- **Rigids to flexibles** – there has been a shift towards using flexible packaging, e.g. pouches and sachets to reduce packaging weight.

[3] It is worth noting that some of these trends in Australia were accelerated by the implementation in 1999 of the National Packaging Covenant (NPC). The NPC was a collaborative scheme between industry and all levels of government, designed to help manage the environmental impacts of consumer packaging in Australia. In 2010, the NPC was re-branded and re-launched as the Australian Packaging Covenant (APC). Both the NPC and APC led to a number of initiatives to reduce packaging material being disposed of and facilitate the re-use and recycling of waste packaging materials. These initiatives included:

- The development of Sustainable Packaging Guidelines ('the guidelines') to assist Covenant signatories review and optimise consumer packaging to efficiently use resources and reduce environmental impact.
- The introduction of national KPIs and targets for recycling of packaging materials including for plastics packaging.

- **Single serve** – products are increasingly sold in single serve containers for customer convenience, which can increase the quantity and complexity of packaging items and reduce their size.
- **Degradable and Biodegradable-plastics** – some manufacturers are trialling degradable[4] or bio-biodegradable [5] plastics in their packaging, with the view that this is better for the environment because these plastic materials will more easily break down in landfills or can be recycled by composting.

2.3 Recovery and recycling of plastics packaging in SA

2.3.1 How does plastic packaging become a waste material?

Figure 2.4 illustrates the 'life cycle' of plastics packaging materials from manufacture right through to resource recovery and recycling.

- The upper half of this diagram shows generation, consumption and/or disposal of plastics packaging by various stakeholders.
    - Packaging manufacturers generate packaging to meet the demands and requirements of packaging brand owners[6] and or product manufacturers that require packaging materials.
    - Consumption occurs from product manufacturer right through to consumer where packaging is incorporated into products and/or products are used.
    - All stakeholders dispose of waste packaging material, even packaging manufacturers which may have to dispose of off-spec packaging items or by-product material from the manufacturing process.
- The lower half of this diagram shows the collection, resource recovery and disposal of the packaging material.
    - Collection can occur via council kerbside collections, commercial waste contractors or drop-off at a public transfer station.
    - The waste plastic material is then subject to resource recovery. During this resource recovery, it is important to note that waste plastics packaging and plastic 'durable' items

[4] Degradable plastics are usually normal petroleum-derived polymers which contain additives that cause the packaging item to eventually break down into the individual polymer molecule when disposed of to landfill or the environment. The individual polymer molecule is generally unchanged by this process.

[5] Biodegradable plastics are usually made of alternative polymer materials, which may be derived from natural sources, and which are susceptible to biological breakdown in the natural environment, leaving harmless end-products. These biodegradable plastics include bio-compostable plastics, which may be disposed of by composting processes.

[6] Brand owners are companies which own product brands that use plastic packaging. The brand owners may not necessarily be involved in the manufacture of packaging or the product. An example of such a brand owner is the major supermarket chains which sell in stores their own privately labelled products, which are supplied by other companies .

of the same polymer are generally processed together and usually end up being mixed together in the resulting product.

- If the plastic packaging is mixed with other recyclable materials (i.e. comingled), it will be processed at a Material Recovery Facility (MRF) to separate out the plastic materials.
  - In the event that the plastic packaging is also mixed with general waste, then Alternative Waste Technology (AWT) plants[7] may be involved in this resource recovery step.
- If the plastic packaging has already been (source) separated prior to collection, the resource recovery step may simply involve shredding, washing and cleaning to remove contaminants and prepare it for re-processing.

- The recovered plastic material is sent for recycling or re-processing. At this time, the plastic packaging material recovered above may again be mixed with plastic recovered from end-of-life 'durable' items.
  - In this step, the recovered plastic may be further separated and cleaned to obtain single polymer streams or mixed plastic fractions suitable for reuse or beneficiation in manufactured products.
  - Some re-processors prepare the plastic for reuse by others (i.e. (1) in Figure 2.5) whilst others directly incorporate the recovered plastic material directly into their own manufactured products (i.e. (2) in Figure 2.5)[8].
- An alternative use, which is not widely used in Australia but growing in popularity overseas, is waste-to-energy where the plastic material is converted to heat and/or electricity (i.e. (3) in Figure 2.5)[9].

[7] AWT is a generic term applied to advanced material recovery facilities that can deal with very dirty and contaminated waste streams, to recover recyclable materials. There are no AWTs currently being used in SA but these plants are used in other states for resource recovery from waste material.

[8] These manufactured products may not be the same as the original products that the waste plastic was derived from. For example, some recycled products from packaging include plastic vineyards posts, bollards, and decking. They may not also be pure plastic products, e.g. plastic-wood composite.

[9] South Australia has one of the few industry examples of waste-to-energy plants. This plant takes C&D and C&I waste material, including plastic packaging, and converts it into a fuel that is co-fired with natural gas in cement kilns.

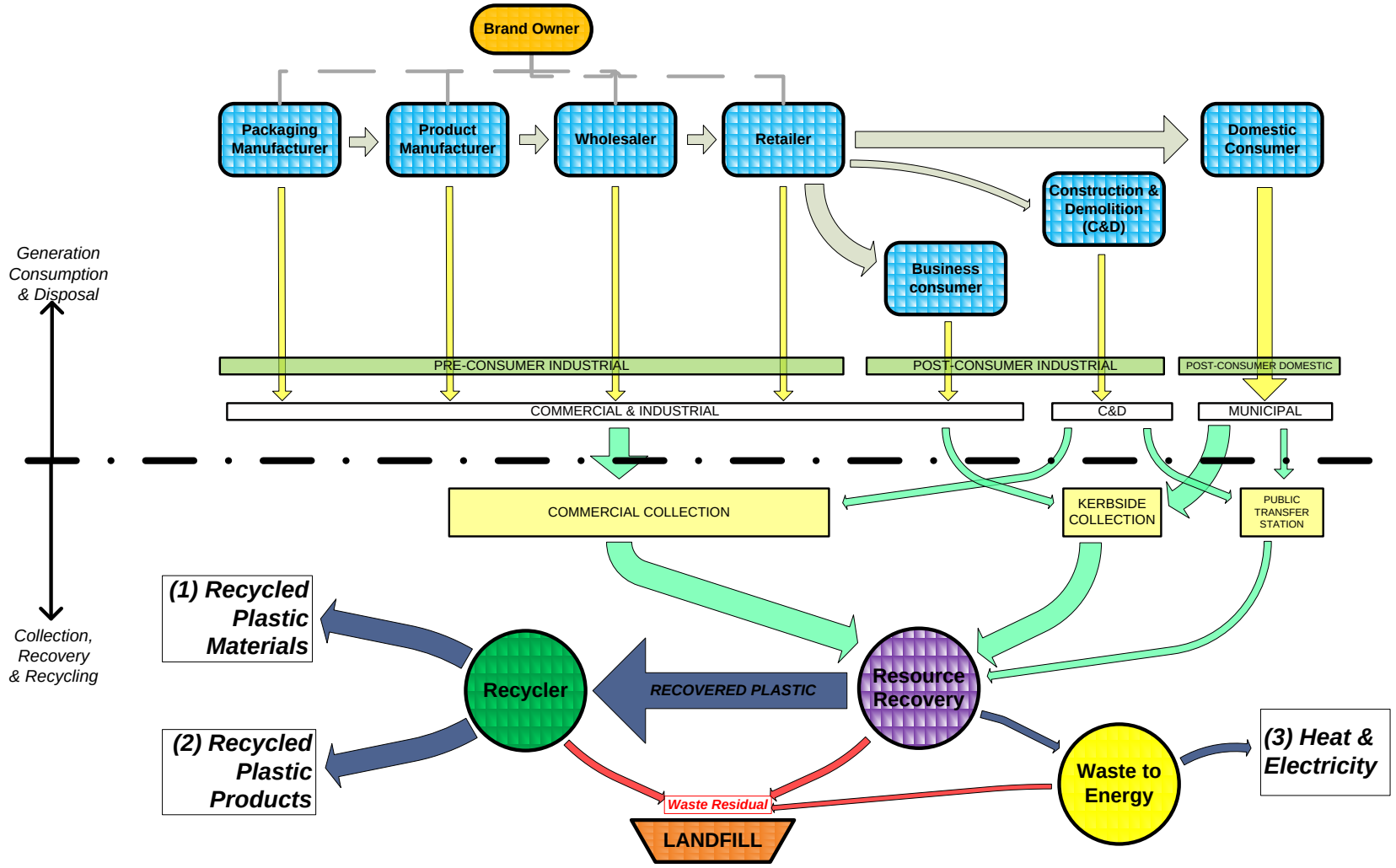

Figure 2.4: Illustrative life cycle of plastic packaging

2.3.2 Source classification of waste plastic packaging

During the 'life cycle' in Figure 2.4, there can be many different types of sources for waste plastic packaging material. It is common for these sources to be classified into the following categories (PACIA, 2011)[10]. The relative positioning of these classifications across the various sources is shown in Figure 2.4.

- **Municipal** –
    - The waste plastic packaging is derived from household or domestic consumption.
    - It is usually disposed of via council kerbside collection or drop-off at council transfer stations.
        - This source of waste packaging is also referred to as ***'post-consumer domestic'*** because it is generated after a product has been sold and is used for its intended purpose by a household or domestically.
- **Commercial and Industrial or C&I** –
    - These sources are associated with commercial and industrial business activity, e.g. manufacturing, hospitality, retail, offices, and mining.
    - C&I can be further divided into:
        - ***'Pre-consumer industrial'*** –
            - Waste plastic packaging generated before the product reaches the final consumer, e.g.
                - Film wrap around or secondary packaging in a box of product, which is removed by a retailer before they stock the product on the shelf or sell it to a customer
                - Waste by-product from manufacturing the plastic packaging itself.
            - This waste packaging is usually disposed of via commercial waste collectors as pre-consumer industrial sources generally involve larger business activity.
        - ***'Post-consumer industrial'*** –
            - Waste plastic packaging generated where the business itself is the final consumer of the product, e.g.
                - Plastic packaging waste from stationery and office items in a small business
                - Waste plastic packaging from bins in a lunchroom at a factory.
            - This type of C&I packaging may be disposed via:
                - Council kerbside collections for small to medium businesses

[10] It should be noted that the demarcation between these classifications are not 'black and white' and there are many contradictions in how different jurisdictions and industry stakeholders may identify and classify the source of waste plastic packaging materials.

- Commercial waste collectors in the case of larger businesses.

- **Construction and Demolition or C&D** –
  - This is waste plastic packaging material generated by the construction and demolition activity
  - It is usually disposed of via commercial collectors.

Figure 2.5 below provides an indicative breakdown between these sources estimated for waste plastic packaging in SA (as part of this Stage 1 study). It shows that most waste plastics packaging in SA originates from Municipal and C&I source sectors. This breakdown between sources is typical of that seen elsewhere in Australia.

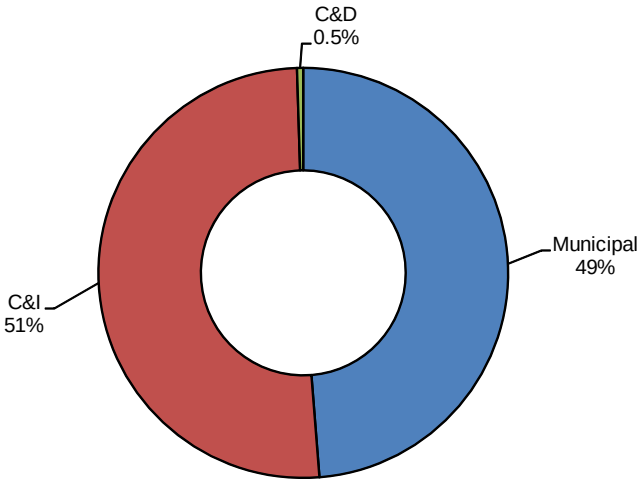

Figure 2.5: Estimated breakdown by source of waste plastics packaging material disposed of in SA

2.3.3 Destinations for recycling

Another important demarcation that is often made is where plastic packaging material is sent for recycling once it is recovered[11]:

- **SA** – The plastic material is re-processed in SA by local recyclers
- **Interstate** – The plastic is sent interstate to a re-processing facility
- **Overseas**– The plastic is exported overseas for re-processing.

Figure 2.6 overleaf gives an indicative breakdown by destination for waste plastic packaging in SA (as estimated during this Stage 1 study). It is important to note that SA does locally re-process a significant amount of waste plastics packaging (which will be discussed later in this report). Not all Australian states or territories have this local re-processing capacity for plastics.

[11] Resource recovery is usually performed locally to minimise transport costs and/or putrefaction of waste materials.

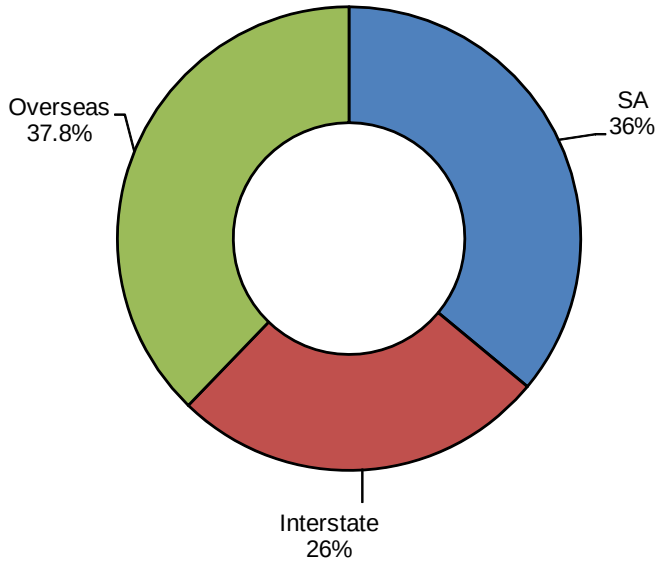

Figure 2.6: Estimated breakdown by destination for waste plastics packaging material disposed of in SA

2.3.4 SA's plastic packaging recycling performance

The PACIA national survey data for 2009-10 (PACIA, 2011) can be analysed to infer how SA performs relative to other states in the recovery of waste plastics packaging for recycling. A summary of the results from the analysis is presented in Figure 2.7 below.

- This figure shows the recovery of both total plastics and plastics packaging as a percentage of total estimated consumption values for these materials, respectively.
- It suggests that:
    - Recovery rates of plastics packaging across Australia exceed that for total plastics (durables + packaging)
    - Whilst SA is the second-best performing state or territory, its plastic packaging recovery performance is still only about 35%.
        - In this respect, it is important to note that the estimated packaging consumption values in the PACIA national survey data do not include imported packaging. Thus, SA's performance could be less than this value once these additional quantities of packaging material are taken into account.

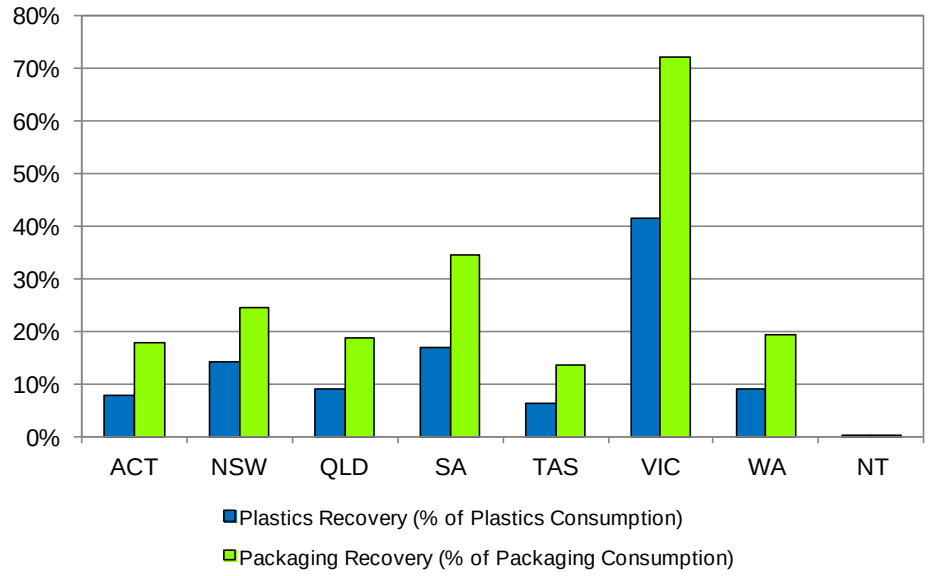

Figure 2.7: Estimated breakdown by destination for waste plastics packaging material disposed of in SA

3 Current and future industry performance

3.1 Scope and approach

The first phase of the Stage 1 study was to undertake an assessment of current and future industry performance. The scope of this assessment was agreed with Zero Waste SA and designed to address objectives (a) to (d) of the Stage 1 study goals (refer Section 1: Introduction).

The findings from this analysis were used to inform subsequent consultation with industry, which in turn was used to identify the main challenges and opportunities for SA in improving current recovery and recycling rates of waste plastics packaging – and thus, achieve Stage 1 objective (e).

The assessment was essentially conducted as a desktop study by analysing existing data on plastics packaging consumption, disposal and resource recovery for SA. This existing data was derived from the following principal sources.

- 2009-10 PACIA National Plastics Industry survey data (PACIA, 2011)
- 2009-10 SA Recycling Activity survey (Zero Waste SA, 2011)
- SA Landfill survey data from 2007 (Zero Waste SA, 2007)
- Selected SA kerbside collection audit data from 2009 (Zero Waste SA, 2009a)
- Review of SA's recycling industry infrastructure and capabilities in 2009 (Zero Waste SA, 2009c).

Further details about the analysis and data sources are included in Appendix 1: Stage 1 Data Report, which documents how this assessment was conducted and the detailed results that were obtained.

The following sections overview the key results of this analysis. In considering these results, however, please note the following clarifications.

- Data collection and analysis techniques between the above sources were often different, including how plastics were classified and quantified. This issue necessitated some interpolation and extrapolation of data, to bridge these gaps.
- The timing and extent of data collected by the above sources may not necessarily be representative of real quantities and compositions of materials being consumed, recycled and disposed of across SA.
- The analysis results presented here are therefore estimates, and it should be recognised that there is a reasonable degree of uncertainty (e.g. ±20%) in values proposed for quantities and compositions of plastics packaging present in various waste streams.

3.2 SA resource recovery and recycling rates

3.2.1 Overall mass balance: Consumption, recovery and disposal

Figure 3.1 overleaf provides mass balance derived estimates of plastic packaging being consumed, recovered for recycling, and disposed of to landfill in SA.

- The estimated amount of waste plastic packaging collected[12] in SA may be up to 50,000-60,000tonnes/yr.
    - This value is greater than the 41,000t/yr of plastic packaging consumption for SA suggested by the 2009-10 PACIA national plastics industry survey but could reflect the extra quantities of waste plastic packaging from consumption of imported products and goods.
- About 13,000-15,000t/yr of this waste plastic packaging is estimated as being resource recovered for recycling.
    - This value suggests a recovery rate of between 25-30% of waste plastic packaging is currently being achieved.
        - PET and LDPE packaging appear to dominate waste plastic packaging recovered for recycling
        - HDPE and PP packaging also appear to make significant contributions.
- Between 35,000-45,000t/yr of waste plastic packaging could therefore still be disposed of to landfill.
    - The composition of this landfill stream of waste plastic packaging is summarised in Figure 3.2 overleaf.
        - Waste plastic packaging classified as Mixed/Other Plastics (at *ca.*17,000t/yr) is the major contributor to this landfill disposal
        - PVC, LDPE, PS and HDPE packaging also feature significantly in this landfill stream of waste plastic packaging.
    - Unfortunately, this information does not necessarily reveal how easy it would be to recover this waste plastic packaging or its suitability for recycling. For instance:
        - Is it as simple as intercepting and source separating these packaging materials out before they are disposed to landfill?
        - Are these packaging materials too contaminated, e.g. with food residue or additives, for them to be suitable for recycling?
        - Are these packaging materials not being effectively captured by existing MRFs, and consequently disposed of to landfill with MRF waste residue?
        - Even if these packaging materials can be resource recovered, is there a re-processor able and willing to take them, and/or is it cost-effective to re-process the material (otherwise it may again be directed to landfill).

[12] This includes all sources, i.e. drop-off at transfer stations, kerbside collections, commercial waste services, and container deposit depots.

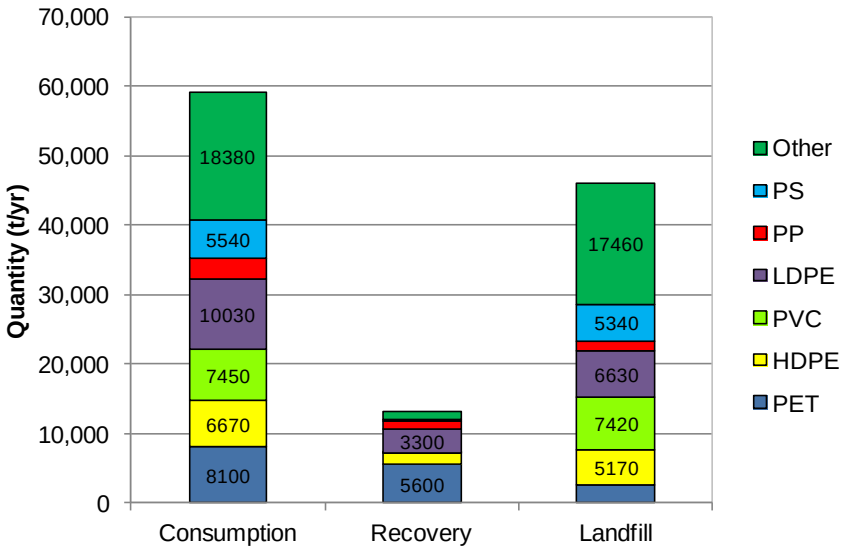

Figure 3.1: Estimated SA plastics packaging consumption, recovery and disposal by polymer

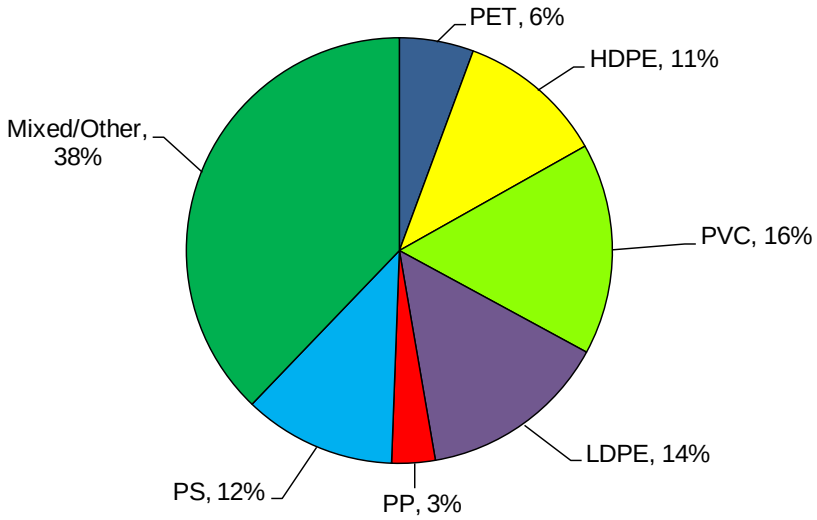

Figure 3.2: Estimated composition of plastics packaging disposed of to landfill.

3.2.2 Recovery and sources by polymer

Figure 3.3 overleaf summarises the current sources (Municipal, C&I and C&D) of plastics packaging being consumed, resource recovered and disposed of to landfill in SA. The figure also shows the % resource recovery of plastics packaging achieved by polymer.

- Virtually all resource recovery is achieved from the Municipal (50-60%) and C&I sectors (40-50%), with negligible recovery from the C&D sector (<1%).

Brief comments on plastic packaging sources and recovery by polymer follow below.

- PET:
    - Is largely associated with Municipal sources.
        - Nearly 80% of the PET would be recycled containers with the majority of this being post-consumer material delivered via CDL depots[13] and kerbside MRFs.
    - SA achieves relatively high PET packaging resource recovery, at about 70%.
- HDPE:
    - The source of this material is evenly split between Municipal and C&I sources but most resource recovery seems to derive from the Municipal sector, via CDL depots and kerbside MRFs
    - Resource recovery of HDPE packaging is relatively low at about 25%.
- PVC:
    - Is predominantly generated by the C&I sector
    - There is currently negligible resource recovery occurring of this packaging material.
- PP:
    - Is majority derived from the C&I sector
    - Resource recovery of PP packaging is about 45%, with most resource recovery sourced from the C&I sector.
- LDPE:
    - Resource recovery of LDPE packaging is principally sourced from the C&I sector, which can be attributed to the successful commercial collections of this packaging material from pre and post industrial sources
    - Resource recovery of this packaging material, however, is relatively low at 35%.
- PS/EPS:
    - Is majority sourced from the Municipal sector
    - At less than 5%, there is very little resource recovery of this plastic packaging occurring in SA.

[13] SA operates a container deposit (or CDL) scheme, where some plastic containers have a return deposit which can be reclaimed by consumers when disposing of the item at a registered CDL depot.

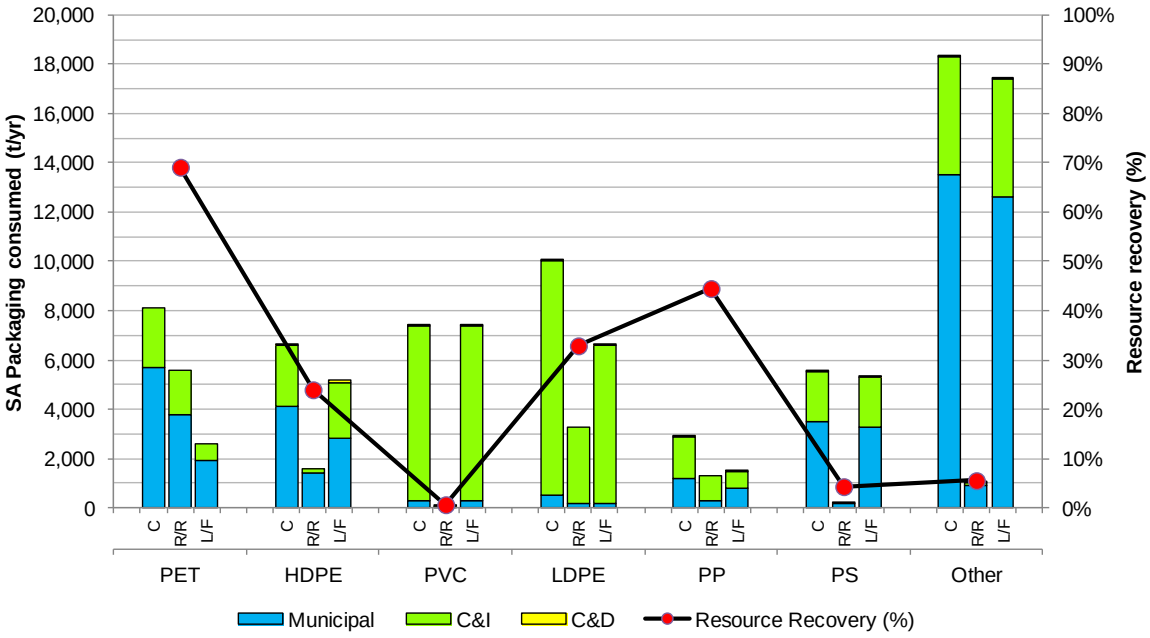

Figure 3.3: Source of plastics packaging consumption, resource recovery and landfill disposal by polymer

- Other/Mixed plastics:
    - Is also majority sourced from the Municipal sector.
        - It is difficult to know how much of this material is a mixture of the above commonly used polymers, which cannot or has not been separated, or consists of other less common polymers.
    - Resource recovery of this packaging material is relatively poor at less than 10%.

3.2.3 Destinations for re-processing

The destinations of recovered plastic packaging material are illustrated in Figure 3.4 overleaf.

- Nearly all PET, PS and Mixed/Other Plastic packaging is exported interstate or overseas for re-processing.
- Significant quantities of HDPE, LDPE and PP, however, are being re-processed in SA.
    - In total, about 30-40% (or *ca.* 4500t/yr) of recovered waste plastics packaging is being re-processed locally.

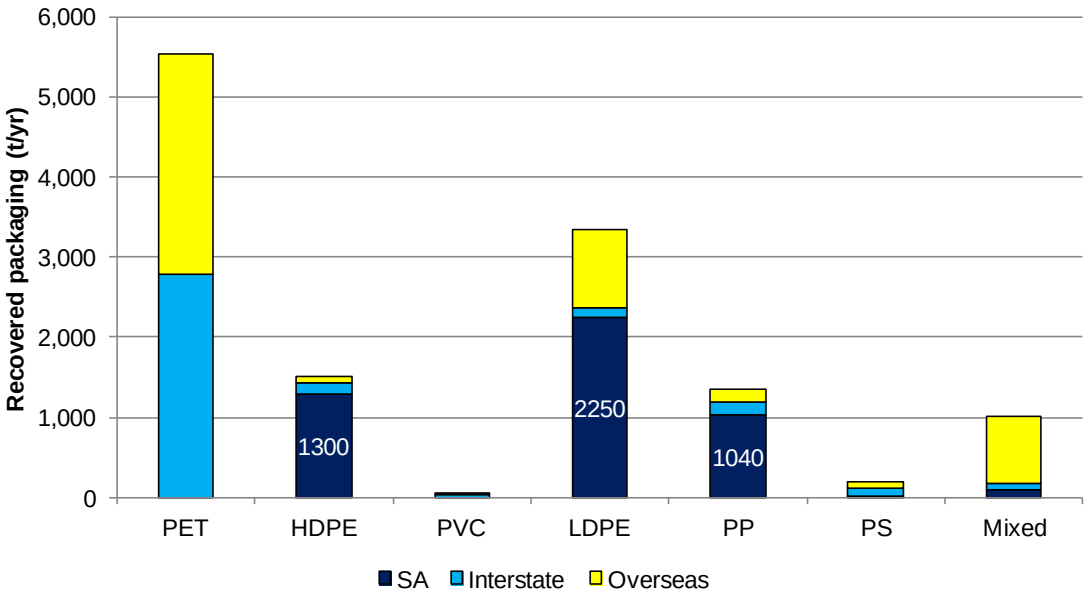

Figure 3.4: Destination for resource recovered plastics packaging in SA

3.2.4 Future resource recovery projections

Future projections of plastics packaging recovery in SA were made based on previous and similar modelling undertaken in 2009 for the SA Recycling Industry Review (Zero Waste SA, 2009c).

- These projections consider the potential impact of the W2REPP[14] and other State Government policy interventions[15] on the recovery of waste plastic packaging.

The future projections are shown in Figure 3.5.

Based on these projections, Table 3.1 provides a high level mass balance summary, comparing the relative rates of consumption, resource recovery and landfill disposal of waste plastics packaging for 2009-10 and (projected for) 2019-20.

In summary, these projections suggest the following.

- Waste plastics packaging recovery will increase from current levels of 25-30% (of material consumed) to at least 30-35% over the next decade.
    - A principal driver behind this improvement would be the W2REPP, which requires all C&I waste material to be subject to resource recovery before disposal to landfill.

[14] The impact of the W2REPP assumed that Municipal metropolitan and regional waste streams will continue to be exempt from the 'resource recovery' requirements of this policy. The analysis also assumes that AWTs will not be introduced and current resource recovery of C&I waste material will occur at existing facilities where there will be incremental improvements in performance over this period.

[15] Other policy interventions include increases in the waste levy and support schemes for expanding collection of and improving resource recovery from source separated C&I material.

- This magnitude of increase could add up to another 10,000t/yr to the volumes of plastic packaging being recovered.
- Two polymers where potential resource recovery could grow significantly are PVC and PS, which currently have relatively low levels of resource recovery.

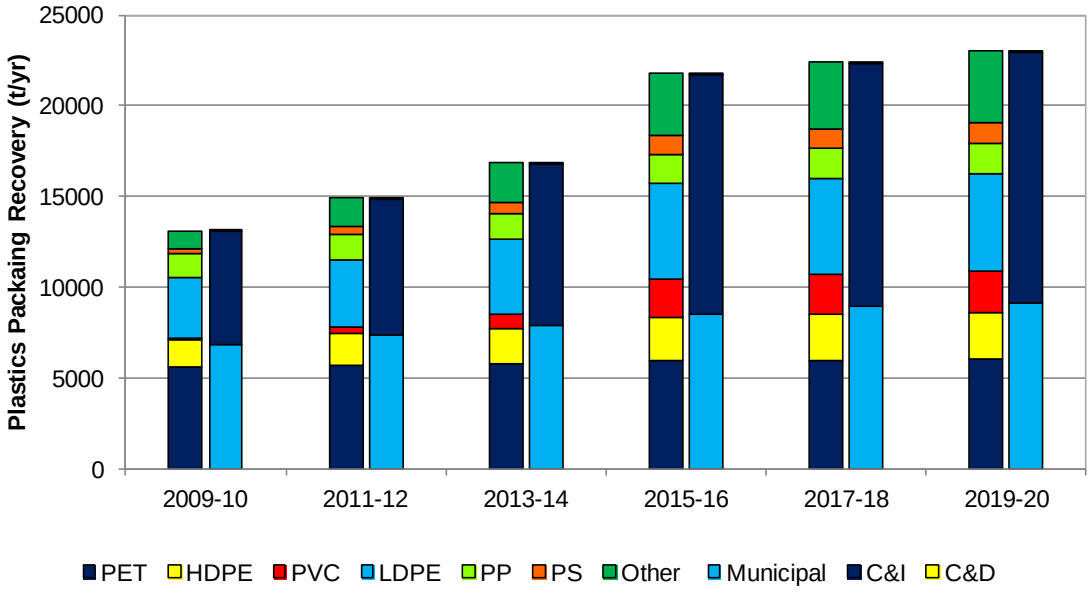

Figure 3.5: Plastics packaging projections from 2009-10 to 2019-20. Note: The contribution from the C&D sector is projected to be relatively negligible, and thus, cannot be easily distinguished in the Figure

Table 3.1: High-level mass-balance summary of projections for waste plastics packaging. This summary also includes summary projections for total plastics, which were made at the same time

Activity	Parameter	2009-10	2019-20
Consumption	Plastics	89,000	104,000
	Packaging	59,000	69,000
Recovery	Plastics	21,000	36,200
	% of Plastics Consumption	23%	35%
	Packaging	13,100	23,000
	% of Plastics Recovery	63%	64%
	% of Packaging Consumption	22%	33%
Landfill	Plastics	68,000	82,800
	Packaging	46,000	55,000

3.3 SA resource recovery and recycling infrastructure

3.3.1 Introduction

The SA Recycling Industry Review (Zero Waste SA, 2009c) conducted in 2009 also made an assessment of local industry infrastructure for waste plastics recovery and reprocessing. This assessment included consultation with industry and a snapshot picture of the SA waste plastics industry which contained more detailed information about this sector.

The following sections briefly summarise and interpret some of the findings of this earlier review relevant to this study.

3.3.2 Assessment of existing infrastructure

The waste plastics industry in SA handles both waste plastics packaging and other waste plastic materials. The infrastructure used by the industry for recovery and re-processing of waste plastics is largely common and shared between plastic packaging and other plastic materials. As 60-65% of the waste plastics recovered in SA are waste plastics packaging, most of this infrastructure is therefore principally designed to handle waste plastic packaging materials.

Infrastructure for processing of waste plastics in South Australia includes both:

- Primary processing: Recovery by sorting, shredding and/or baling only
    - This infrastructure includes:
        - Kerbside and C&I MRFs for resource recovery of waste plastics materials from comingled recyclable streams
        - CDL depots which receive recycle-deposit plastic containers
        - Facilities for aggregation and baling of source-separated waste plastic materials, which will generally be sent interstate or exported overseas for further re-processing.
- Secondary processing: Advanced recovery and re-processing or beneficiation.
    - This infrastructure includes:
        - Re-processors that further sort, clean and granulate the recovered waste plastic material in a polymer-specific or mixed form for others to beneficiate or reuse in the manufacture of recycled plastic products
        - Re-processers which beneficiate or incorporate the recovered plastics material into recycled plastic products.
            - These re-processors may use 100% recycled plastic or blend it with virgin plastic material, and make not only pure plastic products but also plastic composite products
            - Recycled plastic products produced by these re-processors in SA include recycled plastics bollards, wheel stops, garden stakes and edging, and fence posts.

The SA Recycling Industry Review concluded that:

- For primary processing, existing infrastructure appeared adequate to meet all future requirements.
    - Figure 3.6 overleaf re-produces the analysis from the 2009 SA Recycling Industry Review which compared installed capacity for resource recovery of waste plastics with expected demands for waste plastics recovery.
    - There was considered to be significant over-capacity in aggregation and baling facilities for waste plastics.
        - This would enable all future requirements for waste plastics (including plastic packaging) being resource recovered in SA to be achieved, even if there was insufficient local secondary processing capacity, because this material could simply be sent interstate or exported overseas.
- For secondary processing:
    - The majority of waste plastic re-processing in SA was performed by a single company, which converted waste plastic material into granulated feedstock for beneficiation by other re-processors in SA or interstate.
        - This same company was also responsible for most of the planned future expansion in SA's secondary processing capacity.
        - However, this company was principally focussed on re-processing of HDPE, LDPE and PP.
    - The remainder of the local industry were largely involved with beneficiation. Again these companies principally handled HDPE, LDPE and PP.
    - The infrastructure capacity for secondary re-processing was only about one third to a half of the total waste plastics being recovered in SA.
        - Thus, there was scope to expand the capacity of this infrastructure to enable recovered waste plastic materials to be re-processed in SA instead of sending these materials interstate or exporting them overseas.
        - Such expansion could also contemplate potential infrastructure capacity not currently available for local re-processing of other polymers, i.e. PET, PVC, PS.

Figure 3.6: Estimated installed capacity of South Australian recycling infrastructure for waste plastics versus forecast resource recovery (tonnes per annum) for 2008-09, 2013-14 and 2019-20. Reproduced from SA Recycling Industry Investment Review (Zero Waste SA, 2009a).

Recycled material	**2008-09**		**2013-14**		**2019-20**	
	Installed capacity	*Resource Recovery demand*	*Installed capacity*	*Resource Recovery demand*	*Installed capacity*	*Resource Recovery demand*
Plastics	49,700	17,800	76,800	29,700	78,700	33,100

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3.3.3 Barriers and drivers for local industry development

Key issues identified by the review as potential barriers and drivers for successful development of the local industry included:

- The lack of local demand for locally recycled products
- Sourcing appropriate quality and sufficient quantities of feed plastic to achieve cost-effective economies of scale
- Contamination of recovered plastics, which can significantly increase processing cost for recovery and beneficiation
- Inefficient recovery and manufacturing processes, which do not provide high quality and contaminant-free resources or maximise utilisation of the available resource.

It was noted that the plastics recycling market in Australia was dominated by reprocessors in New South Wales and Victoria, who account for nearly 75% of plastics recycled in Australia. Thus, reprocessors in these states were able to:

- Leverage greater economies of scale unless local reprocessors import source materials from interstate or overseas
- Were also closer the major markets for these materials.

This was considered to place local re-processors at a competitive disadvantage. Efficiency in scale and purity of materials achieved by source separation by collection and resource recovery systems in South Australia was therefore considered vitally important for local plastics re-processors to help level the playing field and potentially provide a competitive advantage over interstate counterparts despite their smaller size.

3.3.4 Industry perspectives on future industry development

Industry stakeholders involved in consultation during the review proposed the following measures as possible ways to encourage increased plastics beneficiation in SA. *Please note that the following comments are those of industry which were provided during consultations, and do not necessarily reflect the views of the consultants or Zero Waste SA.*

- A significant, programmed increase in the landfill levy, to increase incentives for resource recovery
- Procurement policies for local and state government which do not discriminate against use of recycled materials in favour of virgin materials
- Direction of waste plastics to specified collection depots where efficient resource recovery and separation can be achieved to produce high quality recovered plastic feedstock for further primary and secondary processing
- Education on source separation to again support the above objective
- Further market development to raise local industry awareness of locally produced recycled plastic products and increased demand for these products and support future expansion of secondary processing.

It was also noted that some industry stakeholders were considering waste-to-energy processes to add value to their plastics waste streams, especially when dealing with mixed plastics.

4 Industry views and perspectives

4.1 Scope and approach

The consultation program was identified and agreed with Zero Waste SA in advance.

It was agreed at the outset that the industry consultations should be conducted on a confidential basis, and that information obtained would be anonymised so participating parties could not be identified. This arrangement was considered important to encourage industry participation and facilitate disclosure of their views and opinions.

Eighteen industry parties were targeted for consultation. These parties represented all major stakeholders involved with the plastics packaging 'life cycle' in SA; including industry bodies, packaging manufacturers, brand owners, consumers, collectors and aggregators, resource recovery facility operators and re-processors.

The industry parties to be consulted were divided into two groups based on method of consultation: face-to-face or phone interviews. The consultations were conducted on various dates and times between December 2011 and February 2012, depending on availability of industry parties. For select face-to-face consultations with industry, a representative of Zero Waste SA also accompanied the consultants.

The questions for the consultations were developed and agreed with Zero Waste SA in advance. Different types of questions were asked depending on the involvement that the interviewee had with plastic packaging. A copy of these questions is given in Appendix 2 of this summary report.

The following sections summarise the key viewpoints and findings obtained from these consultations.

It should be noted that following is a summary presentation of generalised views and comments provided by industry during the consultations, which have been anonymised. These views and comments do not necessarily represent those of the consultants or Zero Waste SA.

4.2 Key industry viewpoints and findings

4.2.1 Whole-of-industry plastics packaging recycling strategies

General industry approaches to recycling of plastics and plastics packaging can be divided into three basic strategies.

- <u>High-value individual polymer recycling in similar or identical plastic products</u>
    - This approach relies on recovering high quality and low contaminated plastic material as individual polymers of the same quality and grade for reuse in similar or identical plastic products.
        - ***Examples: CDL PET is recycled into new PET bottles; recovered LDPE plastic film is recycled into new LDPE plastic film***

        - This approach allows relatively high recycled content, e.g. 10-30%, in the plastic product
        - There may be limitations on whether this approach is suitable for food-contact/grade plastic packaging
        - To ensure quality of recycled feedstock, the approach can involve a combination of the following:
            - Source separation is preferred to obtain individual polymers with low contamination
            - Product Stewardship approaches may also be used to reliably procure known or similar polymer grades[16]
            - Stringent processing to sort and separate polymers and wash and remove contamination.
- Lower value mixed or single polymer product recycling into new plastic products
    - This approach involves recovering lower quality and lower grade plastic materials and using them to manufacture lower value plastic products, which may be a mix of polymers, for industrial and construction use, e.g. bollards, water collars.
        - ***Examples: HDPE/LPDE mixed with wood flour to create vineyard posts; mix of HDPE and PP to make water collars/bunding***
        - In these cases the recycled product can be a wholly recycled material or is blended with another material, e.g. wood flour, to create a composite material
- Very low value mixed plastics (unviable for recycling) recovered for waste-to-energy
    - For plastics too contaminated or mixed that recovery for recycling is not currently commercially viable, the material can be used for waste-to-energy.
        - There is only one current example of this in SA, where C&I and C&D waste material containing waste plastic packaging is converted to solid fuel for co-firing with natural gas in a cement kiln.

4.2.2 Commercial viability of plastics packaging recycling in SA

- Commercially viable recovery and re-processing in SA is seen as a challenge.
    - Plastics packaging is a low density material, where large volumes are needed to achieve high tonnages.
        - This issue makes collection and transport costs per unit weight higher than for other materials.
    - Market values or prices can be low if plastic packaging material cannot be recovered and separated into individual polymers with low contamination.

[16] Product Stewardship has become an established packaging industry practice, internationally and in Australia, where brand owners, who may also be manufacturers and retailers, take responsibility for ensuring that their products are properly disposed of and/or recycled at 'end-of-life'. An example of successful product stewardship in SA is the recycled container deposit (or CDL) scheme, operated by the beverage industry, where plastic containers are collected for recycling.

        - Source separation strategies and product stewardship schemes seem to provide best-quality material but can also (but not necessarily) involve higher costs to organise and operate.
    - Relative to other recyclable materials, higher capital investment is needed for plant and equipment:
        - To undertake recovery and separation of mixed plastics streams or remove contamination
        - For re-processing of recovered plastic material into virgin polymer substitutes.

4.2.3 Manufacturers of plastic packaging

- High % recycled content in packaging products requires:
    - Equivalent or similar quality or grade of polymer recyclate (as virgin resin), not necessarily just the same recyclate polymer.
    - Low contamination, including additives (e.g. dyes) previously added to plastic packaging when it was originally made.
- Top priority in the design of consumer packaging is functionality, i.e. barrier properties (or product protection), presentation, processing and cost.
    - End-of-life was considered but deemed a low priority.
    - Sustainability focus in product design has been on light-weighting.
        - This strategy was seen to be "reducing waste material", which is higher than recycling on the waste hierarchy.
            - However, it could, ironically, lead to lower volumes of material in waste streams, which might make recycling less viable.
        - To retain functionality in flexible packaging, light-weighting has been accompanied by laminates or co-polymer blends.
        - It is recognised that light-weighting also substantially reduces the cost of packaging and product transport for Brand Owners, so sustainability is not the only motivator for light-weighting.
- There is an industry trend away from rigids to flexibles for consumer packaging.
    - Flexibles reduce product weight and better suit perceived customer preference for convenience even though it seems to be recognised that they are more difficult for conventional recycling systems to handle.
- Product stewardship seems not to be a major industry focus.
    - End-of-life considerations are the responsibility of others, e.g. Brand Owners.
    - For food contact and/or health related packaging, health concerns seem paramount and restrict suitability or market acceptance of recycled content.
- There is awareness and concern about growing imports of consumer packaging by Brand Owners (for packaging in Australia or already packaged products).

- This imported packaging is considered not to be at the same standard and quality as Australian packaging:
    - Not light-weighted
    - Could use different resins so not as compatible for recycling
    - Could contain 'degradable' additives (e.g. oxy-degradable), which is not readily identifiable and unsuitable for recycling of the plastic material.
- Australian packaging standards exist, and are being updated, but do not seem to require imported packaging to comply.

4.2.4 Brand Owners

- As per comments above for Manufacturers, Brand Owners are:
    - Also focussed on the functionality of plastics packaging, and not end-of-life.
    - Driving trends in product design:
        - Moving away from rigids towards flexibles – to reduce costs and meet perceived customer demand for convenience
        - Demand for light-weighting – again to reduce costs and improve perceived sustainability.
- Despite Product Stewardship being a major objective of the Australian Packaging Covenant[17], brand owners spoken to in these consultations did not rate such schemes highly as a priority.
    - Instead, industry initiatives in meeting their sustainability obligations under Australian Packaging Covenant were mainly targeted at packaging design, principally light-weighting and reducing unnecessary secondary packaging, and otherwise ensuring that plastics from their own manufacturing or retail operations were being collected for recycling.
    - Strong commitment to Product Stewardship initiatives were only apparent where a Brand Owner's packaging and/or that Brand Owner was involved in the manufacture of plastic packaging already subject to an existing Product Stewardship scheme, e.g. beverage companies which used recycled PET in PET bottles.
    - If there were to be Product Stewardship schemes developed for plastics packaging, Brand Owners thought that these initiatives should preferably be voluntary or not include deposit type return strategies.
- The main initiatives that Brand Owners have attempted or undertaken towards improving packaging sustainability as part of their corporate sustainability charters or commitment to the Australian Packaging Covenant include:
    - Life cycle analysis studies

[17] See 'Australian Packaging Covenant 10 July 2010': http://www.packagingcovenant.org.au/documents/File/Australian%20Packaging%20Covenant%20amended%2010%20October%202011.pdf; Accessed 17/02/12

        - RMIT has developed a packaging specific evaluation tool[18] for this purpose, which is being used by the packaging industry.
    - Surveying existing packaging materials
        - One Brand Owner has developed a large database covering all its plastic packaging products.
    - Working with suppliers to improve packaging sustainability
        - Light-weighting – to reduce material weight per unit and packaging cost
            - However, in some instances this has led to use of lamination and co-blending of polymers in packaging which lowers recycling value
        - Increasing recycled content.
    - Improving labelling for consumers on how to recycle the packaging.

4.2.5 Consumer (primary) packaging

- It is suggested that consumers are often confused about which plastics could be recycled.
    - There is poor labelling to identify recyclable plastics and how they should be recycled.
        - The PIC Code is not considered of practical value for this purpose (nor was it said to be practically used by MRF operators).
    - Kerbside collection systems do not accept all potentially recyclable plastics items, e.g. soft film.
        - The list of what is accepted can be different between councils depending on downstream MRF capabilities, which (in Australia) cannot generally process flexible packaging film or recover some polymers, e.g. PS.
- The exception to this issue is CDL, where it is clear to the consumer what can be recycled, and there is also intrinsic value for them to do so.

4.2.6 Secondary packaging

- It is thought that excessive use of secondary packaging is still a problem and a significant contributor to pre-consumer or C&I waste streams.

[18] RMIT's Packaging Impact Quick Evaluation Tool (PIQET) can be accessed at: http://www.rmit.edu.au/browse/Our%20Organisation%2FDesign%20and%20Social%20Context%2FResearch%2FResearch%20centres%2FCentre%20for%20Design%2FResearch%2FSustainable%20Products%20and%20Packaging%2FPackaging%20Impact%20Quick%20Evaluation%20Tool%20(PIQET)/

4.2.7 Resource Recovery

- Source separation is a preferred resource recovery strategy as it produces higher quality and less contaminated materials.
    - It also provides opportunity to source separate at polymer and polymer grade level, which improves the recycling value of material and enables reuse in the same or similar products.
- SA's CDL Industry:
    - The industry would like to see an expansion of CDL to other packaging items which it believes would achieve higher return rates than MRFs and also give the material an intrinsic value encouraging resource recovery to occur.
        - Some beverage companies were said to favour SA CDL PET for recycled content in PET bottles because of its high quality and low contamination
    - The CDL industry is investigating new auto-sort technology (based on bar codes) that gives CDL depots capability to differentiate between manufacturers' products – which would enable the delivery of recovered material directly back to the same manufacturers for recycling. This technology could be extended to other packaging items.
        - This type of technology could allow the CDL scheme to extend the traditional concept of 'Product Stewardship' to a new concept of 'Life Cycle Product Stewardship'[19], which could potentially further incentivise recycling of plastic packaging for manufacturers, brand owners and/or retailers.
    - The industry is currently investing in new and modern community-based facilities, which would integrate the above technology.
        - A proposal for such a facility is already before a metropolitan council.
    - The industry believes that depots need greater flexibility to sell recovered plastic material into markets themselves, instead of via the super-collector, which would improve the cost efficiency and viability of the CDL scheme and industry in SA.
    - There is concern from the industry about the introduction of bioplastic beverage containers, which can not be recycled, but carry the 10¢ recycling deposit label.

[19] 'Life Cycle Product Stewardship' is a new concept advanced by the consultants in this study, where manufacturers, brand owners and retailers could also accept responsibility for recycling the recovered materials obtained from Product Stewardship initiatives back into their own products. For example, under SA's existing CDL scheme, this could involve the collected plastic containers being used by the same beverage companies for recycled content in new plastic containers or for other plastic products used in their businesses. Other potential applications in SA for 'Life Cycle Product Stewardship' could be the wine industry accepting its waste plastics back as recycled plastic posts for vineyards or Councils accepting kerbside collected plastics back as recycled plastic bollards, park benches, garbage bins or as part of other public infrastructure.

- SA MRFs:
    - Current recovery rates of plastic packaging at SA MRFs are not transparent and could be very low with significant quantities of plastics passing through and being disposed of to landfill.
        - The level of contamination in MRF recovered plastics streams, which affects value, is also uncertain.
    - The PIC Code is regarded of low practical value (and not really used) for identification during manual separation of plastic material passing through a MRF.
    - Current SA MRFs use conventional technology, which does not allow them to handle film and flexible plastics and/or cost-efficiently and easily recover multiple individual polymers.
        - In newer MRFs overseas, technology is now available that allows film and flexible plastics and most polymers to be recovered:
            - Air capture technology – to remove light film materials
            - Optical sorting – to separate and recover plastic material by polymer
            - Associated shredding, cleaning and washing systems to reduce contamination and improve recyclate value.
        - There is interest at some SA MRFs in trialling these new technologies but reservations were expressed about the potentially high costs of upgrading existing facilities.

4.2.8 Aggregators

- Significant quantities of recovered plastic material are now being sold to China and elsewhere overseas instead of to local re-processors.
    - China is willing to pay higher prices and can use cheap labour to manually separate plastic materials and remove contaminants for recycling.
        - The industry feedback suggests that these plastics are recovered in China as recycled material and are not used for waste-to-energy.
    - Some Chinese companies are allegedly setting up their own operations in SA to source and procure this plastic material direct from industry (by-passing existing aggregators and locking out local re-processors altogether).

4.2.9 Re-processors

- Local re-processors say they are struggling to secure material at competitive prices so they can be commercially viable.
    - They would like to see a preference or support for ensuring local material is re-processed in SA.
- Re-processing operations involve high capital investments in plant and equipment to start-up. They also require economies of scale to be viable.

    - SA has built such capacity in HDPE, LDPE and PP.
    - For PET, SA has no current capacity and with large interstate PET re-processing facilities, it may be challenging to build such capacity without significant support and commitment by others in the industry to supply recovered PET and buy the re-processed PET.
    - There appears to be little or no re-processing capacity for PVC and PS.
- Some re-processors are looking to significantly expand their operations.
    - This could involve sourcing recovered material from interstate in addition to SA
    - Access to financial support to assist with substantial upgrades to improve performance and capacity is also being sought
    - Re-processors are also generally looking for support in the following areas:
        - Product development:
            - R&D
            - Testing equipment or facilities
            - Prototype development.
        - Market development:
            - Sales support
            - Networking with local and interstate customers
            - Advocacy
            - Support to amend industry and/or government procurement requirements or standards to allow recycled products.
    - Re-processors are appreciative of the previous funding support that Zero Waste SA and the State Government have provided to their industry, but suggest that the following could assist in providing greater opportunity for the industry to successfully access future funding support.
        - Most schemes require matching dollars which cannot always be delivered by plastics re-processors. In-kind support should be permitted as part of matching contributions.
        - There should be flexible grant schemes available for non-capital initiatives, e.g. marketing and/or market research, product development support, product testing and validation, training and plastics collection subsidies.
        - Grant scheme guidelines should be designed to accommodate smaller companies, which do not have the same administrative resources to prepare complex funding applications and/or may not need significant funding quantums.
        - Funding support should include advice, access to resources and/or financial or technical assistance to help companies prepare grant applications.
- Local re-processors were receptive regarding the potential of the ‘Life Cycle Product Stewardship’ concept to assist them in creating new markets and securing raw materials, e.g.

- Plastic waste from wine industry recycled as vine posts
- Kerbside collected plastic material recycled for council infrastructure
- Branded CDL PET separated and recycled for re-manufacture of the same branded PET bottles.

4.2.10 Interstate plastic packaging projects

- The consultations identified a number of interstate projects in plastics packaging recycling of interest to SA.
    - There are several interstate MRFs that have installed and/or are trialling optical technology for sorting plastics polymers and/or air capture technology for film plastics.
    - Heat shrink technology for PS is being trialled interstate, which can reduce volumes by 90% before collection.
    - A supermarket chain is conducting a trial to evaluate expanding the current plastic bag return scheme to other packaging items.
    - There is a major new plant being built interstate to recover HDPE packaging and recycle it for food-grade packaging.
    - An interstate company is trialling new technology to clean up and recover food-contact HDPE flexibles and film for recycling purposes.

5 Challenges and opportunities

5.1 Scope and approach

Based on the preceding analysis of the current performance of the SA waste plastic packaging sector and consultation with industry, key challenges and opportunities for improving resource recovery and recycling of waste plastics packaging in SA have been identified.

In addition, potential 'change agents', stakeholders and/or participants from industry, government and the community who could or might need to be involved in initiating, developing, facilitating and/or implementing proposed opportunities have also been identified.

The above identification process was conducted in consultation with Zero Waste SA.

As part of this process, the different types of challenges were categorised into logical groupings, and the same was done for potential opportunities.

5.2 Results

Table 5.1 overleaf summarises the challenges, potential opportunities identified for improving resource recovery and recycling of waste plastics packaging in SA, including challenge category and opportunity classification. Also recognised in the Table is a list of prospective change 'agents' or stakeholders for the identified opportunities.

The following sections also briefly describe and/or summarise, respectively, the different: challenge categories; opportunity classifications; and prospective 'change agents' or stakeholders.

5.2.1 Challenge categories

- **Industry knowledge** –
  - The Stage 1 study has identified that there are gaps in information and data about the waste plastics industry in SA. These gaps make it difficult to:
    - Identify quantities and compositions of waste plastics being consumed, recovered and disposed of
    - Understand the capabilities, performance and capacity of existing infrastructure for resource recovery and re-processing.
  - Improving the quality and resolution of this information and data is therefore considered essential for reliably developing and evaluating future policy and project initiatives.

[Continued on page 42]

Table 5.1: List of key challenges, potential opportunities and prospective change agents/facilitators for improving plastics packaging recovery and recycling in SA identified by this study. List of acronyms used in table for Change Agents/Facilitator: APC – Australian Packaging Covenant; DCCEC –Australian Department of Climate Change and Energy Efficiency; DFAT – Australian Department of Foreign Affairs & Trade; DIISRT – Australian Department of Industry, Innovation, Science, Research and Tertiary Education; DMITRE – South Australian Department for Manufacturing, Innovation, Trade, Resources and Energy; PACIA – Plastics and Chemicals Industry Association; SA EPA – South Australian Environment Protection Authority.

Category	Challenge	Opportunity	*Intervention Type/classification*	*Change Agents/Facilitators (see Table label for acronyms)*
1. Industry knowledge	(a) Current knowledge about plastics packaging consumption in SA does not provide reliable information about packaging types, sources and/or imported material	(i) Advocate for expanded plastics packaging data collection by national surveys, e.g. PACIA, or conduct independent SA survey, to improve knowledge resolution in this area	Data collection	Zero Waste SA; Plastics manufacturing industry; PACIA; other Australian and State Government agencies; Australian Customs Service
	(b) Current estimates of plastic packaging types and quantities consumed and disposed of in SA are not robust and/or reliable and do not provide practical information on the potential recyclability of packaging items	(ii) Expand and/or improve design, accuracy and classification of plastics packaging data collection from landfill, kerbside, C&I and C&D audit programs; including assessment of contamination levels and suitability of packaging for resource recovery and recycling	Data collection	Zero Waste SA; Local Government; Waste collection companies; SA MRF/resource recovery facility operators; SA Landfill operators
		(iii) Expand ZEUS to include industry reporting of Municipal, C&I and C&D collection quantities, so better estimates can be made from above compositional data	Data collection	
	(c) Plastics packaging resource recovery performance of SA MRFs and other resource recovery facilities is not known or available	(iv) Initiate and/or expand monitoring and/or audits of MRFs and resource recovery facilities, to confirm existing technology and performance for plastics packaging recovery	Data collection	SA EPA; Zero Waste SA; MRF/resource recovery facility owners &/or operators
		(v) Implement proposed data reporting and resource recovery plan (RRP) requirements for licensing and approval of facilities under the W2REPP	Regulatory intervention & enforcement	
2. Packaging manufacturers & brand owners	(a) Conflicting labelling information is being included on plastics packaging items as to whether and how it can recycled correctly	(i) Develop simple and consistent labelling for recycling of plastics packaging	Advocacy & leadership	Zero Waste SA; SA EPA; SA Plastics re-processors; APC; Recycling Industry; SA CDL industry; MRF/resource recovery facility owners &/or operators; Local Government; Brand owners &/or packaging manufacturers
	(b) Bio-plastics are being introduced into plastics packaging which can contaminate and render recovered plastic material unsuitable for conventional recycling or substantially diminished in value	(ii) Develop voluntary or mandatory schemes for use, stewardship and correct labelling of bio-plastics, so they can be separately and properly disposed of without contaminating recyclable plastic streams	Advocacy & leadership	
		(iii) Ensure that bio-plastics are not approved and sold with recycling container deposits under current Container Deposit Legislation	Regulatory intervention & enforcement	
	(c) Current industry packaging design priorities appear to be focussed on 'functionality' and improving environmental performance through volume reduction strategies, by light-weighting and/or use of flexibles, and/or increased recycled material content. An unintended outcome of this	(iv) Encourage industry R&D and education on design paradigms that achieve 'functionality' and light-weighting whilst still retaining packaging suitability for 'end-of-life' resource recovery and recycling	Industry R&D	APC; Brand owners &/or packaging manufacturers; Zero Waste SA; DIISRTE; Other Australian and State Government agencies;

Category	Challenge	Opportunity		*Intervention Type/classification*	*Change Agents/Facilitators (see Table label for acronyms)*
	current design approach is that plastic packaging is not suited to, or more difficult for, 'end-of-life' for resource recovery and/or recycling; especially where flexibles and/or laminated or multi-layer plastics are deployed				MRF/resource recovery facility operators; SA Plastics re-processors
3. Consumer behaviour	(a) Business and residential consumers are not fully aware (and even misinformed) of how and what plastics packaging can be recycled via existing kerbside collections or commercial collections	(i)	Develop and conduct consumer education programs for residential kerbside collection and C&I sectors: what packaging can be recycled; where and how packaging should be disposed of; benefits or recycling packaging	Consumer education	Zero Waste SA; APC; SA EPA; Brand owners &/or packaging manufacturers; Local Government; other Australian and State Government agencies; SA CDL industry; MRF/resource recovery facility operators; Industry associations; Business & industry; SA Consumers
	(b) Consumers are not sufficiently incentivised to dispose of plastic packaging correctly, so that it is directed to resource recovery and recycling	(ii)	Evaluate the opportunity for expanding SA's existing and successful container deposit system to include and incentivise correct disposal of other plastics packaging items	Consumer education	
4. Collection of packaging materials	(a) The metropolitan municipal sector and regional areas are not covered by W2REPP requirements for resource recovery before disposal to landfill. However, co-mingled recycling services are provided by Councils across the metropolitan area and there are very high recycling participation rates across all households. Landfill bans are in place for plastics packaging once aggregated for recovery	(i)	Within the metropolitan area, continue education on the value of recycling plastics and the plastic types that can be recycled. Consider expansion of SA's W2REPP resource recovery requirements to cover appropriate regional areas, so plastics packaging in these materials is directed to resource recovery	Regulatory intervention & enforcement	Zero Waste SA; Local Government; Waste collection companies; SA EPA; MRF/resource recovery facility operators; Regional Development Boards; Recycling depot operators
	(b) Transport is a major cost factor for establishing and/or maintaining the commercial viability of collection of comingled recyclables and/or separated plastics packaging	(ii)	Where feasible, support development of regional kerbside collection and transfer stations, to create sufficient demand to support collection of recyclables and plastic packaging and achieve lower transport costs from these areas	Industry investment	
		(iii)	Provide support to regional areas and other communities to assist with transport costs of these materials	Market intervention	
		(iv)	Support establishment of commercially viable collection schemes for comingled recyclable and/or separate plastics packaging material for communities, precincts or industry and/or by geographical area	Market intervention	Business & industry; Zero Waste SA; Local Government; Waste collection companies; Industry associations; DIISRT; Regional Development Boards; Recycling depot operators
		(v)	Evaluate new technologies being developed for volume reduction of plastics packaging at source, e.g. heat shrink technology, which reduce transport costs	Industry R&D	
	(c) Besides kerbside collection and outside the existing container deposit scheme, there are no alternative avenues for the general public and small businesses to conveniently and cost-effectively dispose of plastic	(vi)	Evaluate the proposal by Recyclers of SA for new community-based recycling centres to accept 'drop-off' plastic packaging items	Industry R&D	Local Government; SA CDL Industry; Major retailers; Waste collection companies; Recycling

Category	Challenge	Opportunity	*Intervention Type/classification*	*Change Agents/Facilitators (see Table label for acronyms)*
	packaging items	(vii) Evaluate opportunities for other packaging return/drop-off schemes, e.g. Victorian trial by Coles & RED	Industry R&D	depot operators; Zero Waste SA; APC
	(d) Waste plastics packaging are a low density material which can make it marginal for collection and resource recovery of these materials to be commercially viable	(viii) Consider the impact on waste plastics packaging collection and resource recovery in future reviews or proposals to raise SA's waste levy, to ensure that collection and resource recovery of this material is incentivised and commercially viable for the industry	Market intervention	Zero Waste SA, SA EPA; Local Government; SA Plastics re-processors; MRF/resource recovery facility operators
5. Resource recovery	Many of SA's MRFs are > 10yrs old and/or do not operate latest processes and technology and cannot deal with soft packaging plastic items or maximise plastics packaging resource recovery	(i) Support industry research, identification, testing and/or evaluation of new MRF plant, technology and systems, e.g. optical sorting, air capture, size reduction, that enable improved and cost-efficient plastics packaging recovery	Industry R&D	MRF/resource recovery facility operators; Zero Waste SA; Local Government; SA Universities &/or other research agencies; APC; DMITRE; DIISRTE
		(ii) Co- or majority fund industry investment in new MRF plant and equipment that will improve plastics packaging recovery	Industry investment	MRF/resource recovery facility operators; Zero Waste SA; Local Government; DMITRE
		(iii) Support the trial by Recyclers of SA to evaluate new auto-sort technology at CDL depots to improve recovery and quality of recycled container and other plastics packaging items	Industry R&D	SA CDL industry; Local Government; Zero Waste SA
6. Re-processing	(a) There is not a clear industry strategy to guide the future commercial success of the SA plastic packaging re-processing industry	(i) Undertake a comprehensive SA re-processing industry feasibility study to identify and develop strategy for future commercial success, including the re-processing activities that are or could be commercially feasible and developing local R&D and testing capabilities which might be needed	Industry R&D	Zero Waste SA; Local Government; SA Plastics re-processors; SA MRF/resource recovery facility operators; SA Universities &/or other research agencies
	(b) Re-processing is plant and capital intensive and significant investments are needed by the local industry to become more efficient, adapt and succeed in the face of international and interstate competition and increasing energy costs	(ii) Support industry to undertake lean manufacturing and energy efficiency audits to reduce costs and improve efficiency and productivity	Industry R&D	Zero Waste SA; Plastics re-processors; DMITRE; DCCEE
		(iii) Co- or majority fund industry investment in new re-processing plant and equipment for plastics packaging re-processing	Industry investment	
	(c) Local re-processors are struggling to compete with international buyers on price to secure enough source material	(iv) Consider subsidies to incentivise greater resource recovery and local re-processing of plastics packaging materials	Market intervention	Zero Waste SA; APC
		(v) Develop and implement 'Life Cycle Product Stewardship' strategies for local re-processors, which incentivise local companies to direct material to re-processors and enable re-processors to procure source material at lower cost and also derive higher value from resulting products	Market research &/or development	Zero Waste SA; APC; SA Plastics re-processors; Brand owners &/or manufacturers; Local Government; Business &

Category	Challenge	Opportunity	*Intervention Type/classification*	*Change Agents/Facilitators (see Table label for acronyms)*
				industry
		(vi) Create a local plastics industry networking and advocacy body to assist local re-processors gain better access to and procure source materials, and provide support to expand or create new market opportunities	Market research &/or development	Zero Waste SA; SA Plastics re-processors; DMITRE
		(vii) Advocate on behalf of re-processors with national bodies, State Government agencies and local government for review and changes to government and industry procurement policies and technical/engineering standards to facilitate use of recycled plastic content	Market research &/or development	SA Plastics re-processors; Zero Waste SA; Local Government; DMITRE; DIISRTE; SA Universities &/or other research agencies; APC; Standards Australia; Other Australian &/or State Government agencies; Business & industry
		(viii) Provide flexible funding/grant support schemes for local re-processors to develop new products, associated processing capabilities and/or new markets	Market research &/or development	Zero Waste SA; DMITRE; DIISRTE; SA Plastics re-processors
	(d) Some polymers and/or plastics packaging may not be commercially viable to re-process locally	(ix) Identify optimal pathways for interstate and/or overseas re-processing of these materials to minimise cost and maximise resource recovery, which can be recommended to local aggregators	Industry R&D	Zero Waste SA; SA MRF/resource recovery operators; DFAT
		(x) For mixed and/or low-grade or contaminated plastic packaging, develop an SA waste-to-energy strategy as a more practical, commercially viable and environmentally acceptable alternative resource recovery option (than export of this material interstate or overseas)	Industry R&D	SA MRF/resource recovery operators; Zero Waste SA; SA Plastics re-processors; SA EPA; Local Government; DMITRE; DCCEE
	(e) The local industry is not aware of new technologies being developed interstate and overseas	(xi) Assess the local suitability of new plastics packaging re-processing projects and technologies being used interstate or overseas, e.g. APC projects and pilot trials on HDPE flexibles recovery and re-processing	Industry R&D	Zero Waste SA; APC; Local Government; SA MRF/resource recovery operators; SA Plastics re-processors; DMITRE

- **Packaging manufacturers and brand owners** –
    - These parties play an important role in the fate of waste plastic packaging and whether it will be suitable for resource recovery and recycling.
    - It is important that these parties are engaged and involved so that they do not make decisions or take action which lead to unintended consequences.
        - For example, if current trends towards light-weighting continue to occur, could this mean more flexible and/or multi-layer plastic packaging items, which are more difficult to resource recover or recycle.
- **Consumer behaviour –**
    - Consumer behaviour and choice plays an important role in whether waste plastic packaging is correctly disposed of so that efficient resource recovery and recycling can be achieved.
        - Not all domestic and business consumers in SA may be sufficiently incentivised and/or aware of how to correctly dispose of waste plastics packaging items.
- **Collection of packaging materials –**
    - The amount of resource recovery and recycling of waste plastic packaging that can be achieved by SA will be directly proportional to quantities of this material than can be collected in a suitable form.
        - For instance, these quantities could be increased by:
            - Expanding coverage of the W2REPP, so waste material from more sources is subject to resource recovery
            - Incentivising the industry to increase collection of these materials.
- **Resource recovery –**
    - Whilst SA generally has sufficient infrastructure capacity for resource recovery of waste plastics packaging, the performance of this infrastructure at cost-efficiently maximising recovery and separation and removing contamination could be constraining performance improvements.
        - There are new technologies and equipment which could improve the recovery of waste plastics packaging by existing SA MRFs and resource recovery facilities.
- **Re-processing –**
    - A vibrant local re-processing industry for recovered waste plastic packaging material exists in SA, but this industry does not have enough capacity to handle all of the waste plastic packaging which is currently being recovered in SA.
        - In order for this industry to expand and thrive it needs support to:
            - Procure enough source material
            - Successfully develop new markets and higher-value products
            - Identify and invest in new plant and equipment that will reduce costs, improve efficiency and provide flexibility
            - Achieve sufficient economies of scale and cost efficiencies to remain commercially viable against interstate and overseas competitors.

- However, there may be some waste plastic packaging materials where local re-processing in SA may not be competitive. In these instances:
  - It may be best to ensure appropriate infrastructure is in place so this material can be cost-efficiently exported interstate or overseas for re-processing
  - Consider alternatives forms of re-processing, such as waste-to-energy.

5.2.2 Opportunity classifications

- **Regulatory intervention and enforcement –**
  - This opportunity involves creating new regulatory requirements for industry to achieve improved waste plastics packaging resource recovery and recycling.
- **Data Collection –**
  - This type of opportunity involves undertaking projects to collect more reliable data and information about the industry, in order to inform policy development and new industry initiatives.
    - For instance, this may include audits and surveys or reporting of data and information by industry via ZEUS or other means.
- **Advocacy and leadership –**
  - This is a role that Zero Waste SA already fulfils exceptionally well for the recycling industry in SA.
    - It could involve providing the waste plastics industry with a supporting voice and assistance, in order to help it more effectively influence policy, network, overcome market barriers and/or to improve cooperation and collaboration with other stakeholders.
- **Industry R&D –**
  - This involves providing assistance to the industry to undertake R&D to obtain new knowledge and information it needs to improve its performance, such as in market research and development, becoming leaner and energy efficient, evaluating new plant and technologies.
- **Consumer education –**
  - These opportunities help inform domestic and business consumers about how to correctly dispose of waste plastic packaging in order to maximise the industry's ability to successfully collect and resource recover this material for recycling.
- **Market interventions –**
  - These opportunities are interventions to correct market failures which are preventing market improvements.
    - These market failures may be long-term and require on-going support, e.g. subsidising higher transport costs from regional areas.

        - Alternatively, the market failure may be temporary, only requiring a short period of support, e.g. supporting commencement of waste collection services to precincts until viable scales of operation are achieved.
- **Industry Investment –**
    - Industry investment opportunities involve strategic injection of financial support or co-investment into the industry to build new infrastructure or capabilities, particularly in a sector which is making the transition from a low technology to a higher technology industry.
        - These investments may help accelerate changes and improvements already occurring or enable investments in new plant and equipment to become commercially viable for relatively immature elements of the industry.
- **Market research and/or development**
    - This opportunity can include the following types of initiatives.
        - Expanding existing or creating new markets, for recycled plastic materials and products. This could range from expanded or improved marketing and promotion of recycled plastic materials and products, to removing entry barriers for recycled content in material and products that exist in these markets. An example of such an entry barrier observed in this study was procurement procedures and/or standards which do not allow or enable recycled content.
        - Improving current or developing new recycled plastic materials and products so they are more suitable for existing markets. This could include R&D to improve existing products or invent new products, or to develop test methods that enable technical and market-relevant properties of the recycled plastic materials and products to be obtained and/or verified (thus allowing them to compete in relevant markets).
    - This opportunity helps generate market demand for recycled plastics materials and products, providing a 'pull-through' effect which should act to increase the quantity and quality of plastic packaging being collected and/or resource recovered.

5.2.3 'Change agents' or stakeholders

The following provides a brief description of the possible 'change agents' listed in Table 5.1 (besides Zero Waste SA), and the potential role(s) they might play in initiating, developing, facilitating, funding, supporting and/or implementing proposed opportunities that have been identified. Note: The list of possible 'change agents' in Table 5.1 and below is not necessarily exhaustive.

- **Australian Customs Service**
    - Australian Customs administers the export (and import) classification systems which identify goods and materials which are being exported (and imported). It could assist with clarifying data for exported waste plastic packaging (and imported plastic packaging).
- **Australian Packaging Covenant (APC)**
    - The APC is a co-regulatory initiative by Australian governments and industry to reduce the environmental effects of packaging. The APC has a Secretariat, funded by signatories to

the Covenant, which advocates and represents their interests. The activities of the APC Secretariat include undertaking the development of relevant policy, strategies and guidelines, and recommending signatory-sponsored projects that reduce the environmental effects of packaging for co-funding by industry and government.

- The APC could act as an initiator, advocate, supporter, participant and/or partner in, and potentially co-fund, projects and initiatives that have been identified by this study.

- **Brand owners and/or packaging manufacturers**
  - Brand owners and/or packaging manufacturers are those organisations that are involved in the design and manufacture of plastics packaging.
  - If signatories to the APC, these organisations already undertake initiatives to reduce the environmental effects of the packaging.
  - These organisations could also act as an initiator, advocate, supporter and/or partner in initiatives and/or projects, particularly where re-design of plastics packaging materials or using increased recycled content is proposed, and/or by participating in product stewardship initiatives.
- **Business and industry**
  - Business and industry are primary generators of waste plastics packaging materials. They can also be customers making decisions on plastic packaging procurement for the manufacture of products or to provide services.
  - These organisations could act as an initiator, advocate, supporter and/or partner in initiatives and/or projects, particularly where instigating plastic packaging re-design initiatives, improving source separation of plastics packaging materials before collection, and/or by participating in product stewardship initiatives.
- **Australian Department of Climate Change and Energy Efficiency (DCCEE)**
  - DCCEE is responsible for the coordination and administration of the Australian Government's climate change and energy efficiency policies and initiatives, which includes managing associated funding programs for supporting industry improvements in these areas.
  - DCCEE could therefore provide support, including funding, to assist with initiatives that reduce carbon emissions and improve energy efficiency in the recycling of plastics packaging, including energy audits and investments in more energy efficient plant or equipment.
- **Australian Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE)**
  - DIISRTE has a number of departments and divisions, including AusIndustry, which support research and innovation by industry, including a range of funding programs for R&D activities and/or improvements in manufacturing and clean energy use.
  - It could therefore lend support to initiatives, including funding, that enable market research and/or development or adoption of new technologies for the recycling of plastics packaging.

- **South Australian Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE)**
    - DMITRE undertakes an industry development role to support development of high-value manufactured goods, technologies and services, and develops and delivers programs to improve productivity and sustainability of manufacturing, including connecting South Australian businesses to market opportunities.
    - It could therefore be an instigator, partner, advocate and potential co-funder of plastic packaging recycling initiatives or projects.
- **Industry associations**
    - Industry associations are organisations that represent the interests of different industry sectors. This could include organisations which manufacture plastics packaging; sell products containing plastics packaging; generate waste plastics packaging; and/or are involved with collection, waste management and/or recycling of waste plastics packaging.
    - All of these different types of organisations could therefore be involved with instigating, coordinating, partnering in and/or advocating plastic packaging recycling initiatives or projects. Some industry associations may also be able to provide funding support.
- **Local Government**
    - Local government is responsible for delivering most of the kerbside collection services in South Australia, which serve households and many small businesses. In some cases, local governments also own and operate recycling depots and resource recovery infrastructure. Councils play a key role in instigating new recycling initiatives through these kerbside collection services, including consumer education, which influences the quantity and quality of waste plastics packaging presented for recycling. Local government is also involved with procurement of recycled plastics products for their infrastructure needs.
    - Local government could therefore be a key partner to support new plastic packaging recycling initiatives or projects in South Australia.
    - Regional councils and local government associations would also be valuable sources of advice and/or important for facilitating projects targeted at and/or occurring in regional areas.
- **Other Australian and/or State Government agencies**
    - Other Australian and/or State Government agencies include Sustainability Victoria; NSW Department of Environment and Heritage; QLD Department of Environment and Resource Management; WA Waste Authority; Australian Department of Sustainability, Environment, Water, Population and Communities.
    - Many of the plastic packaging recycling initiatives or projects proposed by this study would have potential applications elsewhere in Australia, and these other government agencies could therefore be potential partners and sources of funding support.

- These other government agencies also run their own projects and/or initiatives, and thus could provide inspiration for new plastic packaging recycling initiatives or projects in South Australia.

- **Plastics manufacturing industry**
  - Represented by PACIA, the Australian plastics manufacturing industry, which includes waste plastics re-processors, would be affected by, and/or could be involved in the implementation of plastic packaging recycling initiatives or projects for South Australia.
  - PACIA or individual companies involved with manufacturing plastics packaging and/or using recycled plastic material in their products are therefore important stakeholders and could also be potential partners and sources of funding support.
- **Recycling depot operators**
  - Recycling depot operators could include transfer stations, scrap plastic merchants and/or CDL depots. These operators receive waste plastics packaging not collected at kerbside or by commercial operators.
  - These depots therefore play an important role in accepting waste plastics packaging from other sources.
- **Regional Development Boards**
  - There are up to thirteen regional development boards situated across regional South Australia. These boards support economic development and employment initiatives in the areas outside of metropolitan Adelaide.
  - They could therefore be valuable sources of advice, facilitators and/or supporters for plastic packaging recycling initiatives or projects implemented to improve waste plastics packaging recovery and/or recycling in regional areas.
- **SA CDL industry**
  - There are over 130 CDL depots in South Australia, which are located in most metropolitan and regional areas. These depots are already collectors of significant quantities of waste plastics packaging material from recycled CDL containers. Many depots also act as more general recyclingfacilities, accepting a range of other materials.
  - The CDL industry, represented by Recyclers of South Australia Inc., is looking to expand its role, including the collection and/or resource recovery of other non-CDL waste plastics packaging at its depots.
- **SA Consumers**
  - SA consumers include households and businesses that make decisions everyday about what products containing plastics packaging they purchase and how to dispose of this plastic packaging material after product use. This behaviour strongly dictates quantities and quality of waste plastic packaging recovered in South Australia.
- **South Australian Environment Protection Authority (SA EPA)**
  - The SA EPA is responsible for the licensing and regulatory environment that governs the collection, resource recovery and disposal of waste material in South Australia.

- The SA EPA is currently implementing the Environment (Waste-to-Resources) Protection Policy 2010 (W2REPP), which will introduce on 1 September 2012 new MRF/resource recovery facility licensing and/or approval requirements for resource recovery of waste destined for landfill.
- The SA EPA also administers the Container Deposit Scheme operating in South Australia.
- The SA EPA would therefore need to be involved in any future initiatives that affect the licensing and regulatory environment.

- **SA Landfill operators**
  - SA landfill operators are the companies or organisations in South Australia involved in accepting waste material for disposal to landfill.
- **SA MRF/resource recovery facility operators**
  - SA MRF/resource recovery facility operators are the companies or organisations in South Australia involved with the resource recovery of waste plastic packaging materials from collected recyclables or waste materials.
- **SA Plastics re-processors**
  - SA Plastics re-processors are the companies in South Australia involved with the re-processing of recovered waste plastic packaging material, into either virgin plastic substitutes or recycled plastic products.
- **SA Universities and/or other research agencies**
  - SA Universities and/or other research agencies includethe University of South Australia (UniSA); University of Adelaide, Flinders University; SA Divisions of the CSIRO; and South Australian Research and Development Institute (SARDI). These organisations can also include consulting businesses and other companies which have in-house research and/or R&D capabilities.
  - These research organisations could provide research expertise, access to research and testing laboratories and/or equipment, as well as access to research-based funding programs, which could support plastic packaging recycling initiatives or projects.
- **Standards Australia**
  - Standards Australia develops Australian Standards which are often used in technical specifications for procurement of products and/or infrastructure that contains recycled plastics content.
- **Waste collection companies**
  - Waste collection companies are the organisations which provide kerbside and commercial collection services to households and/or businesses in South Australia.
  - The services these organisations provide, and the quality of these services, can influence the quantities and quality of waste plastic packaging recovered in South Australia, as well as the costs of this recovered material.

6 Conclusions and Stage 2 Recommendations

The Stage 1 study has found that SA has achieved relatively good performance in resource recovery and recycling of waste plastic packaging when compared with other Australian states and territories. However, the recovery rate of waste plastic packaging at 25-30% of waste material consumed is still low. The rates of recovery between different packaging polymers also vary widely. For some polymers, such as PVC and PS, there is almost negligible resource recovery being achieved. It is therefore concluded that there is scope for improvement.

Consultation with the industry supports this conclusion and offers a range of views and perspectives on how this improvement might be achieved.

As a consequence, a range of potential opportunities for the development of policy and project initiatives which could improve the recovery and recycling of plastics packaging in SA have been identified. These opportunities are listed and described in Table 5.1 in the previous section. Also recognised in this Table are possible 'change agents' or stakeholders that could or should be involved in instigating, developing, funding and/or collaborating or participating in implementation of the identified opportunities.

It is expected that Stage 2 of this study will consider and evaluate these opportunities, to determine which could be considered for implementation.

In considering and evaluating these opportunities during Stage 2, it is recommended that a two-stage approach be taken.

1. **Step 1 – High-level screening to identify 'preferred' or 'best' opportunities**
    - A large number of opportunities have been identified.
    - To cull these opportunities to a manageable number, and identify those with the greatest prospects for successful outcomes, it is suggested that a high-level screening step is conducted in the first instance.
    - This high-level screening would involve:
        - Identifying key evaluation criteria, e.g. potential investment/funding cost; likely resource recovery or recycling improvement; implementation time; alignment with the SA Waste Strategy; industry cooperation or co-funding.
        - Rating or quantifying the expected or relative performance of each opportunity for each evaluation criteria.
            - This may involve some high-level investigations or 'back-of-the envelope' calculations, and identification and consultation with relevant 'change agents' or stakeholders (as identified in Table 5.1).
        - Weighting of the evaluation criteria in terms of importance.
        - Applying multi-criteria decision analysis (MCDA) techniques to rank the opportunities.

- The above would provide a rational and time-efficient approach to prioritising opportunities that might be pursued further.
- It may also be possible to engage and include industry in the above screening process by asking relevant parties to assist with identifying evaluation criteria, rating opportunities and/or deciding what weights should apply between criteria.

2. Business case evaluation of 'preferred' or 'best' opportunities

- A select group of the highest ranked opportunities from Step 1 might be subject to further detailed investigation.
- This investigation would aim to develop a 'business case' for the implementation of the potential opportunity. This 'business case' would provide a concise description of the following:
  - Summary of the opportunity
  - Description of how it would or could be implemented
  - The type of regulatory intervention, administrative changes and/or funding support it might require
  - Identification of potential collaborators with ability to support or participate and/or contribute in-kind or financially
  - Industry involvement or role required
  - Financial requirements, including funding required and/or available from Zero Waste SA, industry or other parties
  - A financial benefit/cost analysis
  - Listing and/or assessment of other social, community or environmental impacts or benefits the opportunity might achieve.
- A key aspect of Stage 2 should be to engage and involve the waste industry early in the development of these business cases.
  - At the end of the day, it will be the industry that will carry most responsibility for implementing and delivering on these opportunities.
  - It is therefore crucial that they are on-side, supportive and committed to the future implementation of the opportunity.

Completion of the process outlined above should result in a set of fully described and evaluated opportunities with high prospects for success which, in conjunction with relevant industry partners, might confidently advance towards implementation.

7 Glossary

7.1 Terms

Alternative fuel	A fuel usually derived from renewable sources, used as an alternative to fossil fuels.
Container deposit	Sometimes referred to as container deposit legislation or CDL. A refundable charge imposed on a range of recyclable beverage containers. The deposit is included in the retail price and refunded when the container is returned to a collection point.
Commercial and industrial waste (C&I)	Comprises solid waste generated by the business sector as well as solid wastes created by state and federal government entities, schools and tertiary institutions. Unless otherwise noted, C&I waste does not include waste from the construction and demolition (C&D) sector.
Construction and demolition waste (C&D)	Includes waste from residential, civil and commercial construction and demolition activities, such as fill material (e.g. soil), asphalt, bricks and timber. C&D waste excludes construction waste from owner/occupier renovations, which are included in the municipal waste stream. Unless otherwise noted, C&D waste does not include waste from the commercial and industrial waste stream.
e-waste	End-of-life electrical and electronic equipment, including computers, televisions, monitors, household electrical appliances, batteries (but not automotive), etc.
Expanded Polystyrene (EPS)	A foam version of polystyrene used in packaging.
High density polyethylene (HDPE)	A member of the polyethylene family of plastics and is used to make products such as milk bottles, pipes and shopping bags. HDPE may be coloured or opaque.
Kerbside collection	Collection of household waste, recyclable materials (separated or co-mingled), and organic waste that are left at the kerbside for collection by local council collection services.
Low density polyethylene (LDPE)	A member of the polyolefin family of plastics. It is a flexible material and usually used as film for packaging or as bags.
Mixed/Other Plastics (MIX)	Plastics containing material that cannot be classified by PIC Codes 1-6 and/or cannot be identified by polymer and/or which is aggregated or too contaminated so it cannot be easily separated and recycled as an individual polymer.
Municipal waste	Solid waste generated from domestic (household) premises and council activities such as street sweeping, litter and street tree lopping. May also includes waste dropped off at recycling centres, transfer stations and construction waste from owner/occupier renovations.
Packaging	Material used for the containment, protection, marketing or handling of product.
Plastics Identification Code (PIC)	Numeric system of labelling of plastic materials by polymer, voluntarily used and imprinted on plastic packaging by plastics manufacturers in Australia and overseas.
Polyethylene terephthalate (PET)	A clear, tough, light and shatterproof type of plastic, used to make products such as soft drink bottles, film packaging and fabrics.
Polypropylene (PP)	A member of the polyolefin family of plastics. PP is light, rigid and glossy and is used to make products such as washing machine agitators, clear film.
Polystyrene (PS)	A member of the styrene family of plastics. PS is easy to mould and is used to make refrigerator and washing machine components. It can be foamed to make single use packaging, such as cups, meat and produce trays.
Polyvinyl chloride (PVC)	A member of the vinyl family of plastics. PVC can be clear, flexible or rigid and is used to make products such as fruit juice bottles, credit cards, pipes and hoses.
Post-consumer material	Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.
Pre-consumer material	Material diverted from the waste stream during a manufacturing processes for reprocessing at a different site. Excluded are waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e. process scrap).

Primary packaging	Primary packaging is a term commonly used to describe packaging material that is an integral component of the product and is disposed as waste when the product is consumed.
Recovered material	Material that would have otherwise been disposed of as waste, but has instead been collected and reclaimed as a material input, in lieu of a new primary material, for a recycling or manufacturing process.
Recycling	Material that has been reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or into a component for incorporation into a product. The term recycling is used to cover a wide range of activities, including collection, sorting, reprocessing and manufacture into new products. Waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e. process scrap) are not defined as recycling for the purpose of this study.
Reprocessing	Changing the physical structure and properties of a waste material that would otherwise have been sent to landfill, in order to allow it to be reused or re-incorporated into manufactured products.
Reuse	Reuse involves recovering value from a discarded resource in its original state without reprocessing or remanufacture.
Secondary packaging	Secondary packaging is a term that generally refers to packaging material that is not necessarily an integral component of the product itself and has only been used to protect the product(s) during transportation to point of sale or use.
Solid waste	Waste materials ranging from municipal garbage to industrial waste, but excluding gaseous, liquid, hazardous, clinical and intractable wastes.

7.2 Acronyms

APC	Australian Packaging Covenant
Ca.	Circa (i.e. about)
CCA (wood)	Copper-Chromium-Arsenate treated wood (Note: This same acronym is used for Coca-Cola Amatil, an industry party that was consulted)
CDL	Container Deposit Legislation
C&D	Construction & Demolition
C&I	Commercial & Industrial
EPS	Expanded Polystyrene
HDPE	High Density Polyethylene
LCA	Life Cycle Analysis
LDPE	Low Density Polyethylene
LPB	Liquid Paperboard
MRF	Material Recovery Facility
PET	Polyethylene Teraphthalate
PIC	Plastic Identification Code
PP	Polypropylene
PS	Polystyrene
PVC	Poly Vinyl Chloride
RMIT	Royal Melbourne Institute of Technology
R&D	Research & Development
wt.	Weight (usually as basis to calculate proportions or describe composition)
ZEUS	Zero Waste Environmental Users System

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Appendix 1: Stage 1 Data Report

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Zero Waste SA

Study on the South Australian Plastics Packaging Resource Recovery Sector, Stage 1 – Data Report

December 2011

- IMPORTANT NOTES-

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Glossary

Alternative fuel	A fuel usually derived from renewable sources, used as an alternative to fossil fuels.
APC	Australian Packaging Covenant – A co-regulatory initiative by Australian governments and industry to reduce the environmental effects of packaging.
Container deposit	Sometimes referred to as container deposit legislation or CDL. A refundable charge imposed on a range of recyclable beverage containers. The deposit is included in the retail price and refunded when the container is returned to a collection point.
Commercial and industrial waste (C&I)	Comprises solid waste generated by the business sector as well as solid wastes created by state and federal government entities, schools and tertiary institutions. Unless otherwise noted, C&I waste does not include waste from the construction and demolition (C&D) sector.
Construction and demolition waste (C&D)	Includes waste from residential, civil and commercial construction and demolition activities, such as fill material (e.g. soil), asphalt, bricks and timber. C&D waste excludes construction waste from owner/occupier renovations, which are included in the municipal waste stream. Unless otherwise noted, C&D waste does not include waste from the commercial and industrial waste stream.
e-waste	End-of-life electrical and electronic equipment, including computers, televisions, monitors, household electrical appliances, batteries (but not automotive), etc.
Expanded Polystyrene (EPS)	A foam version of polystyrene used in packaging.
High density polyethylene (HDPE)	A member of the polyethylene family of plastics and is used to make products such as milk bottles, pipes and shopping bags. HDPE may be coloured or opaque.
Kerbside collection	Collection of household waste, recyclable materials (separated or co-mingled), and organic waste that are left at the kerbside for collection by local council collection services.
Low density polyethylene (LDPE)	A member of the polyolefin family of plastics. It is a flexible material and usually used as film for packaging or as bags.
Mass Balance	A scientific method of analysis that requires that mass quantities in process systems are conserved. In most cases, this mass conservation principle is as simple as saying *"the mass that goes in to a system must be equal to the mass coming out of the system, except where mass is being accumulated in that system"*.
Mixed/Other Plastics (MIX)	Plastics containing material that cannot be classified by PIC Codes 1-6 and/or cannot be identified by polymer and/or which is aggregated or too contaminated so it cannot be easily separated and recycled as an individual polymer.
MRF	Materials Recycling or Recovery Facility – A resource recovery facility where mixed or comingled waste material is separated into constituent materials to enable recycling.
Municipal waste	Solid waste generated from domestic (household) premises and council activities such as street sweeping, litter and street tree lopping. May also includes waste dropped off at recycling centres, transfer stations and construction waste from owner/occupier renovations.
PACIA	Plastics and Chemical Industries Association of Australia
Packaging	Material used for the containment, protection, marketing or handling of product.
Plastics	Can refer to materials made from a range of synthetic or natural organic materials, including polymers, cellulose derivatives, casein materials, and protein, which can be shaped when soft and then hardened. Plastics are widely used to make many industrial and consumer goods. The most commonly used plastics are manufactured from industrial chemicals derived from oil and gas – including ethylene, styrene and propylene.
Plastics Identification Code (PIC)	Numeric system of labelling of plastic materials by polymer, voluntarily used and imprinted on plastic packaging by plastics manufacturers in Australia and overseas.
Polyethylene terephthalate (PET)	A clear, tough, light and shatterproof type of plastic, used to make products such as soft drink bottles, film packaging and fabrics.
Polypropylene (PP)	A member of the polyolefin family of plastics. PP is light, rigid and glossy and is used to make products such as washing machine agitators, clear film.
Polystyrene (PS)	A member of the styrene family of plastics. PS is easy to mould and is used to make refrigerator and washing machine components. It can be foamed to make single use packaging, such as cups, meat and produce trays.
Polyvinyl chloride (PVC)	A member of the vinyl family of plastics. PVC can be clear, flexible or rigid and is used to make products such as fruit juice bottles, credit cards, pipes and hoses.
Post-consumer material	Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.
Pre-consumer material	Material diverted from the waste stream during a manufacturing processes for reprocessing at a different site. Excluded are waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e. process scrap).

Primary Processing	This term generally refers to the initial or primary resource recovery steps for waste material, which usually includes separation and aggregation of material(s) so that it can be re-processed for recycling.
Recovered material	Material that would have otherwise been disposed of as waste, but has instead been collected and reclaimed as a material input, in lieu of a new primary material, for a recycling or manufacturing process.
Recycling	Material that has been reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or into a component for incorporation into a product. The term recycling is used to cover a wide range of activities, including collection, sorting, reprocessing and manufacture into new products. Waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e. process scrap) are not defined as recycling for the purpose of this study.
Reprocessing	Changing the physical structure and properties of a waste material that would otherwise have been sent to landfill, in order to allow it to be reused or re-incorporated into manufactured products.
Reuse	Reuse involves recovering value from a discarded resource in its original state without reprocessing or remanufacture.
Secondary Processing	The secondary stage of resource recovery where recovered materials are further separated and/or re-processed into the form of a substitute to virgin material which can be recycled.
Solid waste	Waste materials ranging from municipal garbage to industrial waste, but excluding gaseous, liquid, hazardous, clinical and intractable wastes.
W2REPP	SA Environment (Waste-to Resources) Protection Policy 2010

1 Introduction

1.1 Study on the South Australian Plastics Packaging Resource Recovery Sector

Zero Waste SA has commissioned this study with the objectives of*:*

- *"Obtaining an in-depth understanding of the current and potential future plastics packaging sector in South Australia (SA), with a view to developing strategies to support implementation of the Waste to Resources EPP";*

And through this understanding being able to identify and develop policy strategies and industry support programs which could:

- *"Encourage innovation by identifying cutting-edge plastics technologies and opportunities for the potential commercial application of these technologies in SA (and/or Australia)."*

1.2 Stage 1

Stage 1 of this study is focussed on the first objective above: "*Develop an in-depth understanding of the South Australian situation."* The goals of Stage 1 were to assess and/or consider the following.

(a) Current & future SA consumption of plastic packaging by polymer type

(b) Current & future SA industry material flows by polymer type

(c) Consider the impact of W2REPP on fate of the aggregated plastic packaging to be banned from landfill

(d) Describe existing & planned SA plastic packaging resource recovery capacity & capability by polymer type

(e) Identify current barriers/constraints for the recovery of plastic packaging

1.3 This Data Report

This data report is intended to address Stage 1 objectives (a) – (c) above. The findings from the data report will be used to inform consultation with industry and provide the basis for achieving Stage 1 objectives (d)-(e).

1.4 Data Sources

The following principal data sources were identified and have been considered in preparing this data report.

- The PACIA National Survey, 2009-10, Report (PACIA, 2011) – which provides data on plastics and plastics packaging consumption and resource recovery.
- Recycling activity in South Australia, 2008-09 Financial Year (Zero Waste SA, 2011)– which gives information on plastics recycling activity and packaging resource recovery for SA.

- SA Disposal Based Survey - October/November 2007 (Zero Waste SA, 2007)– which gives data on plastics disposal to landfill from C&I and C&D sectors or waste streams.
- Food Waste Pilot Kerbside Audit 2008-09 ((Zero Waste SA, 2009a) (Zero Waste SA, 2009a)– which provides data on the plastics and plastics packaging composition in SA municipal kerbside collections.
- South Australia Recycling Industry Investment Review (Zero Waste SA, 2009c) – This review presents projections of future resource recovery in SA, including for plastics, and also provided a high-level assessment of existing plastics recovery infrastructure.

Each of the above data sources present data for plastics packaging in SA with different perspectives and coverage. A brief summary of the above data sources and their limitations for the purpose of this study is included in this data report.

It is also recognised that there are other potential data sources available. For example, the following were identified.

- Euromonitor market report: Packaging industry in Australia (Euromonitor, 2011)
- BIS Schrapnel: Plastics Packaging in Australia, 2008-2010 (BIS Shrapnel Pty Ltd, 2009)

Unfortunately, these reports were proprietary products, not publicly available, could only be obtained by purchase, and it could not be readily determined if their content would necessarily provide additional or better data beyond that already available in the principal data sources.

It was therefore agreed with Zero Waste SA that these other data sources would not be considered at this time for the purpose of this study.

1.5 Organisation of Data Report

This data report is organised as follows.

- Section 2 – Provides some background information on classification of plastics packaging, including the types of polymers used, and some common examples (including photos) of different packaging types for each polymer. Also included in this section is a discussion of the Plastics Identification Code (PIC), which is used during resource recovery of identify and separate polymers for recycling.
- Section 3 – Which is the data report proper, provides assessment and analysis of the principal data sources, including extracting relevant data and manipulating it into useful forms for the purpose of this study. Future projections of the SA plastics packaging recovery are also made.
- Section 4 – Revisits some of the findings of the SA Recycling Industry Review, where existing plastics recycling infrastructure and industry perspectives were considered.

2 Classifying plastics & packaging

2.1 What is Packaging

Packaging may be defined as material used for the containment, protection, marketing or handling of product (PACIA, 2011).

2.2 Classifying Packaging by Source

Different ways of classifying packaging by source are as follows. It should be recognised that the application of these source sector classifications is not always clear cut, and there can be variability in how they are used for collecting and presenting waste and recycling data, including in the data sources being used for this data report.

- According to sector from where the packaging is derived.
    - Municipal activity
        - This collection activity can include:
            - Kerbside collections;
            - Hard waste collections;
            - Local government operations;
            - Container deposit recycling.
    - Commercial & Industrial (C&I) activity
    - Construction & Demolition (C&D) activity
- Based on where the packaging waste stream originates in the supply chain (PACIA, 2011).
    - Pre-consumer industrial –
        - Packaging waste produced by the industry from manufacturing activity.
    - Post consumer industrial –
        - Used material from non-household sources, e.g. offices, businesses, retail, hospitality, etc.
    - Post-consumer domestic –
        - Used material from household sources, i.e. packaging material from kerbside recycling and hard waste collections and container deposit recycling.

2.3 Classifying Plastics and Packaging by Polymer

Plastics and plastic packaging may be classified by polymer type. The following polymer classifications are generally used but these can vary between different studies and data sets.

- Polyethylene Terephthalate (PET)
- High Density Polyethylene (HDPE)
- Polyvinyl Chloride (PVC)
- Low Density Polyethylene (LDPE)
- Polypropylene (PP)
- Polystyrene (PS)
- Mixed and other plastics (MIX).
    - This mixed or other plastics category can include:
        - Other polymer types, e.g. polyurethane (PU), acrylo-butadiene styrene (ABS), nylon, etc.;
        - Plastics that cannot be identified;
        - Aggregated packaging materials with a mix of different polymers.

Table 2.1 includes further information on the above polymer types, including their physical properties, how they are used for packaging applications, and some photo examples of different packaging forms for each.

- It is important to note that each polymer has different types of physical properties. These properties, along with the price of the resin, can define the suitability of a given polymer type for various packaging applications. For example, HDPE has a high resistance to mineral oils and is therefore widely used to contain milk and milk products.
- It should also be noted that the photo examples in this table are not exhaustive. Nevertheless, some of the examples given may challenge pre-conceptions of what each polymer is used for. For instance, soft and/or film packaging can often be associated with LDPE, however, other polymers appear also to be used to construct packaging that is in a flexible and/or film-type form, e.g. HDPE, PVC, etc.

2.4 The Plastic Identification Code (PIC)

The Plastic Coding System or Plastics Identification Code (PIC) is a system where plastics packaging is marked using a standard numerical symbol to identify the plastic resin from which they are made. Table 2.1 includes the PIC of the polymers which have been listed (Packaging Council of Australia, 2005).

The PIC was originally developed by the Society of the Plastics Industry, Inc., in America. It has been adopted by many countries internationally and was adopted in Australia in 1990. However, the adoption of the PIC in Australia and in many other countries is voluntary, and thus, it is not compulsory for it to be used. The Environmental Code of Practice for the Packaging Council of Australia (2005) recommends that the PIC should apply to all plastics packaging manufactured or consumed in Australia. Australian companies which are signatories to the Packaging Covenant are required to commit to this Code (PACIA, 2001).

The PIC would be a marker used by recyclers to identify individual and separate polymers for collection or materials recovery from plastics streams. In this respect, it is not usually feasible to re-process polymers if in a mixed form. The plastics would therefore be separated into their individual polymeric forms first. This strategy seems to be the basis of most resource recovery operations for plastics, whereby plastics are either source separated into their polymeric forms or physically separated, manually or mechanically, into their polymeric forms at a material recovery facility. The plastics which cannot be separated and remain in mixed form, as a consequence, might then have limited options for re-processing, or end up being exported, used for waste-to-energy or disposed of to landfill.

In view of this, there have been several studies which have investigated or commented on the use of the PIC for resource recovery of plastics, including packaging material. These studies are briefly noted below.

- Kerbside audits in 2008-09 by Zero Waste SA identified that the main volume (>60%) of plastic items placed in the general waste bin were comprised of mixed plastics or plastics that could not be identified by PIC codes (Zero Waste SA, 2009a) (Zero Waste SA, 2009a).
- In 2001, EcoRecycle Victoria undertook a review of the voluntary PIC System (PACIA, 2001). The review found PIC identification of plastic materials, including packaging, was not always legible or readily identifiable and often obscured or too small to read. This problem would make it difficult for consumers and recyclers to correctly identify plastics for the purposes of recycling.

From an anecdotal perspective, any visit to a supermarket and inspection of plastic packaging used will suggest that the PIC is not universally applied, nor consistently used. The PIC appeared to be noticeably absent on packaging materials used for some imported products. Where the PIC was used, it varied widely in form, position, prominence, size and visibility.

2.5 PCA Environmental Code of Practice

The Environmental Code of Practice for Packaging (the Code) is a statement of general principles for the design of environmentally responsible packaging and applies to the packaging of all products manufactured or consumed in Australia (Packaging Council of Australia, 2005).

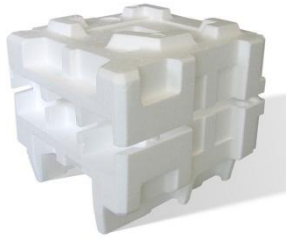
Although not enforced, users of the Code are encouraged to consider the overarching targets for reductions in packaging to landfill and increased packaging recycling under the Covenant. The Code and Guidelines set out a number of strategies for achieving these targets and provides practical guidelines for working towards the strategies (Packaging Council of Australia, 2005). Some of these strategies, which may be relevant to this study, include the following.

- Packaging should be manufactured so that the packaging volume and weight is limited to the minimum amount required, e.g. light-weighting, concentrating the product, material elimination, etc.
- Layers of packaging in the system should be minimized.
- Product waste should be minimized by allowing complete dispensing of the product, i.e. minimal residue left behind in the package when disposed of by the consumer.
- Reusable distribution packaging should be considered, e.g. plastic pallet, fold-up crates, re-sealable plastic bags, etc.
- The package should consist of a single material, or materials, which can be readily separated and sorted for recovery.
- Packaging should be designed to minimise the impacts that any components such as closures, labels, sleeves, carry handles, etc may have on the recovery process.

Table 2.1: Summary and examples of the different polymers used in plastics packaging.

Type of Plastic (Name and PIC Code)	**Properties** *Adapted from TFO Canada* (TFO Canada, 2010) *& PACIA* (PACIA, 2005)	**Packaging applications** *Adapted from* (PACIA, 2005)	**Photo Examples**		
POLYETHYLENE TEREPHTHALATE 1 PET	• *Clear, tough, solvent resistant.* • *Used for rigids, sheets and fibres.* • *Highest tensile strength of packaging polymers* • *Low elongation* • *Can be made clear or translucent* • *Crystallised form has high use temperature* • *Good moisture and gas barrier (desirable for packaging of carbonated drinks)* • *Softens: 55° C* • *SG = 1.38*	**Virgin Grade** Carbonated soft drink bottles, fruit juice bottles. **Recycled grades** Beverage bottles, bottles for detergents, clear packaging film.	Detergent Bottle, PIC code found at bottom of bottle. Source: Rawtec. 	Drink Bottle, PIC code found on front of bottle. Source: Rawtec. 	
HIGH DENSITY POLYETHYLENE 2 HDPE	• *Hard to semi-flexible, waxy surface, opaque.* • *Low cost, easily processed* • *Good moisture barrier, poor oxygen barrier* • *Low softening and melting points* • *Compatible with most foods and most household chemicals* • *Softens: 60° C* • *SG = 0.96*	**Virgin Grade** Crinkly shopping bags, freezer bags, milk bottles, bleach bottles. **Recycled grades** Film, blow moulded containers, crates, household bags	Food Bottle (salt), PIC code found on bottom of bottle. Source: Rawtec. 	Detergent Bottle, PIC code found on bottom of bottle. Source: Rawtec. 	HDPE Film Packaging Material. Source: http://img.diytrade.com/cdimg/351980/5145803/0/1254539622/HDPE_Sheet_HDPE_Film.jpg 

Type of Plastic (Name and PIC Code)	**Properties** *Adapted from TFO Canada* (TFO Canada, 2010) *& PACIA* (PACIA, 2005)	**Packaging applications** *Adapted from* (PACIA, 2005)	**Photo Examples**			
POLYVINYL CHLORIDE 3 PVC	**Unplasticised Polyvinyl Chloride UPVC** • *UPVC is hard rigid, can be clear, can be solvent welded* • *Softens: 70° C* • *SG = 1.40* **Plasticised Polyvinyl Chloride PPVC** • *PPVC is flexible, clear, elastic, can be solvent welded* • *Softens: 70° C* • *SG = 1.35*	**Virgin Grade** Blister packs, clear cordial and fruit juice bottles, bags **Recycled grades** Detergent bottles	Antiseptic Bottle. Source: Rawtec.  	Food packaging. Source: http://www.av.com.au/Packagingproducts 	Cordial Bottles. Source: http://www.foodmag.com.au/news/cottees-launches-new-cordial-bottle  	Flexible cosmetic bag. Source: http://www.pvc-bag-pvc.com/pvc_product/pvc_drawing_Bag/PVC_drawing_bag-pvc77.html 
LOW DENSITY POLYETHYLENE 4 LDPE	• *Soft, flexible, waxy surface translucent, withstands solvents* • *Low cost, easily processed* • *Films are soft and clear* • *Lowest softening and melting points (good for heat sealing)* • *Compatible with most foods and most household chemicals* • *Fair moisture barrier, very poor oxygen barrier* • *Very high elongation (desirable for stretch wrap)* • *Softens: 40° C* • *SG = 0.92*	**Virgin Grade** Garbage bags, squeeze bottles, stretch and shrink films, silage and mulch films, garbage bins **Recycled grades** Films and bags	Film. Source: http://www.frandcom.com/Plastics/PeFilm/29.htm 	Protective packaging around television, PIC code displayed across packaging. Source: Rawtec. 	Packaging for instruction manual, PIC code displayed across packaging. Source: Rawtec. 	

Type of Plastic (Name and PIC Code)	**Properties** *Adapted from TFO Canada* (TFO Canada, 2010) *& PACIA* (PACIA, 2005)	**Packaging applications** *Adapted from* (PACIA, 2005)	**Photo Examples**		
POLYPROPYLENE  	• *Semi-crystalline, wide property and application range.* • *Translucent (can be transparent), hard, flexible, good chemical resistance, low SG.* • *Low cost, easily processed, good chemical compatibility* • *Three dimensional parts translucent, so colourant added* • *Oriented PP film is clear, stiff and glossy* • *Un-oriented PP becomes brittle at low temperatures* • *Good moisture barrier, poor oxygen barrier* • *Forms best "internal hinge" when moulded* • *Higher softening point than PE (can be hot filled)* • *Softens: 80° C* • *SG = 0.90*	**Virgin Grade** Film, crates, housewares / kitchenwares, bottles, caps **Recycled grades** Crates, boxes	Plastic crate, Source: http://www.hiwtc.com/products/stacking-crate-stacking-container-plastic-crate-plastic-container-464656-13396.htm 	Juice Bottle (lime), PIC code found on bottom of bottle. Source: Rawtec.  	Food tub (butter), PIC code found on bottom of bottle. Source: Rawtec. 
POLYSTYRENE  	**Polystyrene PS** • *Clear, glassy, rigid, brittle, opaque semi-tough, melts at 95°C.* • *Affected by fats and solvents.* • *Can be modified to provide more impact resistance* • *Poor solvent resistance (can be solvent bonded)* • *Poor overall barrier properties* • *Softens: 85° C* • *PS = 1.06* **Expanded Polystyrene EPS** • *PS expanded into a foam using gases* • *Light weight, energy absorbing, heat insulating* • *Softens: 85° C* • *SG = 0. 92*	**Virgin Grade** Meat & poultry trays, yoghurt & dairy containers, vending cups, protective packaging for fragile items (EPS) **Recycled Grades** Produce boxes	EPS. Source: http://en.wikipedia.org/wiki/File:Expanded_polystyrene_foam_dunnage.jpg 	Food container (cream), PIC Code found on bottom of container. Source: Rawtec.  	Packaging around electronic item, PIC code found on front. Source: Rawtec. 

Type of Plastic (Name and PIC Code)	**Properties** *Adapted from TFO Canada* (TFO Canada, 2010) *& PACIA* (PACIA, 2005)	**Packaging applications** *Adapted from* (PACIA, 2005)	**Photo Examples**		
OTHER: UNALLOCATED REFERENCES 07-19 *Includes all other resins and multi materials (eg laminates). Eg acrylonitrile butadiene styrene (ABS), acrylic, nylon, polyurethane (PU), polycarbonates (PC) and phenolics.*	• *Various properties depending on polymer type and/or content*	**Virgin Grades** Various type of packaging for food and industrial uses **Recycled Grades** Pallets	Plastic Pallets. Source: Rawtec. 	Food container (mustard), PIC code found on bottom of bottle. Source: Rawtec. 	Food sachet (drinking chocolate powder), PIC code found on back of sachet. Source: Rawtec. 

3 Data Report

3.1 Data Sources

The data sources that will be used for this data report are listed below, including a brief summary of the data they contain and the limitations to this data.

These data sources have been used to assess and project the quantities of plastics packaging material being consumed and recovered for recycling in SA. The methods of how these data sources were used and the results that were obtained from this assessment are presented in subsequent sections.

3.1.1 PACIA National Survey, 2009-10

- The PACIA National Survey is undertaken annually by PACIA and the results are published in a report which is publicly released.
    - Previously, the PACIA National Survey has been prepared on a calendar-year basis but it was conducted over the financial year for the first time in 2009-10.
- The 2009-10 PACIA National Survey Report (PACIA, 2011) (hereafter referred to as the 'PACIA Report'), provides polymer-specific data for plastics consumption and recycling for Australia but not on a State-specific basis.
    - Plastics and plastics packaging consumption data was only collected on a national basis.
    - Plastics recycling data was collected on a State-specific basis but the breakdown by polymer for recycling for individual states and territories was not separately identified in the PACIA Report.
        - This State-specific recycling data by polymer for SA, however, was subsequently sought and received from PACIA by Rawtec for the SA Recycling Activity Survey, 2009-10.
    - The recycling data in the PACIA Report also presents information on:
        - Source sector (i.e. Municipal, C&I, C&D) for resource recovery – but not by polymer or separately for packaging;
        - Destination (SA, Interstate, Overseas) for re-processing – but not by polymer or separately for packaging;
        - Amount of packaging recovered – but not by polymer.

3.1.2 SA Recycling Industry Investment Review, 2009

- The SA Recycling Industry Investment Review, 2009 (Zero Waste SA, 2009c) provided analysis and future projections to 2020 of waste generation, recycling and landfill disposal of materials for SA.
    - These future projections involved determining quantities of different materials, including for plastics and by polymer, which might be recovered in SA.

- The projections included the potential effect of future interventions on resource recovery, e.g.
    - Municipal –
        - Introduction of kerbside food waste collection
        - Improved kerbside recovery of dry recyclables
    - C&I –
        - Continuation of the Recycling at Work (r@w) program
        - Implementation of W2REPP, including landfill bans
        - Introduction of national product stewardship initiatives
    - C&D –
        - Implementation of W2REPP, including landfill bans
- Key sources of data used to infer composition of waste and recycling streams were:
    - Zero Waste SA kerbside audit data from select Adelaide Councils from 2009 (Zero Waste SA, 2009e) (Zero Waste SA, 2009d)
    - Local Government municipal waste collection and landfill disposal data, including between regional and metropolitan areas (Zero Waste SA, 2009b).
    - Zero Waste SA, SA Recycling Activity Survey data from 2008-09 (Zero Waste SA, 2010)
    - Zero Waste SA Landfill audit data from 2007 (Zero Waste SA, 2007)
- Key assumptions underpinning projected growth in waste generation and resource recovery were applied at sector level as follows.
    - Sector growth:
        - Municipal – In line with SA's projected future population growth
        - C&I – Continuation of SA's historical growth trend of this sector
        - C&D – In line with SA's projected future population growth
    - Growth in material recovery:
        - In proportion to the sector's projected growth.
        - In proportion to any increased sector-wide recovery of material.
        - For C&I and C&D projections, also considering specific interventions and taking into account residual material left in waste being disposed to landfill from that sector.
            - These interventions included implementation of the W2REPP

- As these projections were focussed on resource recovery, they did not separately project what was remaining in the waste disposed to landfill, which is important to this study.
- The analysis also did not separately identify in the plastics projections what could be attributed to packaging materials.

3.1.3 SA Recycling Activity Survey, 2009-10

- In 2009-10, the SA Recycling Activity Survey (Zero Waste SA, 2011) was conducted independently to the PACIA National Survey.
    - The resolution of this data was greater than that ordinarily available in the PACIA Report, and enables identification and estimation of SA plastics packaging recovery by polymer, including source sectors and destination.

3.1.4 Zero Waste SA Food Waste Pilot – Kerbside Audits, 2008 & 2009

- During 2008 and 2009, Zero Waste SA commissioned a series of kerbside audits to evaluate the potential for food waste collection over a number of metropolitan and regional councils in SA.
    - Data for select councils from several of these early audits was used for municipal projections developed by the SA Recycling Industry Investment (Zero Waste SA, 2009c)
    - Since this time, the Master Report (Zero Waste SA, 2009a) on these audits has been released.
        - This Report gives detailed aggregated compositional data for the municipal kerbside collection waste stream across SA, including for plastics by polymer.
        - Of particular relevance to this study, the polymer compositional data is also broken down according to different presentation types, including for packaging.

3.1.5 Zero Waste SA Landfill Audit 2007

- A landfill disposal survey was conducted in 2007 by Zero Waste SA of C&I and C&D waste presented for disposal at select metropolitan and regional transfer stations and landfills (Zero Waste SA, 2007).
    - The data collected provided resolution for different classes of plastics: plastic bags/film, hard plastic and polystyrene.
    - Whilst not differentiating between individual polymer classifications or between packaging and durable items, this data can be used to infer the potential plastics and plastics packaging composition of the C&I and C&D waste streams.

3.2 Data analysis methodology – Overview

With all of the different data sources, it is challenging to assess and interpret the data in a meaningful and consistent way. In particular, the data sources above each present different perspectives and coverage of both plastics and plastics packaging consumption, collection, resource recovery and/or recycling in South Australia. In view of this, the following approach was taken.

Please note in the following discussion that plastics packaging is a component of total plastics data for consumption and recycling.

It should also be recognised that there is an inherent degree of uncertainty in the data available from these sources, which is a function of how and when the data was collected. For example, the accuracy of estimates derived from this data analysis might be ±20-30%, but it is hard to assess. [This inherent uncertainty in data quality is not always discussed or described in these data sources].

- Section 3.3.1: PACIA data (PACIA, 2011) was used first to provide an initial estimate of plastics and plastics packaging consumption and recovery, including by polymer, for South Australia.
    - Data in the PACIA Report relevant to sources and destinations (for re-processing) of plastics packaging are also presented and discussed.
    - Other information in the PACIA Report about plastics packaging and potentially relevant to this study is also highlighted.
- Section 3.3.2: Recent SA data on waste collection, resource recovery and landfill disposal were then used to make an estimate of plastics packaging consumption and recovery, including by polymer, for South Australia.
    - It is important to note that quantities of plastics collected can provide another measure of consumption that is different to that for consumption contained in the PACIA data, principally (and for other reasons which are discussed in Section 3.3.2) because:
        - Some plastics do not necessarily enter the waste stream after they are ‘consumed’, such as durable plastic items incorporated into consumer goods, e.g. televisions, computers, etc.
        - There are contributions to plastics and plastics packaging collection from imported goods [which is believed not to be reported in the PACIA data].
- Section 3.3.3: Uses data from the SA Recycling Industry Review (Zero Waste SA, 2009c) to make high-level projections to 2019-20 of potential future plastics and plastics packaging consumption and resource recovery.
    - These projections were informed and updated from the analyses conducted in Sections 3.3.1 and 3.3.2.

3.3 SA Plastics & plastics packaging consumption & resource recovery

The following sections set out to assess and interpret the data obtained from the above sources in a practical way, as discussed above, in order to gain insights and a quantitative understanding of plastics and plastics packaging consumption in SA. Both plastics consumption and plastics packaging consumption are considered, as the collection and recycling of packaging and durable materials of the same polymer often use the same infrastructure and may be re-processed together. Again, please note that:

- Plastics packaging is a component to total plastics quantities.
- This analysis is presented on source data which may not necessarily accurately depict reality, and thus, there will be a degree of uncertainty in quantities that are estimated.
    - In this respect, many of the estimates are rounded so that the number of significant figures does not suggest higher accuracy than exists.
    - In some cases, this rounding means that there may be some minor discrepancies where totals do not precisely add up, as to do so would lose some resolution in smaller quantities which shouldn't be rounded to higher or lower values (otherwise they might be unrepresentative, e.g. becomes 1000 instead of 510 if rounding up, or become equal to zero if rounding down).
- This analysis often attempts to analyse the same or different data sources from differing perspectives, to make sure that consistent results and/or themes are identified.
    - This exercise is important as a reality check given the uncertainty which exists in some of these data sources.

3.3.1 PACIA Data analysis

3.3.1.1 Total plastics and plastics packaging consumption

- The PACIA Report's national per capita plastics and plastics packaging consumption statistics– see Table 3.1 – can be used to make a high-level estimate[1] of plastics and packaging consumption for South Australia.
    - SA Plastics consumption (based on national value of 67.3 kg/p/yr[2]) *ca.* 111,000 tonnes per annum
    - SA Plastics Packaging consumption (based on national value of 25.3 kg/p/yr[3]) *ca.*42,000 tonnes per annum

[1] Based on SA Estimated Population for June Quarter, 2010 (ABS, 2011)

[2] This per capita value was estimated by dividing PACIA's 2009-10 reported national plastics consumption value (PACIA, 2011) by Australia's June Quarter, 2010, population (ABS, 2011).

[3] This per capita value was estimated by dividing PACIA's 2009-10 reported national plastics packaging consumption value (PACIA, 2011) by Australia's June Quarter, 2010, population (ABS, 2011).

- However, the following important qualifications to this high-level estimate should be noted.
    - National plastics and plastics packaging consumption data may not reflect actual consumption levels in SA.
        - National consumption data is likely to be distorted by differences in plastics and packaging manufacturing and/or industrial activity between States.
            - For instance, Victoria was reported (PACIA, 2011) to have a higher level of plastics manufacturing than other states, resulting in greater generation and recovery of pre-consumer material.
            - Victoria was also reported (PACIA, 2011) to have the largest number of plastics recyclers of any state.
    - These consumption estimates do not include domestic consumption of plastic components and/or associated packaging incorporated into imported pre-consumer and post-consumer products, e.g. Glad wrap; Plastic bags; Electronic goods; Foodstuffs; Automotive components etc.
        - These imported contributions to plastics and packaging consumption in SA could be significant but do not seem to be measured and/or would not be easily quantifiable from other data sources, e.g. import data.

- The PACIA Report also referenced other data (SV & PACIA, 2008) which proposed the probable market sectors for plastics consumption – see Figure 3.1.
    - This data suggests that 37% of consumption could be attributed to packaging type material or activities.
        - The remainder (63%) of consumption would be for durable and/or non-packaging items (see Figure 3.1 for examples of what these durable and/or non-packaging items are).
    - If this proportion (37% of consumption) was strictly applied to the SA plastics consumption estimated above, as an alternative estimate of SA packaging consumption, it would be *ca.* 41,000 tonnes per annum.
        - This value seems consistent with the other high-level packaging estimate above, based on PACIA Report national per capita consumption statistics, of SA plastics packaging consumption.

3.3.1.2 By polymer

- The PACIA Report presents national plastics consumption data by polymer type. Percentage estimates for a polymer's consumption which could be attributed to packaging were also suggested by the PACIA Report.
    - Table 3.1 includes estimates of SA plastics and packaging consumption by polymer based on this national polymer consumption data and percentage attribution to packaging.

- Packaging consumption can be identified at *ca.* 43,000 t/yr according to this alternate assessment.
    - However, this does not include a potential contribution from the 'Other' polymer category, where packaging content was not separately identified.
- This assessment also suggests that the following polymers dominate SA packaging consumption, collectively constituting up to 80% (by wt.) of the State's estimated total.
    - HDPE, *ca.* 30%
    - LDPE, *ca.* 27%
    - PET, *ca.* 17%
    - PP, *ca.* 16%

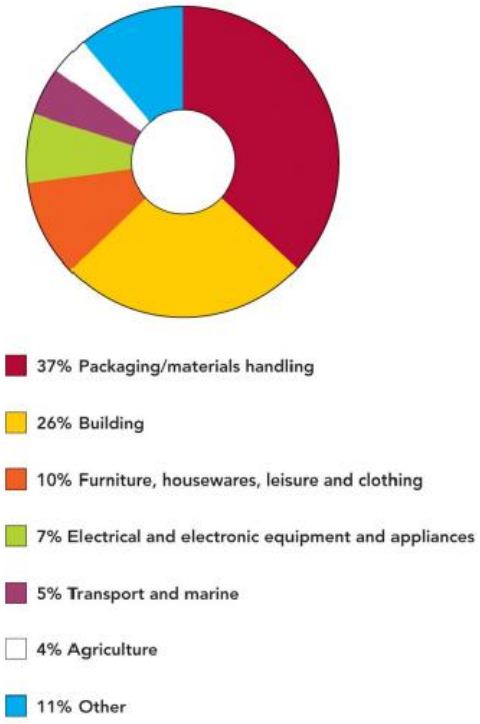


Figure 3.1: Market sectors for plastics use in Australia (SV & PACIA, 2008); Reproduced from PACIA Report (PACIA, 2011)

Table 3.1: SA plastics and plastics packaging consumption and resource recovery by polymer as estimated from PACIA Report data. PACIA data may not include data on imported plastics and plastics packaging. Please note that some data in this table were calculated as part of this analysis and may have been rounded - this may mean that some totals in the Table below do not necessarily precisely add up.

Polymer	PIC	Consumption				Resource Recovery										
		Plastics		Packaging		Plastics							Packaging			
		tonnes	%	tonnes	%	tonnes	%	% Recovery (Plastics Consumption)	No. Re-processors	Destination			tonnes	%	% Recovery (Packaging Consumption)	% Recovery (Plastics Recovery)
										SA	Inter-State	Over-seas				
PET	1	9030	8.1%	7220	16.8%	5269	28.1%	58.3%	0	_[(a)]	_[(a)]	1511	_[(a)]			
HDPE	2	23320	21.0%	12830	29.9%	4557	24.3%	19.5%	5	_[(a)]	_[(a)]	1436	_[(a)]			
PVC	3	15130	13.6%	300	0.7%	206	1.1%	1.4%	2	_[(a)]	_[(a)]	76	_[(a)]			
LDPE	4	19400	17.5%	11640	27.1%	4050	21.6%	20.9%	5	_[(a)]	_[(a)]	0	_[(a)]			
PP	5	17010	15.3%	6970	16.2%	3420	18.2%	20.1%	4	_[(a)]	_[(a)]	605	_[(a)]			
PS	6	2670	2.4%	2140	5.0%	479	2.6%	17.9%	2	_[(a)]	_[(a)]	165	_[(a)]			
EPS	6	3300	3.0%	990	2.3%	175	0.9%	5.3%	2	_[(a)]	_[(a)]	5	_[(a)]			
ABS/SAN	7	1480	1.3%	440	1.0%	66	0.4%	4.5%	3	_[(a)]	_[(a)]	0	_[(a)]			
PU	7	4050	3.6%	0	0.0%	121	0.6%	3.0%	0	_[(a)]	_[(a)]	0	_[(a)]			
Nylon	7	1300	1.2%	390	0.9%	4	0.0%	0.3%	2	_[(a)]	_[(a)]	0	_[(a)]			
Other	7	14420	13.0%	_[(a)]	_[(a)]	435	2.3%	3.0%	2	_[(a)]	_[(a)]	0	_[(a)]			
Total		111110	100%	42920	100%	18782	100%	17%	10	10582	4403	3797	14520	100%	34%	77%

Table Notes:

(a) NI/M: Not measured by the PACIA National Survey, 2009-10, or identified in the PACIA Report.

3.3.2 SA Consumption, recycling & landfill data

3.3.2.1 Total consumption

- Collection of plastics and plastics packaging could provide another measure of consumption as distinct from the consumption figures derived from the PACIA report, especially as there can be time delays between consumption and collection for durable items and there may be additional quantities arising from non-domestic sources.
- An estimate of total SA plastics and packaging consumption was achieved via a mass balance approach using data from SA Recycling Activity Survey (Zero Waste SA, 2011), SA kerbside collection data (Zero Waste SA, 2009a) and SA landfill audit data (Zero Waste SA, 2007).
    - For the landfill survey data, this approach involved making some assumptions about polymer and packaging splits between plastics classifications.
        - In this respect, it should be noted that the accuracy level of these estimates could be in the order of ±20-30%.
        - Please note that some estimates calculated as part of this analysis have rounded - This may mean that there are some minor discrepancies between some data where quantities do not necessarily precisely add up (as previously discussed).
    - The results from these estimates are given in Table 3.2 and Table 3.3 and suggest the following.
        - Plastics consumption for SA was estimated at *ca.* 90,000t/yr
            - This value is much lower than SA plastics consumption suggested by PACIA data above.
            - There could be several reasons for this as follows.
                - SA landfill audit and municipal kerbside data for plastics composition used in these estimates may not be representative, and thus, plastics consumption was underestimated. For instance, this data was often collected only at single or two time(s) of the year and was not necessarily weighted to reflect different geographical contributions.
                - The plastics consumption value from this analysis was considered (in the consultants' observation) particularly sensitive to the municipal kerbside collection plastics composition.
                - Plastics being consumed are incorporated into products, which are exported out of the state, e.g. food and consumer goods. This net export of plastics could be greater than plastics contained in imported products.
                - Collection of durables, e.g. television sets, play equipment, crates, etc. for recycling lags consumption of durables, which are a significant proportion of plastics consumption. This lag could involve from several years, e.g. 5-10yrs, to even longer periods.

        - Some durable items, e.g. batteries, e-waste, are recovered for recycling, may be collected and sent whole interstate or overseas for recycling, and thus their plastics content is not separately identified in resource recovery statistics for SA.
        - The PACIA national per capita consumption overestimates plastic consumption for SA, as SA's situation could be distinct or different to that of other states or the national average.
- Packaging consumption for SA was estimated at *ca.* 60,000t/yr.
    - This value is greater than packaging consumption suggested from PACIA data above.
    - Some reasons for this could include the following.
        - Like plastics consumption data above and for the same reasons, SA landfill and municipal kerbside data were not representative.
        - It includes the additional quantities of packaging entering SA as part of imported products, e.g. electrical/electronic equipment, food wrap, plastics bags, consumer goods, etc. from interstate or overseas.
        - The PACIA national per capita consumption underestimates packaging consumption for SA, again for the same reasons above.
            - In this respect, it is possible that this could be the case as states or territories with less plastics manufacturing activity, could consume a higher proportion of packaging relative to durables.

Table 3.2: Estimates of SA plastics consumption, resource recovery and disposal to landfill based on SA recycling, kerbside collection and landfill data. Please note that some data in this table were calculated as part of this analysis and may have been rounded - this may mean that some totals in the Table below do not necessarily precisely add up.

Polymer		Consumption				Resource Recovery					Landfill			
		Municipal	C&I	C&D	Total tonnes	Municipal	C&I	C&D	Total tonnes	Resource Recovery % of consumption	Municipal	C&I	C&D	Total tonnes
PET	1	5800	2900	100	8800	3800	1800	0	5600	64%	2000	1100	100	3200
HDPE	2	6600	7600	400	14600	1200	3700	0	4900	34%	5300	3900	400	9600
PVC	3	900	9100	300	10300	100	30	0	130	1%	900	9100	300	10300
LDPE	4	1400	11000	200	12600	1200	3000	0	4200	33%	200	8000	200	8400
PP	5	3600	4500	100	8200	600	3400	0	4000	49%	3000	1100	100	4200
PS	6	4500	2900	200	7600	200	100	0	300	4%	4300	2900	200	7400
Other	7	19000	6900	700	26600	800	400	500	1700	6%	18200	6500	300	25000
Total	tonnes	41800	44900	2000	88700	7900	12430	500	20830	23%	33900	32600	1600	68100
	%	47%	51%	2%	100%	38%	60%	2%	100%		50%	48%	2%	100%

Table 3.3: Estimates of SA plastics packaging consumption, resource recovery and disposal to landfill based on SA recycling, kerbside collection and landfill data

Polymer		Consumption				Resource Recovery					Landfill			
		Municipal	C&I	C&D	Total tonnes	Municipal	C&I	C&D	Total tonnes	Resource Recovery % of consumption	Municipal	C&I	C&D	Total tonnes
PET	1	5700	2400	0	8100	3800	1800	0	5600	69%	1900	700	0	2600
HDPE	2	4100	2500	70	6670	1400	200	0	1600	24%	2800	2300	70	5170
PVC	3	300	7100	50	7450	40	10	0	50	1%	270	7100	50	7420
LDPE	4	500	9500	30	10030	200	3100	0	3300	33%	200	6400	30	6630
PP	5	1200	1700	20	2920	300	1000	0	1300	45%	800	700	20	1520
PS	6	3500	2000	40	5540	200	40	0	240	4%	3300	2000	40	5340
Other	7	13500	4800	80	18380	900	100	20	1020	6%	12600	4800	60	17460
Total	tonnes	28800	30000	290	59090	6900	6200	20	13120	22%	21850	24000	270	46140
	%	49%	51%	0.5%	100%	53%	47%	0.2%	100%		47%	52%	1%	100%

3.3.2.2 By Polymer

- Table 3.2 and Table 3.3 include the estimates of SA plastics and plastics packaging consumption by polymer.
- For packaging, these estimates by polymer are also shown graphically in Figure 3.2 and Figure 3.3.
- These estimates suggest that:
    - Mixed/Other plastics (at 31%) could constitute the greatest quantity of packaging material collected.
        - It should be noted that this polymer category may result from how the plastic is classified (or cannot be classified) during kerbside and landfill audits.
        - Thus, it may consist of other polymers, which are not properly labelled with a PIC and/or are too contaminated to identify properly.
    - The other major polymers being collected appear to be relatively evenly spread across other polymer categories except for PP, which constituted only 5% of packaging being collected.

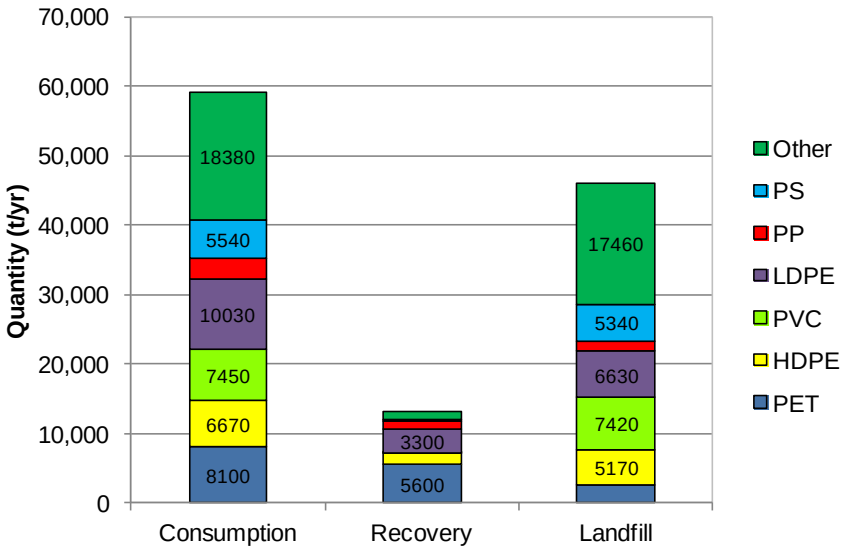


Figure 3.2: Estimated SA plastics packaging consumption, recovery and disposal by polymer

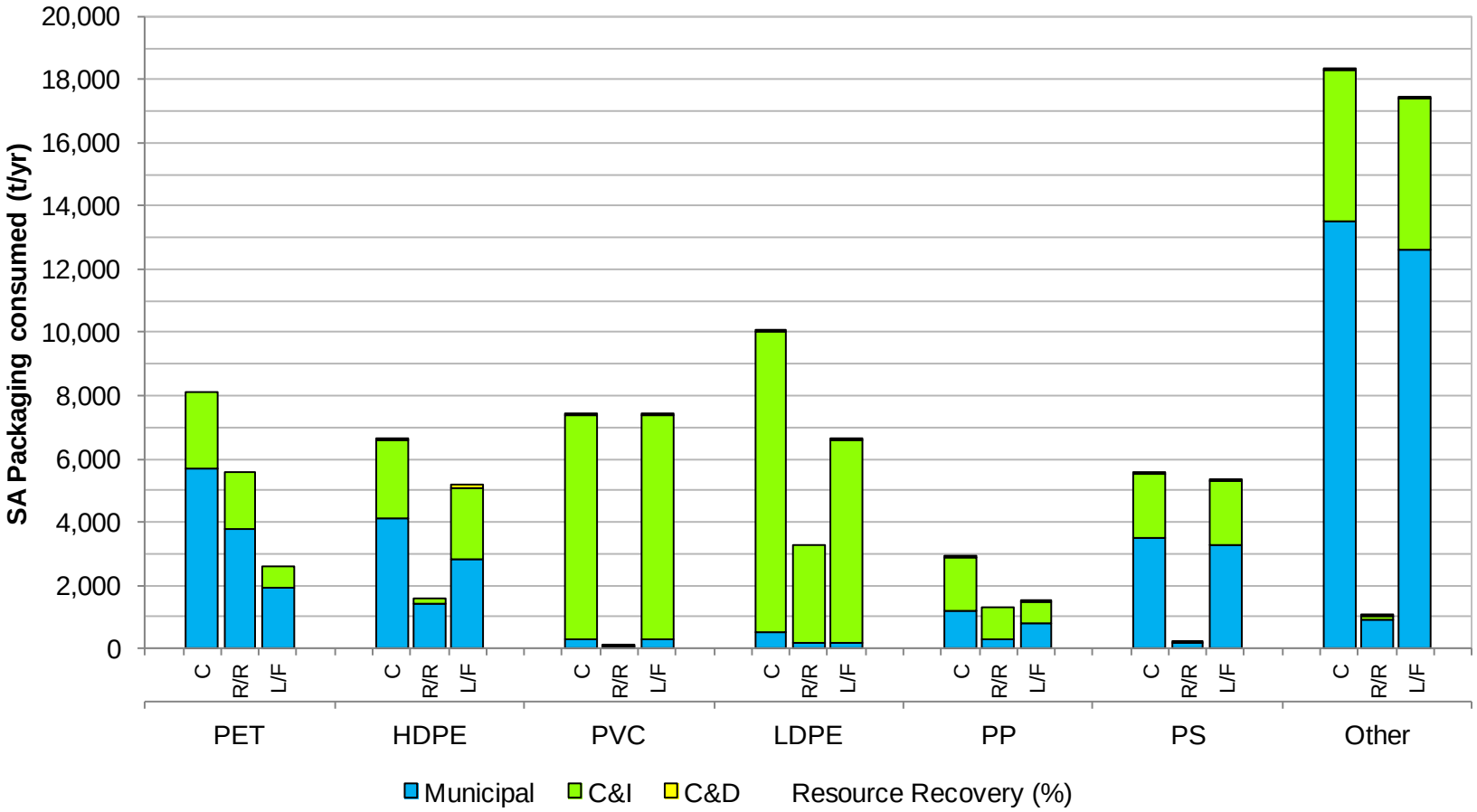


Figure 3.3: Estimates for SA plastics packaging consumption, recovery and disposal by polymer and source sector; C – Consumption, R/R – Resource recovery; L/F – Landfill. Data from Table 3.3. Refer to this table for C&D values which are negligible and difficult to distinguish from this graph.

3.3.2.3 By Sector

- Table 3.3 and Figure 3.3 include data on the source sectors from where plastic packaging may be being collected in the SA waste stream. The following comments can be made.
    - PET & Other category– Majority appears to originate from Municipal waste stream.
        - For PET, both the municipal and C&I contributions are probably mostly PET bottles.
        - For the Other category, contaminated film plastic, particularly in the Municipal stream, could be considered a significant contributor.
    - HDPE & PS – Seems to be equally split between Municipal and C&I waste stream.
    - PVC & LDPE – Appears to be dominated by the C&I waste stream
        - This may reflect larger volumes of soft or semi-rigid plastic packaging consumed by this sector.

3.3.3 Plastics & plastics packaging resource recovery

3.3.3.1 Total recovery

- The PACIA Report and 2009-10 SA Recycling Activity Survey (Zero Waste SA, 2011) estimated total plastics recovery at *ca.* 19,000 and 21,000t/yr, respectively – which can be considered similar outcomes given the accuracy of these data sets.
    - These values suggest that SA resource recovery of plastics could be between 20 and 25% of total plastics consumption.
- For plastics packaging recovery, the PACIA Report – see Table 3.1 – and Mass Balance derived estimate – see Table 3.3 – are 14,520 and ca. 13,000t/yr, respectively – which again are similar outcomes.
    - These values suggest that SA resource recovery of plastic packaging could be in the following ranges (taking into account the uncertainty in the data and depending on the definition of consumption used).
        - 70-75% of the total plastics recovery above.
        - 25-30% of the plastics packaging being consumed.

3.3.3.2 By polymer

- Table 3.2 and Table 3.3 include the estimates of SA plastics and plastics packaging resource recovery by polymer.
- For plastics packaging, these recovery estimates by polymer are also shown in Figure 3.2 and Figure 3.3.
- These estimates suggest that:
    - PET (at 43%) and LDPE (25%) appear to dominate resource recovery.
        - Nearly 80% of the PET would be CDL derived with majority being post-consumer material, e.g. bottles, other food packaging/containers, from the Municipal sector via CDL depots and kerbside MRFs.

        - The resource recovery of LDPE packaging seems to principally be from the C&I sector, which could be attributed to the commercial collection of these soft plastics from pre and post industrial sources.
    - HDPE (12%) and PP (10%) also appear to make significant contributions.
        - HDPE recovery seems to derive mainly from the Municipal sector, either from CDL depots and kerbside MRFs.
        - PP seems to be mainly from the C&I sector – It is not obvious what this C&I source for polypropylene is.
    - Despite Other/Mixed plastics constituting the biggest proportion of plastics being collected, very little of it appears to be subject to resource recovery.
    - Likewise, resource recovery of PVC seems extremely poor compared to the estimated quantities being collected in the waste stream.

3.3.3.3 By sector

- Table 3.3 and Figure 3.3 include data on the source sectors from where plastic packaging is recovered in the waste stream.
- Overall packaging recovery data by source sector from data in the PACIA Report is also illustrated in Figure 3.4.
    - As can be seen in Table 3.3, an almost identical result for sector split was obtained by the Mass Balance derived estimate.
- This information shows that virtually all resource recovery appears to occur from the Municipal (50-60%) and C&I sectors (40-50%), with almost negligible recovery from the C&D sector (<1%), which is not surprising as plastics consumption by this sector is small compared to MSW and C&I (Table 3.2.3.3).
- Comments on source sector recovery by polymer are as per discussion in the previous section.

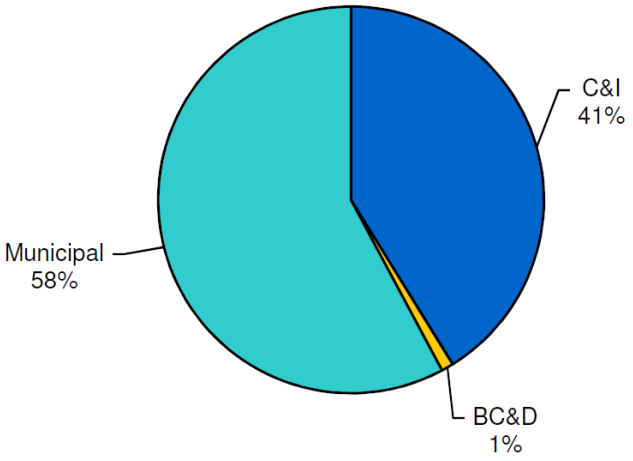


Figure 3.4: Source sectors for plastics recovered in SA, 2009-10; Reproduced from PACIA Report.

3.3.3.4 By geographical area

- The 2009-10 SA Recycling Activity Survey (Zero Waste SA, 2011) collected data for geographical sources of plastics recovery.
    - This data is summarised in Figure 3.5.
    - The metropolitan/regional split in SA should be approximately 75/25 (based on population split between metropolitan and regional areas in SA (ABS, 2011)).
        - The PET recovery appears to align with this population split, as most of this plastic material is recovered via CDL depots which are prevalent throughout SA.
        - For other polymers, the recovery splits seem to be in favour of metropolitan areas, which could be attributable to:
            - Greater resource recovery achieved by kerbside collection services and commercial services for C&I plastics collections;
            - Industry infrastructure and scale for aggregation and re-processing of the collected plastics.
- It was not feasible to use this data to easily and reliably predict the geographical split for plastics packaging, however, it would be expected to roughly align with that for total plastics.

3.3.3.5 Destination

- The PACIA Report contained data on the destination for plastic resource recovery in SA but not for plastics packaging recovery, and not by polymer except for overseas exports.
    - This data is included in Table 3.1 and summarised in Figure 3.6.
        - This figure suggests that significant quantities (56% or *ca.* 10,600t/yr) of the plastics recovered in SA had been reprocessed in the State.
        - Given that 77% of SA plastics recovery was attributed to plastics packaging, this observation suggests that there may be significant re-processing of plastics packaging already occurring in SA.
- Greater resolution on the destination for recovered packaging by polymer can be obtained from the SA Recycling Activity Survey Report (Zero Waste SA, 2011).
    - This data is summarised in Figure 3.7.
        - It suggests that:
            - Nearly all PET, PS and Mixed/Other Plastic packaging is exported interstate or overseas for re-processing.
                - Most of the Mixed/Other Plastic packaging goes overseas and is probably used to generate energy.
            - Significant quantities of HDPE, LDPE and PP, however, appear to be being re-processed in SA.
            - In total, about 30-40% (or *ca.* 4500t/yr) of the recovered plastics packaging currently appears to be being re-processed in SA

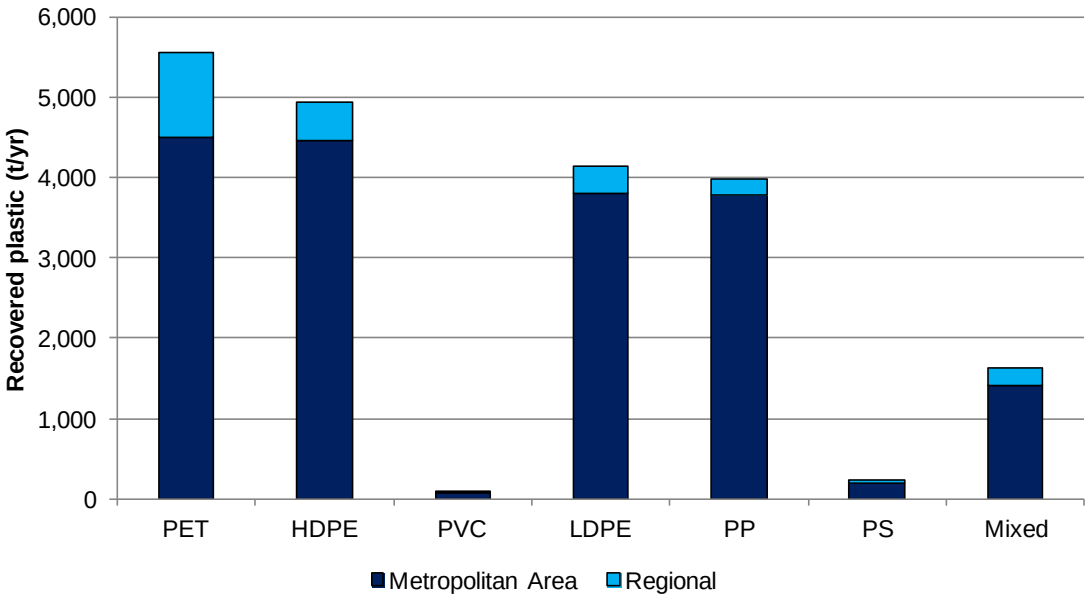


Figure 3.5: Plastics recovery by polymer showing estimated splits between metropolitan and regional area. Based on data in 2009-10 SA Recycling Activity Survey (Zero Waste SA, 2011)

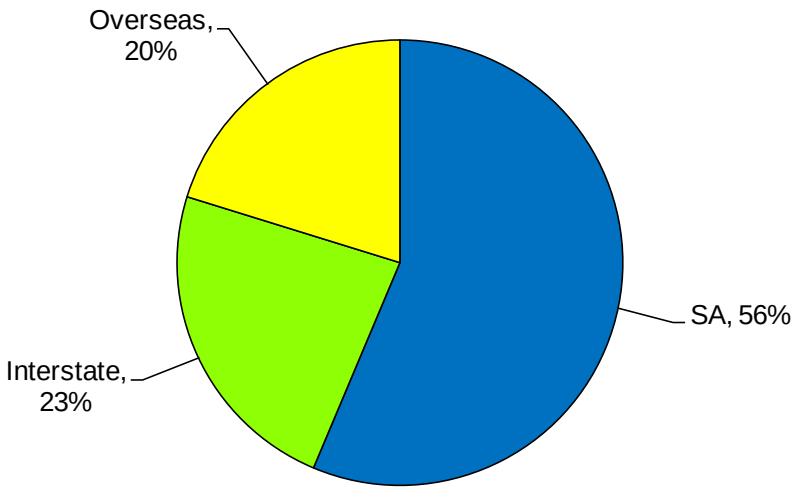


Figure 3.6: Destination for plastics recovered in SA, 2009-10. Based on data in 2009-10 SA Recycling Activity Survey (Zero Waste SA, 2011)

3.3.3.6 *Re-processors*

- The PACIA Report included the number of SA 'reprocessors' for each polymer that participated in the National Survey. *[It is assumed that these 'reprocessors' are companies involved in recycling in SA, not just resource recovery of plastics – but this has not been confirmed and may not be accurate].*
    - This data is included in Table 3.1.
    - There were no re-processors listed for PET, and therefore, it might be reasonably assumed that all plastics being recovered including packaging material was exported interstate and/or overseas.
    - In each other polymer category, there were between 2 and 5 re-processors, suggesting that SA has an existing recycling industry where 30-40% of these plastics are being re-processed in the State.
        - However, it cannot be determined whether and which re-processors are recycling packaging material.

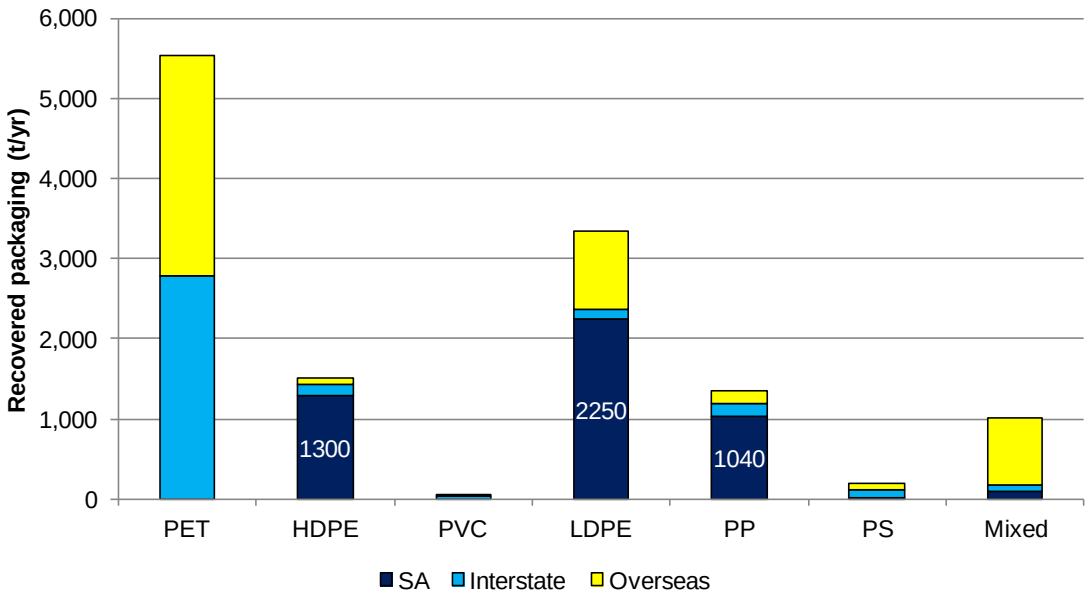


Figure 3.7: Destination for resource recovered plastics packaging in SA

An anonymised list of companies that reported recycling activity for SA during the SA Recycling Activity Survey is given in Table 3.4.

- Table 3.4
    - The list includes relative scale of activity, whether local/SA re-processing was conducted, if plastics packaging was sourced for resource recovery, and which polymers were handled during resource recovery.
    - It should be noted that this list does not include many other companies involved with resource recovery of plastics in SA; for example, CDL depots and super-collectors, where aggregated CDL recycling data was obtained from the SA Environment Protection Authority (Zero Waste SA, 2011), as opposed to directly contacting them.
    - This table suggests that only 4 companies had reported involvement in local re-processing.
        - These companies were generally involved in re-processing of HDPE, LDPE and PP.
        - It is not clear how much of the local re-processing included use of recovered plastic packaging.
    - The rest of the companies seem to only be involved with resource recovery.
    - Nearly all companies reported sourcing plastic packaging as part of their resource recovery activities.
        - The PACIA Report indicated that about 2,000t of plastic material were imported into SA from other states or territories (principally WA) during 2009-10 for re-processing. These amounts are not included in the 2009-10 SA Recycling Activity Survey data but may be important for the commercial viability of these re-processors.

3.3.3.7 SA performance vs. other states and territories

- Figure 3.8 summarises the plastics and plastics packaging recovery performance for SA and other Australia states and territories, based on data extracted from the PACIA Report.
    - It suggests that SA had the second best performance for plastics (at 17% of plastic consumed) and plastics packaging (35% of plastics packaging consumed) recovery in Australia.
        - Only Victoria had a superior performance to SA. The main reasons suggested in the PACIA Report for Victoria's superior performance over other states were:
            - Victoria has extensive kerbside recycling coverage which almost uniformly accepts plastics;
            - The State is home to nearly half the plastics reprocessors in Australia (by number); and
            - There is also substantial plastics manufacturing occurring in Victoria with a high level of pre-consumer recyclate recovery.

Table 3.4: Summary of organisations that directly reported plastics recycling activity for SA in 2009-10

Company	Relative Scale - Total Plastics Recovery	Local/SA Re-processing Activity	Sources Recovered Packaging	Polymers handled (Packaging & durables)						
				PET	*HDPE*	*PVC*	*LDPE*	*PP*	*PS*	*Mixed*
1	Medium	X	X							*X*
2	Large	X	X		X					
3	Large		X		X		X			*X*
4	Small		X							*X*
5	Medium		X	X	X	X	X	X		X
6	Small		X	X						*X*
7	Small		X	X						*X*
8	Medium	X	X		X		X	X		
9	Very Large	X	X		X		X	X		*X*
10	Medium				X					
11	Large		X							
Total	-	4	10	3	6	1	4	3	-	7

3.3.3.8 Trends in plastics packaging recovery

- The PACIA Report presents national data on historical trends in plastic packaging recovery since 2002 – see Figure 3.9.
    - This PACIA data suggests that plastics packaging recovery rates (based on consumption) have nearly doubled in the past decade – from *ca.* 20% in 2002 to *ca.* 35% in 2009-10.
- Based on the SA historical data in the PACIA Report, similar trends to those in Figure 3.5 appear to have also occurred in SA – see Figure 3.10.
    - Plastics packaging recovery seems to have increased from about 9% in 2002 to > 30% in 2009-10.
    - This figure also includes the historical PACIA National Survey data on plastics and plastics packaging consumption reported for SA.
        - It is worthwhile noting that whilst estimated plastics consumption levels have stayed relatively constant over this period, reported packaging consumption seems to have decreased by about 20% (from 50,500 to 41,900t/yr).
        - This decrease in packaging consumption has contributed significantly to the reported plastics packaging recovery; and in fact, given the variability of reported plastics packaging recovery, which has fluctuated between 10,000 and 14,500t/yr, it might therefore be hard to determine if there has been any substantive improvement in packaging recovery since 2004.

- The PACIA Report (2011) provides the following general explanations for changes in consumption and recycling trends of plastics packaging.

  "*Technical developments:*

  1. *Light weighting – new production techniques are enabling plastics to be produced with ... thinner material, meaning ... less packaging material per unit weight of product. In some cases, this can be in the order of 15% ...*
  2. *Multi-layer plastics (co-extruded) – blended plastics, primarily films, are being increasingly produced where different types of plastics ... are extruded together. These are being used to ... [improve] ... food preservation and product protection. Co-extruded films are less able to be mechanically recycled ...*

  "Packaging design developments:

  3. *"Rigids to flexibles – [there has been] .... a shift ... back from packaging in cardboard, glass or tin-plated steel, to rigid plastics ... [,which] ... are now further evolving to use flexible pouches and sachets. ... these types of flexible packaging are not currently recoverable through kerbside recycling systems.*
  4. *"Single serve – products are increasingly sold in single serve containers. This is increasing the quantity ... of plastic items....*

  "Collection and infrastructure:

  5. *Costs and purchase price – prices paid for plastic recyclate have been highly variable ... [which]... has had a direct impact upon export and local demand....*
  6. *Changes in processing – ... shift from hand sorting to high speed mechanical sorting has potentially reduced yields for some types of plastic packaging. International innovations in processing equipment (e.g. polymer sorters) mean there is greater capacity to sort and separate different plastic packaging types by polymer type and colour. This type of equipment is achieving some scale of use in Australia..."*

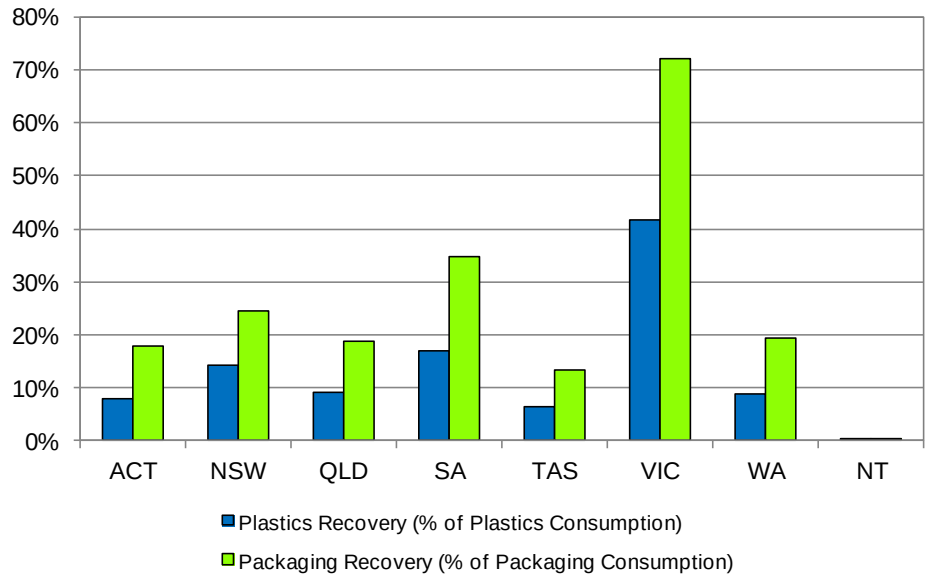


Figure 3.8: Relative performance between states and territories for plastics and packaging recovery. Based on plastics and plastics packaging consumption and recovery data in the PACIA Report

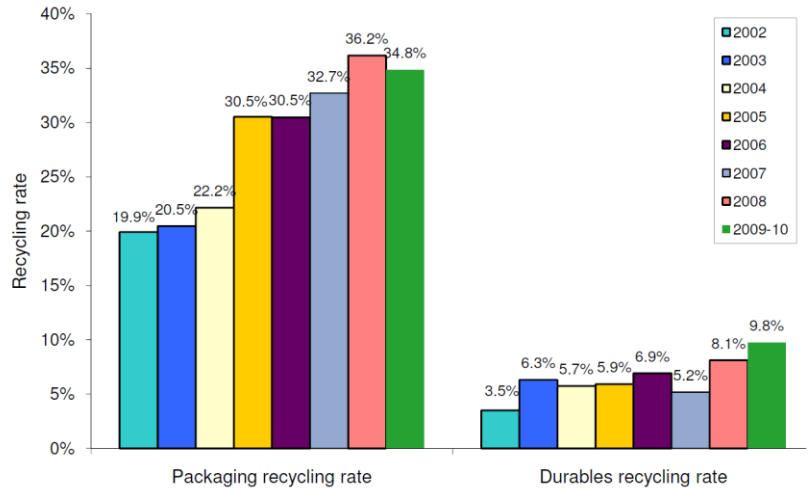


Figure 3.9: National trends in plastics packaging recovery; Reproduced from PACIA report. [The changes in recovery rates for durable plastics are also included in this figure.] Note: Surveys were conducted on a calendar year basis prior to 2009-10

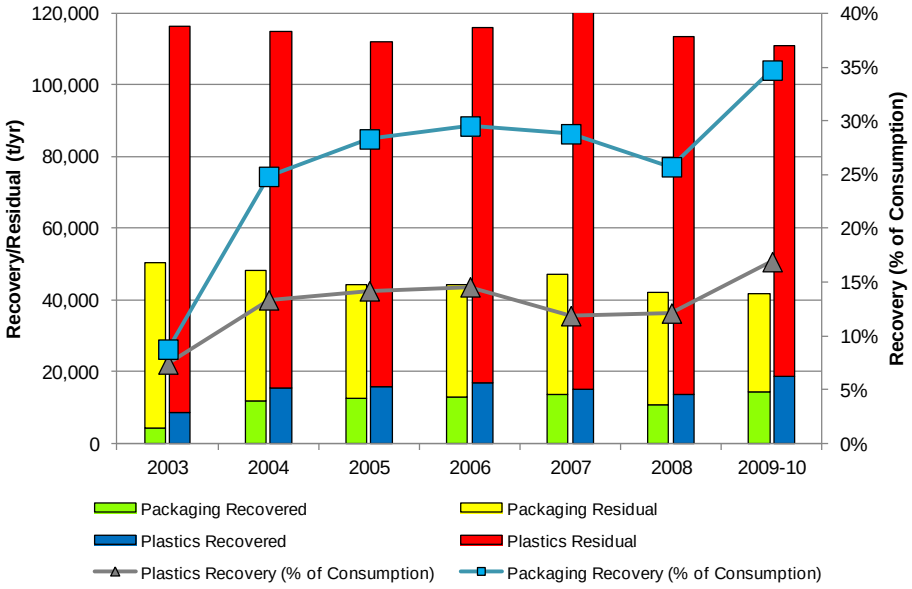


Figure 3.10: SA trends in plastics and packaging recovery based on recovery and consumption data in the PACIA Report. [The changes in plastics and packaging consumption are also included in this figure.] Note: Surveys were conducted on a calendar year basis prior to 2009-10

3.3.4 Landfill disposal of plastics and plastics packaging

- Table 3.2 includes the estimate of plastics, by polymer, disposed to landfill in SA.
    - It is estimated that there could be *ca.* 70,000t/yr of plastics ending up in landfill.
    - Figure 3.11 summarises this estimated composition of plastic material disposed to landfill by polymer.
        - The largest amount (at 37%) of plastic material being disposed to landfill appeared to be classified as Mixed/Other Plastics.
        - However, there were significant quantities of other plastic material also present.
- Table 3.3 includes the estimate of plastic packaging, by polymer, disposed of to landfill in SA. Figure 3.3 also included a summary of this data.
    - It is estimated that there could be up to 35,000-45,000t/yr of plastic packaging being disposed of to landfill.
    - Figure 3.12 summarises this estimated composition of plastic packaging disposed to landfill by polymer.
        - This composition roughly aligns with that suggested for total plastic material in Figure 3.11 and also suggests that Mixed/Other Plastics are the major contributor of plastics packaging in SA landfills.

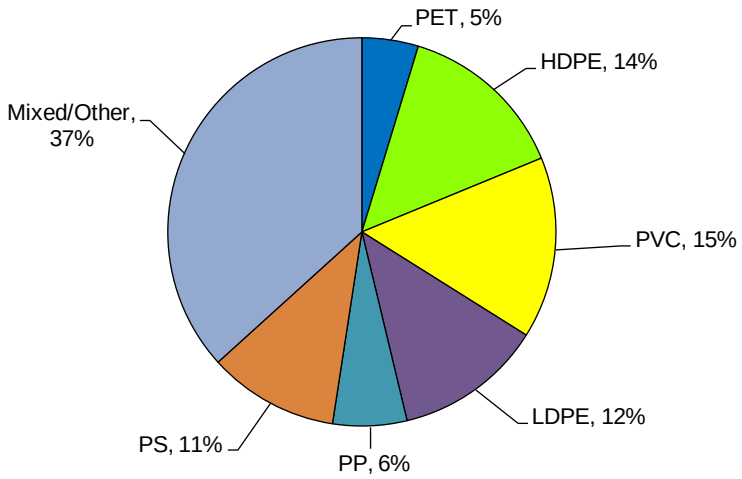


Figure 3.11: Estimated composition of plastics disposed of to landfill.

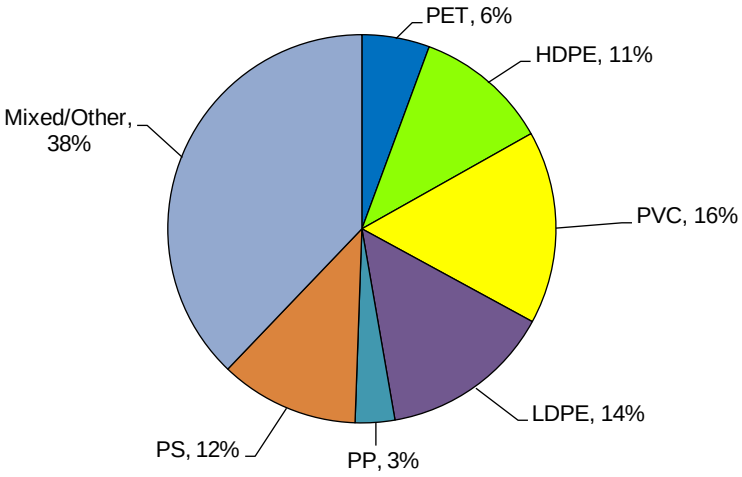


Figure 3.12: Estimated composition of plastics packaging disposed of to landfill.

3.3.5 Material Flows

The above analysis has been used to graphically map out, at a high level, the flow of plastic packaging materials occurring in SA for each source sector. These graphical flow diagrams are illustrated in **Error! Reference source not found.**, **Error! Reference source not found.** and Figure 3.15.

This mapping exercise describes the flow of materials from consumption, to collection, through to resource recovery and re-processing. Approximate quantities and typical compositions of waste and recycling streams at selected stages in this sequence of activities are also indicated, based on the data in Table 3.3.

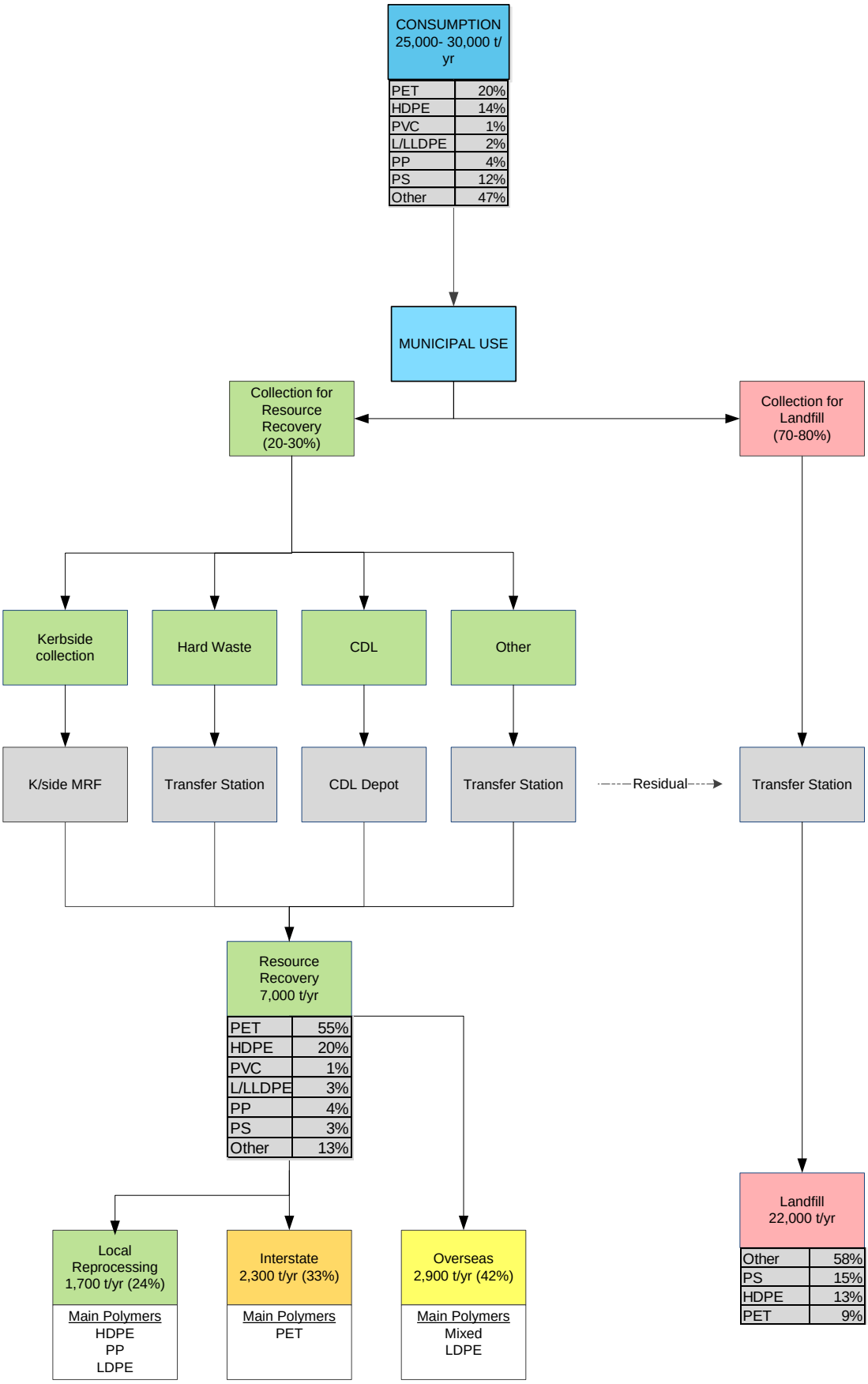


Figure 3.13: Material flow map illustrating high-level material estimates for plastics packaging in the Municipal sector

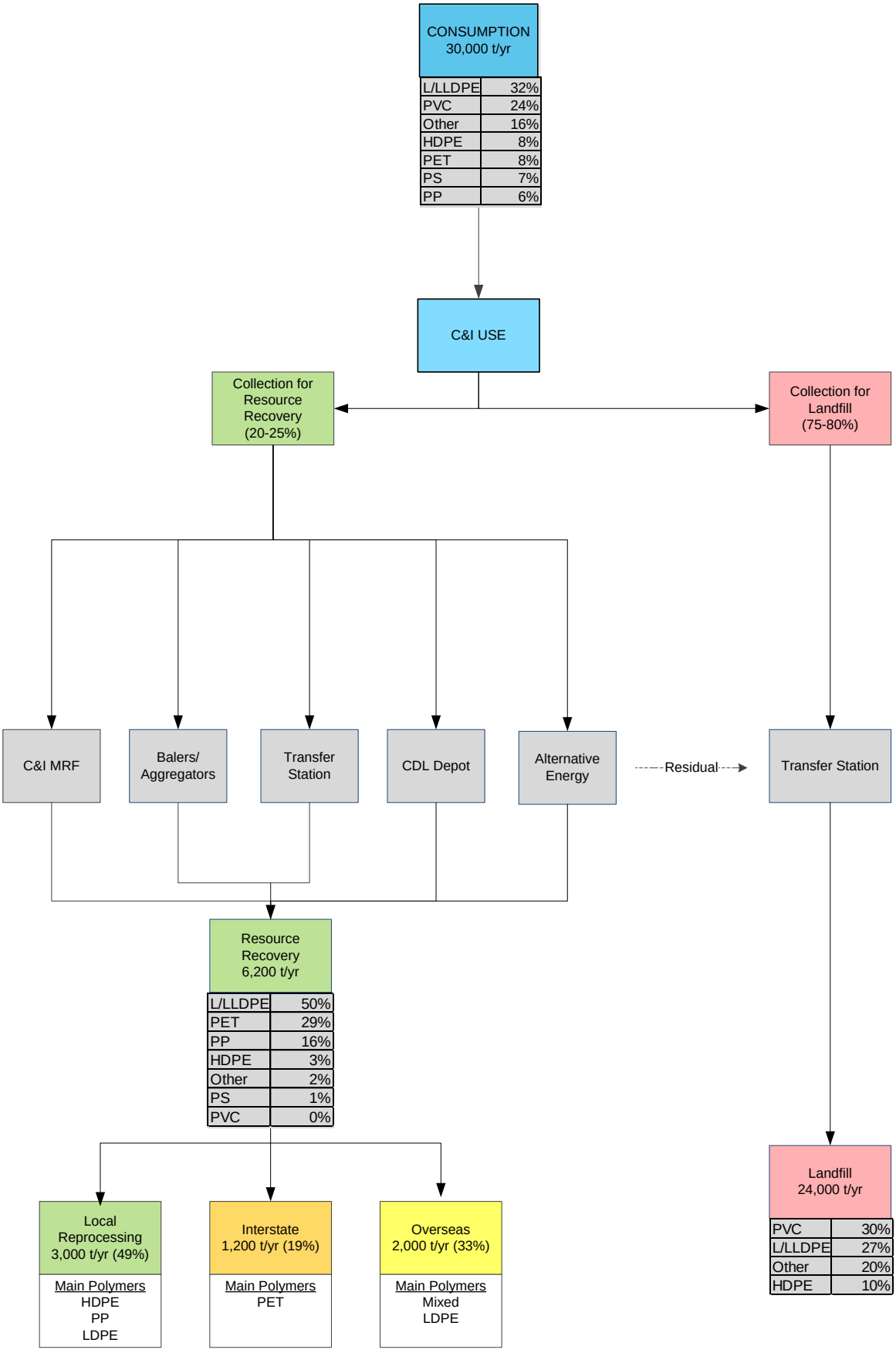


Figure 3.14: Material flow map illustrating high-level material estimates for plastics packaging in the C&I sector

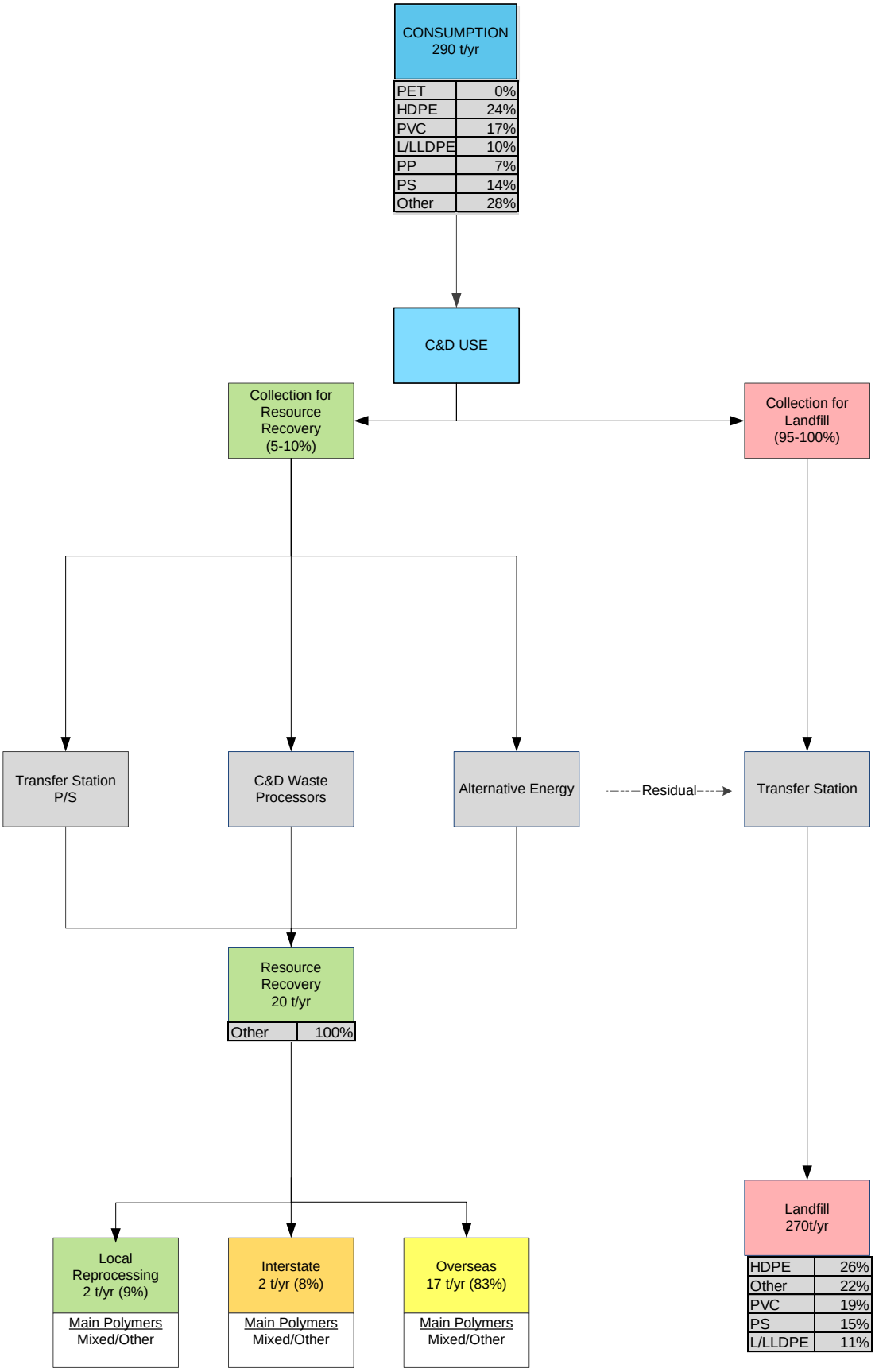


Figure 3.15: Material flow map illustrating high-level material estimates for plastics packaging in the C&D sector

3.4 Future projections

3.4.1 Previous SA Recycling Industry Review Projections

- Figure 3.16 shows the original SA Recycling Industry Review (Zero Waste SA, 2009c) projections for plastics recovery in SA from 2009-10 to 2019-20 (on a bi-annual basis).
    - The projections predicted close to a doubling of plastics recovery over this period.
    - This growth in plastics recovery was mainly attributed to the C&I sector, with the two polymers expected to show greatest gains in additional recovery being LDPE and PVC.
        - These predicted gains in LDPE and PVC essentially arose from suggested additional capture of residual material for these polymers from the waste-to-landfill stream that were to be achieved by the W2REPP and r@w program.

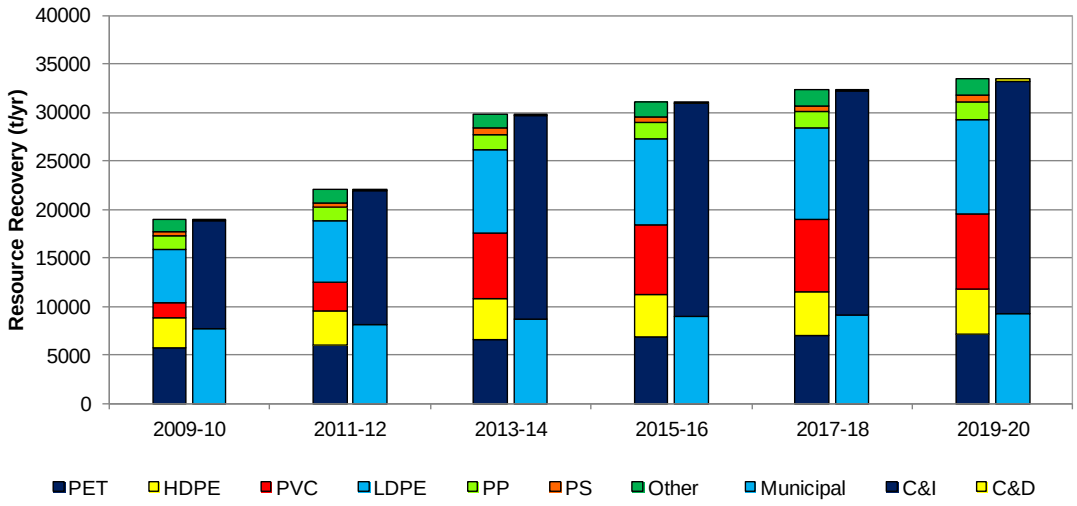


Figure 3.16: Recycling Industry Review (bin-annual) projections of plastics recovery by polymer and sector

3.4.2 Data report plastics & plastics packaging projections

- For the purpose of this data report, SA Recycling Industry Review projections for plastics recovery were first updated and expanded to allow projections of future plastics recovery as follows.
    - The plastics polymer compositions of each waste stream, by sector and for resource recovery and landfill disposal, in the original projections were updated to match the estimates developed in this data report and given in Table 3.2.
    - The same improvements in future resource recovery, due to various interventions, for original projections were retained for the purpose of this study.
    - Increased plastics polymer recoveries arising from these improvements were based on the remaining landfill composition.
        - This is a slightly modified approach to that previously used, which had increased resource recovery in line with existing resource recovery composition. It therefore recognises increased recovery is likely to return slightly different proportions of plastics and individual polymers for recycling, in line with what is actually left in the waste-to-landfill stream.

- Landfill plastic polymer compositions were updated accordingly.

- The same approach was also then separately applied to plastics packaging recovery.

The results of the projections for plastics and plastics packaging are shown in Figure 3.17 and Figure 3.18. A high level mass balance summary of these projections is given in Table 3.5.

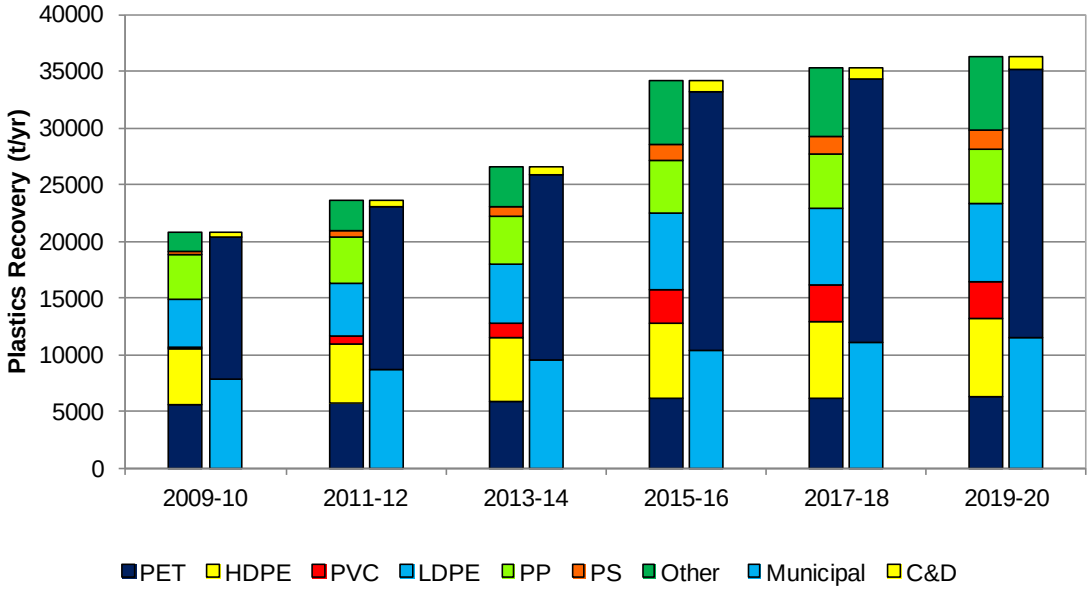


Figure 3.17: Plastics projections from 2009-10 to 2019-20

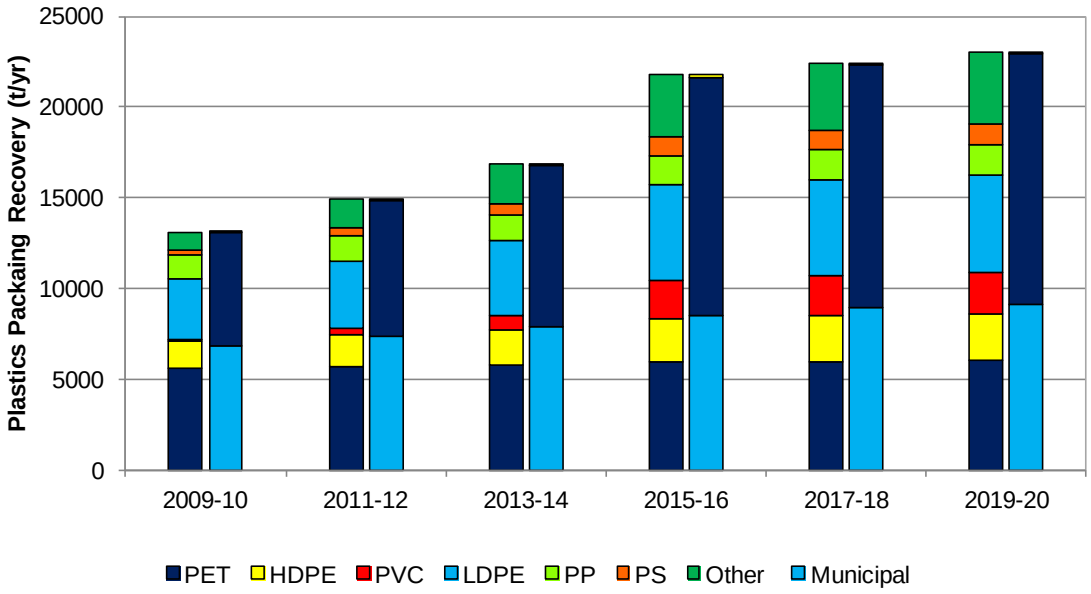


Figure 3.18: Plastics packaging projections from 2009-10 to 2019-20. Note: The contribution from the C&D sector is projected to be relatively negligible, and thus, cannot be easily distinguished in the Figure

Table 3.5: High-level summary of projections for plastics and plastics packaging

Activity	Parameter	2009-10	2019-20
Consumption	Plastics	89,000	104,000
	Packaging	59,000	69,000
Recovery	Plastics	21,000	36,200
	% of Plastics Consumption	23%	35%
	Packaging	13,100	23,000
	% of Plastics Recovery	63%	64%
	% of Packaging Consumption	22%	33%
Landfill	Plastics	68,000	82,800
	Packaging	46,000	55,000

In summary, the projections suggest the following outcomes.

- Both plastics and plastics packaging recovery could rise from current levels of 20-25% to 30-35% over the next decade.
    - A principal driver behind this improvement would be the W2REPP, which will require all C&I waste material to be subject to some type of source separation or resource recovery before disposal to landfill.
    - This type of increase will add at least another 10,000t/yr to the volumes of plastic packaging being recovered.
    - Two polymers where potential resource recovery could grow significantly are PVC and PS, which currently have relatively low levels of resource recovery.

3.5 Summary

- There could be about 13,000-15,000t/yr of plastics packaging being recovered from between 50,000-60,000t/yr of plastics packaging being consumed.
    - Thus, current resource recovery of plastics packaging is probably between 20 and 30% (a range is given as this best reflects uncertainty of the data used to derive this estimate).
- The source of this plastics packaging would be relatively evenly split between Municipal and C&I sectors with a negligible contributions from the C&D sector.
- However, the mix of polymers recovered from these two sources would be different.
    - Municipal seems to contain mainly PET plus HDPE, PS and Mixed/Other plastics.
    - C&I recovery appears dominated by LDPE with lesser contributions from PET, PP and Mixed/Other plastics.
        - This suggests that separate strategies for each of these sectors may need to be developed to improve plastic packaging recovery.
- There already could be substantial re-processing of recovered plastic packaging occurring in SA.
    - This could be in the order of 3,000-5,000t/yr which probably involves mainly HDPE, LDPE and PP – this proposition would need to be verified.
- The rest of the recovered packaging material seems to be exported interstate or overseas for re-processing.
    - This material appears to include:
        - Virtually all PET and Mixed/Other plastic packaging material.
        - Substantial amounts of LDPE.
    - These polymers and Mixed/Other plastic packaging material may therefore present a potential opportunity to develop new local re-processing capacity.
    - Durable plastic items should be considered when looking at these potential opportunities, to help with commercial viability.
    - For the same reason, also considered should be opportunities to import material from other states where SA's location may be advantageous over eastern States, e.g. WA and NT.
- There remain substantial quantities, between 30,000 and 40,000t/yr, of packaging plastics being sent to landfill.
    - This landfill waste stream appears to be dominated by Mixed/Other plastic packaging material.
        - This material may be too contaminated or unfeasible to recover and re-process, except by waste-to-energy techniques.
        - Nevertheless, it represents a significant opportunity to increase plastics packaging recovery.
            - Improved source separation may be important to unlocking the potential for greater resource recovery of this material.
    - However, there are significant quantities of other plastic packaging in landfill stream which might be recoverable for recycling.

        - This includes PVC, LDPE, PS and HDPE, which should also be considered.
- Projections for plastics packaging to 2019-20 suggest a substantial increase in recovery of plastics packaging might be achieved as a consequence of the W2REPP.
    - Plastics packaging recovery could rise from 20-30% to 30-40%, increasing quantities recovered from *ca.* 13,000t/yr to 20,000-25,000t/yr.
    - The majority of this increase is expected to be derived from the C&I sector due to landfill bans and increased resource recovery requirements imposed under the W2REPP.
        - The Municipal sector is exempt from many of the requirements of the W2REPP, and therefore, may not experience the same increases in plastics recovery.
    - Recovery of PVC and PS, which currently have relatively low levels of resource recovery, could grow substantially.
        - This may require (and depend on) new investments in resource recovery or re-processing infrastructure to handle these polymer types.
- Some potential barriers that were identified or inferred from the data sources that could reduce future plastics packaging recovery and recycling include the following.
    - Expanding use of multi-layer film or composite packaging, which may not allow individual polymer components to be separately recovered.
    - Shifts from rigid plastics to flexible plastics, which are more difficult to handle, separate and remove contamination from.
    - The growth in imported packaging which is not properly identified with a PIC.
    - Inability of MRFs to handle soft or film plastics, which mean they are not collected in comingled bins and/or from Municipal sources for recycling.
    - Potentially low diversion levels of plastics packaging at MRFs, which may result from difficulties in properly and cost efficiently identifying different polymers.
- Some possible opportunities that were identified or inferred from the data sources and this analysis which might improve plastics packaging recovery and recycling included the following.
    - Shifts from manual towards high-speed mechanical sorting, which reduces labour costs, and through use of light sensing technologies, enables better recovery outcomes.
    - Improved source separation so that plastics are not mixed, which restricts recovery and recycling potential.
    - Broader and proper use of the PIC by packaging manufacturers and industry users.
    - Achieving economies of scale in resource recovery or re-processing, including sourcing of material from interstate.
    - Development of innovative new recycled products manufactured from recovered plastics packaging.
    - Adoption of waste-to-energy strategies for mixed or contaminated plastics, which would not be economic to process by other means.
    - There could be scope for expanded product stewardship initiatives, which ensure that packaging is designed with recycling in mind.

4 Industry Analysis

4.1 Introduction

The SA Recycling Industry Review (Zero Waste SA, 2009c) conducted in 2009 also made an assessment of local industry infrastructure for plastics recovery and reprocessing. This included a snapshot picture of the plastics industry containing more detailed information about this sector.

The following sections have extracted aspects of this review relevant to this study. It is worthwhile reflecting on these aspects in advance of planned industry consultation regarding plastics packaging.

In reading this information it should be borne in mind that this review was not necessarily considering infrastructure specific to each polymer or packaging, but at a high level across the plastics sector, based on existing resource recovery activities being undertaken (and whether these could continue to meet similar future demands.)

4.2 Assessment of existing infrastructure

4.2.1 Type of infrastructure

Infrastructure for processing of recycled plastics in South Australia includes both:

- Primary (recovery by sorting, shredding and/or baling only) ;
- Secondary processing (recovery and reprocessing or beneficiation).

The primary recovery infrastructure includes kerbside MRFs for municipal recycling streams.

Those involved with secondary processing generally appear to separately source and collect recovered plastics for their reprocessing and beneficiation activities. The recycled plastic products produced by secondary processors in South Australia mainly include recycled plastics bollards, wheel stops, garden stakes and edging, fence posts and granulated plastic of near virgin material quality as a feedstock for plastics manufacturing.

4.2.2 Capacity

The estimated capacity of plastics industry infrastructure estimated by the SA Recycling Industry Review (Zero Waste SA, 2009a) is re-produced in Figure 4.1 overleaf. These capacity values do not include the kerbside MRFs.

The Review concluded that existing infrastructure appeared adequate to meet the future resource recovery requirements, including the existing kerbside MRFs. However, it did note that over-capacity was generally in collection and aggregation rather than separation and local re-processing. It was noted that the bulk of the plastics beneficiation in South Australia is performed by a single company, and the rest of the industry is dominated by collection and sorting companies. This same company is also responsible for most of the planned future expansion in secondary processing capacity.

It was therefore concluded that there may be opportunities to assist South Australian recyclers with expanding capacity for local beneficiation of plastic materials.

Figure 4.1: Estimated installed capacity of South Australian recycling infrastructure versus forecast resource recovery (tonnes per annum) for 2008-09, 2013-14 and 2019-20. Colour codes: Green = Installed capacity substantially or clearly greater than Resource recovery; Yellow = Installed capacity at or close to forecast resource recovery; Red = Installed capacity potentially less than forecast resource recovery. Bracketed numbers in red for Plastics represent current value and the future extrapolated resource recovery (from this value) in proportion to resource recovery forecasts. Reproduced from SA Recycling Industry Investment Review (Zero Waste SA, 2009a).

Recycled material	2008-09		2013-14		2019-20	
	Installed capacity	*Resource Recovery*	*Installed capacity*	*Resource Recovery*	*Installed capacity*	*Resource Recovery*
Plastics	49,700	17,800 (35,000)	76,800	29,700 (58,400)	78,700	33,100 (65,100)

Figure 4.2: Breakdown between recovery only (sorting and/or baling) and re-processing (sorting and some form of beneficiation) of existing infrastructure for plastics recycling in South Australia. Reproduced from SA Recycling Industry Investment Review (Zero Waste SA, 2009a).

4.3 Costs and value adding by recycling plastics

The following was given as a general guide to costs involved with recycled plastics collection and value achieved from primary and secondary processing of these materials.

- Collection – Plastic recyclers generally pay between $0 and $100 per tonne at the gate to receive recycled plastic materials depending on degree of source separation and contamination.
- Primary processing – Current international market prices for sorted and bundled baled scrap plastic materials with minimal contamination can range from about $500 per tonne up to $1000 per tonne.
- Secondary processing – Beneficiated plastic materials can be sold for upwards of $1000 per tonne depending on extent of beneficiation, i.e. simplest form: granulated feedstock, advanced forms: industrial and consumer products.

It was noted that the above numbers suggest an economic multiplier of at least 2 to 3 from collection to primary processed recycled plastic products, and above 5 for secondary processing.

4.4 Barriers and drivers for local industry development

Key issues identified by the review for industry as potential barriers and drivers for successful development of the local industry included:

- The lack of local demand for locally recycled products;
- Sourcing appropriate quality and sufficient quantities of feed plastic to achieve cost-effective economies of scale;
- Contamination of recovered plastics, which can significantly increase processing cost for recovery and beneficiation; and
- Inefficient recovery and manufacturing processes, which do not provide high quality and contaminant-free source or maximise utilisation of the available resource.

It was noted that the plastics recycling market in Australia was dominated by reprocessors in New South Wales and Victoria, who account for nearly 75% of plastics recycled in Australia. Thus, reprocessors in these states were able to:

- Leverage greater economies of scale unless local reprocessors import source materials from interstate or overseas; and
- Were also closer the major markets for these materials.

This was considered to place local re-processors at a competitive disadvantage. Efficiency in scale and purity of materials achieved by source separation by collection and resource recovery systems in South Australia was therefore considered vitally important for local plastics re-processors to help level the playing field and even provide a competitive advantage over interstate counterparts despite their smaller size.

4.5 Industry perspectives on future industry development

Industry stakeholders involved in consultation during the review proposed the following measures as possible ways to encourage increased plastics beneficiation in SA:

- A significant, programmed increase in the landfill levy, to increase incentives for resource recovery ;
- Procurement policies for local and state government which do not discriminate against use of recycled materials in favour of virgin materials ;
- Direction of waste plastics to specified collection depots where efficient resource recovery and separation can be achieved to produce high quality recovered plastic feedstock for further primary and secondary processing;
- Education on source separation to again support the above objective; and
- Further market development to raise local industry awareness of locally produced recycled plastic products and increased demand for these products and support future expansion of secondary processing.

It was also noted that some industry stakeholders were considering waste to energy processes to add value to their plastics waste streams, especially when dealing with Mixed plastics waste streams.

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Appendix 2: Stage 1 Industry Consultation – Consultation Questions

2 December 2011

ZERO WASTE SA

SOUTH AUSTRALIAN PLASTICS PACKAGING

RESOURCE RECOVERY SECTOR STUDY, STAGE 1

Consultation Questions

PO Box 1159,
Glenelg South, SA, 5045
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* There could be different questions asked depending on Packaging Industry Role, as indicated below. Not all questions would necessarily be asked depending on relevance to the consultation candidate.

General Questions (asked to all)
1. How much & what types of packaging does your organisation manufacture/consume/collect/recover/re-process?
2. Where and how is this packaging material obtained?
3. Where and how is this packaging waste material disposed of and/or re-processed?
4. Do you know what polymers are in this packaging material? If yes, how did or do you identify, obtain or record this information?
Packaging Manufacturers & Brand Owners' Questions
5. What is your policy on recycling of packaging material & how do you implement it?
6. How do you specify or design your products with recycled content, recycling and/or reuse in mind?
7. How or do you specify/require/apply labelling strategies do support packaging recycling or reuse, e.g. PIC, other?
4. What is the recycling content of your existing packaging and what dictates whether you can use recycled content and how much?
5. Do you monitor how much recycling of your plastic packaging is occurring?
6. Do you take a product stewardship approach to recycling/reuse?
7. What future trends do you see in plastics packaging design & use and how do you see they will affect recycling/reuse of these materials?, e.g.
- Product stewardship, life cycle/supply chain principles?
- Light weighting
- Laminated or multi-film packaging?
- Degradable and/or bio-compostable plastics?
- Carbon tax?
8. What are the key barriers/opportunities that you see affecting improvements in plastic packaging recycling?
Consumers' Questions
1. What is your policy on use & recycling of packaging material & how do you implement it?
2. Do you specify recycled content in your packaging material and what dictates when you use recycled content and how much? Could you reduce and/or substitute plastic packaging materials?
3. What special recycling systems/procedures do you have in place to identify and source separate different packaging materials?
4. Is it easy for you to identify what polymers are used in the packaging? Which polymers do or can you recycle?
5. Do you know what happens to packaging materials in waste & recycling streams when they are collected & disposed/recycled?
6. What future trends do you see in plastics packaging design & use and how do you see they will affect recycling/reuse of these materials?
7. What are the key barriers/opportunities that you see affecting improvements in plastic packaging recycling?
Aggregators, Re-processors & MRFs' Questions
1. What facilities do you have in SA and what activity(ies) are they involved in?

2. Please describe these facilities, including capacity and types of plant and equipment.
3. Which polymers are you handling, how are they handled and where do they go for recycling? If sent overseas, where do they go and what is their fate?
4. What source sectors, e.g. Municipal, C&I and C&D, do you obtain recovered polymers from? What is the split between these sectors?
5. What barriers/issues determine whether you can collect & recycle plastic packaging material?, e.g.
- Identification of the polymer?
- Local reprocessing capacity or markets?
- Volumes & economies of scale?
- Commodity prices?
- Interstate competitors and/or imports?
- Market acceptance or exclusions for recycled content?
- Degradable plastic additives (or other contaminants)?
- Laminated or multi-layer plastic packaging materials?
- Organic contamination?
- Compostable plastics?
- The W2REPP and/or other regulatory issues/barriers?
6. What are the economic or cost factors that dictate the commercial viability of your operations?
7. What is in the mixed/other plastics fraction that is collected and could recovery from this fraction be improved?
8. If more material was available, could you increase capacity to take it? What would help you do this?
9. Could you expand or start new operations to accept different polymers? What would help you do this?
10. Would the following initiatives and/or technologies assist this outcome or make your current operations more efficient or commercially viable?, e.g.
- Better labelling for plastics identification?
- Sensor-based automatic sorting technologies?
- Uniform size reduction of material for sorting/separation purposes, including mixed fraction?
- Volume reduction technologies for improved collection efficiency or lower collection costs, e.g. PS?
- Product stewardship schemes?
- Waste-to-energy technologies where material cannot be recovered cost effectively?
- Better testing and/or standards to allow or increase market acceptance of recycled plastics?
- New product and/or market development for recycled products?
10. What new opportunities do you see or would be interested in for local (SA) re-processing of plastics packaging?
11. What type of support/initiatives from Government would assist in exploiting these opportunities?