Standing Council on Environment and Water

Attachment C:

Cost benefit analysis report

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WRIGHT CORPORATE STRATEGY PTY LTD

Focused Innovation

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Acronyms

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ADF	Advance Disposal Fee
APC	Australian Packaging Covenant (formerly NPC)
AWT	Alternative Waste Technology
BCR	Benefit Cost Ratio
C&I	Commercial and Industrial
CAGR	Compound Annual Growth Rate
CBA	Cost Benefit Analysis
CDL	Container Deposit Legislation
CDS	Container Deposit Scheme
COAG	Council of Australian Governments
CPI	Consumer Price Index
CRF	Container Recycling Fee
CRIS	Consultation Regulatory Impact Statement
DEWHA	Department of the Environment, Heritage, Water and the Arts (now DSEWPAC)
DRIS	Decision Regulation Impact Statement
DRS	Dansk Retursystem
DSD	Duales System Deutschland
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (formerly DEWHA)
FTE	Full Time Equivalent
EPHC	Environment Protection and Heritage Council
EPR	Extended Producer Responsibility
EU	European Union
HDPE	High Density Polyethylene

IVT	In-Vehicle Time
KAB	Keep Australian Beautiful
LGA	Local Government Area
LPB	Liquid paperboard
MRF	Material Recovery (/Reclamation) Facility
MS2	Martin Stewardship and Management Strategies
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NPC	National Packaging Covenant
NPV	Net Present Value
OBPR	Office of Best Practice Regulation
PET	Polyethylene terephthalate
PSO	Product Stewardship Organisation
PV	Present Value
PwC	PricewaterhouseCoopers
RIS	Regulation Impact Statement
RTA	Roads and Traffic Authority
RVM	Reverse Vending Machine
SMEs	Small and Medium Enterprises
SCEW	Standing Council on Environment and Water
SOOG	Senior Oversight Officers Group
TEC	Total Environment Centre
VKT	Vehicle Kilometres Travelled
VOC	Vehicle Operating Cost
WCS	Wright Corporate Strategy
WG	Working Group

Contents

Executive summary

Used packaging in Australia has a range of impacts such as imposing costs on third parties through litter and land filling and creating opportunity costs due to the embedded resources lost under current disposal methods. These problems were identified and discussed in the *Problem Statement for Packaging* complied as part of this project.

Based on the market failures identified, a range of options to mitigate the impacts of used packaging were developed. These options are:

Non-regulatory:

- Option 1: National Waste Packaging Strategy

Co-regulatory:

- Option 2A: Co-regulatory Packaging Stewardship
- Option 2B: Industry Packaging Scheme
- Option 2C Extended Packaging Stewardship Scheme

Mandatory:

- Option 3: Mandatory Advance Disposal Fee (ADF)
- Option 4A: Boomerang Alliance (BA) Container Deposit Scheme (CDS)
- Option 4B: Hybrid CDS

Each option involves a range of initiatives or programs to address different problems within the packaging waste stream. Details of initiatives, regulatory arrangements and funding are detailed in the *Packaging Option Report*.

It is possible to combine the non-regulatory options (Option 1) with the co-regulatory (Options 2A, 2C and2C) or mandatory options (Options 3 and 4), although this is a more complicated exercise than simply adding the costs and benefits of each option given diminishing marginal returns.

The *Problem Statement* also identified that recycling in Australia is already at relatively high levels, particularly for at home recycling. This means that further gains in increasing recycling will come at increasing cost. In other words, linear rates of increases in both the participation and recycling effort cannot be expected. Therefore, it is necessary to make trade-offs between the cost of a given option and the benefits, particularly the reduction in litter and increase in recycling, it could achieve. A Cost Benefit Analysis (CBA) has been conducted to assess these trade-offs and compare- indicative costs and benefits of each option. This report presents the assumptions and results of the CBA. The report has been prepared by PwC and Wright Corporate Strategy (WCS) based on advice provided by the Standing Council on Environment and Water (SCEW) Working Group (WG) and Packaging Waste Senior Officers Oversighting Group (SOOG).

A range of assumptions regarding the costs and benefits of each option have been made and are summarised in this report. The CBA compares each option relative to a 'business as usual' scenario (the base case). Economic costs and benefits will be measured from the perspective of society as a whole and where possible, they will be monetised and discounted to convert them to their net present value (NPV). To do this, the following key assumptions and estimates are required.

Table ES.1: Key assumptions and estimates

Assumption type		Assumption
General assumptions	Base year of appraisal	2011
	Evaluation period	25 years[1]
	Real discount rate	7%
Projections	Consumption projections	Same for all options and based on historical growth of packaging consumption relative to population growth.
	Recycling projections	Recycling projections are based on the initiatives of each option and the maximum recycling rate that is considered feasible.
	Litter projections	Due to the lack of data on litter, a method to project litter under each option was developed which examines the 'packaging available to be littered'.
	Landfill projections	Landfill projections are iterated from the consumption and recycling projections
Cost assumptions	Scheme design and implementation costs	Regulation design / implementation costs, government participation costs and communications costs.
	Scheme operation	Government costs to administer regulations, scheme administration costs, scheme initiatives and infrastructure.
	Scheme compliance	Reporting and labelling costs.
Benefit assumptions	Use values	Market value of resources, avoided regulatory costs, avoided landfill externalities, avoided operating costs of landfill, avoided costs of mixed waste contamination and avoided costs of litter clean up.
	Non-use values	Society's willingness to pay for increased recycling.

There are already packaging recycling levels of 62.5% and any change from this will require cost outlays. The CBA allows us to compare the potential recycling levels against estimates of the likely costs that will be incurred by government, industry, households, businesses and other stakeholders.

Option 2A is the only option with a positive NPVs and BCRs of greater than 1 meaning that the benefits of this option are greater than the costs when non-use values are excluded. All other options have negative NPVs and BCRs meaning that the costs are greater than the benefits when non-use values are excluded. Options 2B has the second highest BCR and NPV, with a BCR of 0.91. Options 2C and 3 have the highest benefits, however also entail the greater costs than Options 1, 2A or 2B. Options 4A and B have relatively high benefits, however also have the greatest costs resulting in the lowest NPV and BCR of the options.

[1] All options are evaluated over the same 25 year period (2011-2035). This represents the longest evaluation period of all the options (Options 4A and 4B) as measured by 20 years from the first year of operation (2016).

Table ES.2: Results of CBA based excluding non-use values ($2011 millions, discounted)

		Option 1 National Waste Strategy	Option 2A Co-reg Stewardship	Option 2B Industry Scheme	Option 2C Extended Stewardship	Option 3 Mandatory ADF	Option 4A Boomerang CDS	Option 4B Hybrid CDS
Costs	$millions	$311	$258	$554	$984	$981	$2,125	$2,471
Benefits	$ millions	$262	$304	$503	$786	$786	$710	$710
NPV	$ millions	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
BCR	Number	0.84	1.18	0.91	0.80	0.80	0.33	0.29

Note: Real discount rate of 7% and evaluation period of 25 years (see table ES.1 for summary of general assumptions.

The table below summarises the key factors driving the results of the CBA, which include:

- Option 1 and 2A are relatively low-cost options, while Options 4A and 4B are relatively high cost options. This is driven by the higher household participation costs and scheme initiatives/infrastructure costs of Options 4A and 4B relative to other options. A CDS moves from a well understood and utilised, centralised kerbside recycling system offering substantial coverage to a decentralised system requiring significant behavioural change

- All options involve an overall increase in recycling by 2035, with Options 2C and 3 having the highest overall recycling rate in 2035 (4.5 million tonnes) and Options 4A and 4B having the highest beverage container recycling rates in 2035 (1.1 million tonnes).

Table ES.3 Summary of key factors driving the results of the CBA

Option	Costs ($2011, PV, millions)	Benefits ($2011, PV, millions)	2035 packaging recycling quantity (million tonnes)	2035 litter quantity (tonnes)	2035 landfill quantity (tonnes)
Option 1	$311	$262	4,22	30,300	956,000
Option 2A	$258	$304	4.20	31,000	977,000
Option 2B	$554	$503	4.26	28,900	915,000
Option 2C	$984	$786	4.50	21,700	689,000
Option 3	$981	$786	4.50	21,700	689,000
Option 4A	$2,125	$710	4.31	28,400	867,000
Option 4B	$2,471	$710	4.31	28,400	867,000

Table ES.2 presents the results of the analysis excluding non-use values. This analysis estimates a net benefit to society of up to $46 million (2011, PV) for Option 2A to a net cost to society of $1.7 billion (2011, PV) for Option 4B.

An additional measure of the increased value of recycling as a result of the options is the willingness to pay for recycling (incorporating non-use values), although the extent to which there is double counting of benefits of the use value benefits is unknown. Households place a value on increasing recycling that, to an unknown extent, includes the value of the embedded resources in recycled goods and a range of other 'non-use' components. These non-use components that lead households to value recycling could include the environmental benefits or a feeling of civic duty.

In 2010 PwC was commissioned by the EPHC to undertake a study of households' willingness to pay (WTP) for recycling. In the study it was found that households were willing to pay on average $2.77 per year for every 1% increase of packaging recycled above current levels of tonnes.[2]

[2] PwC, 2010. *Estimating consumes' willingness to pay for improvements to packaging and beverage container waste management.*

The table below presents the present value of the willingness to pay benefits estimated using the 95% confidence interval lower bound of $2.19 and upper bound of $3.77 (in addition to the core point estimate of $2.77). A 95% confidence interval means that there is a 95% level of confidence that the true, average value lies within this range.[3]

This analysis estimates that the present value of the willingness to pay benefits ranges from $233 million for the lower bound estimate of Option 2A to $1.2 billion for the upper bound estimate of Options 2C and 3.

Table ES.4: Summary of recycling willingness to pay benefits (incremental to base case, $millions, PV)

		Option 1 National Waste Strategy	Option 2A Co-reg Stewardship	Option 2B Industry Scheme	Option 2C Extended Stewardship	Option 3 Mandatory ADF	Option 4A Boomerang CDS	Option 4B Hybrid CDS
Lower confidence interval	PV	$234	$233	$422	$689	$689	$465	$465
Point estimate	PV	$296	$295	$534	$871	$871	$588	$588
Upper confidence interval	PV	$403	$402	$727	$1,186	$1,186	$801	$801

It is potentially misleading to include both estimates of the willingness to pay for increased recycling and the use value benefits given the possibility of double counting (i.e. if it was true that households considered market values of packaging materials when estimating their willingness to pay). It is not possible to disaggregate this WTP value into the use (i.e. the market value of materials) and non-use values of recycling, so the extent of this potential double counting is indeterminate. As such, it will be necessary for decision makers to make a judgment as to whether it is reasonable to expect that the society's willingness to pay for increased recycling (excluding any double counting) are likely to exceed the net cost estimated in Table ES.2based on the market value of materials alone.

As well as placing a value on increasing recycling, society places a value on reducing litter. The 2010 PwC study conducted analysis of the extent to which households value decreases in litter. However, it was not possible to reliably include these WTP for reductions in litter in the CBA. This is because households were asked about their willingness to pay for a reduction in litter, but were not given units of measurement. It is therefore not known whether people were thinking about the number of littered items, their volume, weight, visual impact, environmental impact or some other measure when valuing litter reduction.

There are also likely to be 'co-benefits' associated with increased recycling and reduced litter of non-packaging products as a result of the proposed packaging options. These co-benefits could arise from the use of CDS collection infrastructure, increased awareness of recycling/litter more generally and reduced contamination of kerbside recycling. However, the complexity of quantifying these impacts in the tight timeframes associated with the Consultation RIS (especially given that there may also be additional costs required to realise these co-benefits which would also need to be quantified) has meant that these potential benefits have been discussed qualitatively.

[3] *Ibid.*

Background and general assumptions

1. Introduction

Role of this paper

This report presents a range of assumptions and estimates that will underpin a cost benefit analysis (CBA) of options relating to the end of life management of packaging (the results of which are in Chapter 6).

The CBA enables comparison relative to a 'business as usual' scenario (the 'base case') of the impacts of proposed options for government intervention to address the problems of packaging. Economic costs and benefits will be measured from the perspective of society as a whole, and for comparative purposes, where possible, they will be monetised and discounted to convert them to their net present value (NPV). To do this, the following key assumptions and estimates are required, and form the content of this report. The key estimates and assumptions are listed below.

- **General assumptions** – These include the base year of the appraisal (2011), the evaluation period (2011-2035) and the discount rate (7%, real).
- **Consumption, recycling, landfill and litter projections** – Underlying projections (in tonnes) for the level of packaging consumption, recycling, landfill and litter nationally are required for each option and the base case. This is because a number of the costs and benefits will be dependent on the quantity recycled, landfilled or consumed. At times, this will be a key distinguisher between two different options.
- **Cost assumptions** – There could be incremental costs associated with the options for government, households, businesses and the packaging industry:
  - **Scheme design and implementation**: Regulation design / implementation costs, government participation costs and communications costs
  - **Collection, transport and recycling**: Vehicle Operating Costs (VOCs), In-Vehicle Travel Time (IVT), accumulation time, container deposit redemption time, collection and transport costs, and processing costs at Material Recovery Facilities (MRFs)
  - **Scheme operation**: Government costs to administer regulations, scheme administration costs, scheme initiatives and infrastructure, and
  - **Scheme compliance**: Reporting and labelling.

  Costs for collection, transport and sorting recycled packaging at a MRF or other recycling business will be linked to recycling projections (i.e. $/tonne). Other cost assumptions are on an annual basis (i.e. $/year) and will differ between the options based on characteristics such as regulation type and responsibility for scheme administration.
- **Benefit assumptions** – There will be benefits and avoided costs with the options which will be quantified based on:
  - **Use values**: Use value of resources, avoided regulatory costs, avoided landfill externalities, avoided operating costs of landfill and avoided costs of litter clean up, and
  - **Non-use values**: Society's willingness to pay for increased recycling.

A number of other costs and benefits are discussed qualitatively in this report. They are not quantified as part of the CBA due to difficulties quantifying them or because they would result in double counting of impacts already captured. Costs and benefits that have not been quantified include some government participation costs (ie. database set up costs, development of cost recovery statement and the cost of renegotiating contracts), co-benefits, willingness to pay for reduced litter and avoided costs of mixed waste contamination.

The assumptions and parameters, as well as the resulting cost and benefit estimates, should be interpreted with care as the numbers are indicative not definitive. Sensitivity analysis will be undertaken to illustrate how the economic results respond to changes in key assumptions and variables. There is potential to include a number of assumptions as sensitivity tests and these have been identified in this report. While the impact of changing all of these assumptions will be modelled in the CBA, only those with the largest potential impact on the CBA results will be presented in Chapter 6.

Options to be analysed

As detailed in the *Packaging Option Report*, the following options for policy change are to be evaluated using a CBA.

- **Non-regulatory**
  - **Option 1:** National Waste Packaging Strategy
- **Co-regulatory**
  - **Option 2A:** Co-regulatory Packaging Stewardship Scheme
  - **Option 2B:** Industry Packaging Scheme
  - **Option 2C:** Extended Packaging Stewardship Scheme
- **Mandatory**
  - **Option 3:** Mandatory Advanced Disposal Fee (ADF)
  - **Option 4A:** Boomerang Alliance Container Deposit Scheme (CDS)
  - **Option 4B:** Hybrid CDS[4]

It is possible to combine the non-regulatory options (Option 1) with the co-regulatory (Options 2A to 2C) or mandatory options (Options 3 and 4), although this is a more complicated exercise than simply adding the costs and benefits of each option given diminishing marginal returns.

The costs and benefits of these options are compared to a base case which represents the business as usual scenario, defined as a continuation of the Australian Packaging Covenant (APC) under the Used Packaging Material National Environment Protection Measure (NEPM).

This CBA Report should be read in conjunction with the *Packaging Option Report*. The *Packaging Options Report* presents the key features of each option, including coverage, operation and governance. For the purposes of developing cost and benefit assumptions for the CBA, a number of additional assumptions have been made beyond those contained in the Packaging Options Report. These include recycling and litter initiative years of operation and CDS infrastructure requirements.

Recycling and litter initiatives: years of operation

Table 1 summarises the assumed years for development and commencement of each of the options. The following sections present the assumed years of operation, broken down into timing for each of the scheme initiatives. There is a high level of uncertainty relating to the specific initiatives in each option and when they may practically be implemented. For the purposes of the CBA there is a need to make assumptions relating to the initiatives to develop recycling, landfill and litter projections.

Common to each option is the assumption of 6-12 months for stakeholder consultation and development of the Decision Regulatory Impact Statement (DRIS). The non-regulatory option (Option 1) is assumed to commence in 2013 as it could take 1 year after the DRIS to develop the National Waste Packaging Strategy. Options requiring the design and implementation of new regulations and a new product stewardship scheme (Options 2A, 2B, 2C and 3) are assumed to take an additional 2 years after the DRIS. It should be noted that under Section 108 of the *Product Stewardship Act*, the Minister has to publish a notice of the list of products to be considered for accreditation and regulation in the following financial year (i.e. effectively 12 months notice). As such, the earliest introduction could be 30 June 2012.

Options 2A to 4B may require Australian Competition and Consumer Commission (ACCC) authorisation. The assumed commencement date of these options incorporates the time it may take to develop regulations, establish the Product Stewardship Organisation(s) (PSO) and receive ACCC authorisation. The CDS options

4 PwC and Wright Corporate Strategy (2011) *Packaging option report*, Draft Version 2, 19 August, prepared for the Environment Protection Heritage Council, pp 26-45.

(Options 4A and 4B) are assumed to commence in 2016, a year later than other options, due to the additional time it could take to develop CDS infrastructure.

All options are assumed to commence in the calendar year following the completion of their development.

Table 1 – Option development and commencement timing assumptions

Option	Option development period	Commencement year	Note
Option 1	2012-2013	2014	• One year to develop the DRIS (2012) • One year to develop a national packaging waste strategy (2013). The strategy could coordinate jurisdictional action that increases the recovery of packaging waste and reduces litter with minimal additional resources and/or funding.
Option 2A Option 2B Option 2C Option 3	2013-2014	2015	• One year to develop the DRIS (2012) • Two years to develop the scheme regulations, establish the Product Stewardship Organisation(s) (PSOs) approved arrangements and receive Australian Competition and Consumer Commission (ACCC) authorisation of the PSO(s) (2013-2014)
Option 4A Option 4B	2012-2015	2016	• One year to develop the DRIS (2012) • Two years to develop the scheme regulations establish the PSO(s) approved arrangements and receive ACCC authorisation of the PSOs (2013-2014) • One year to implement the additional infrastructure (2015)

The following peculiarities regarding the development of the options should be acknowledged (although they will not be directly factored into the CBA):

- The *Product Stewardship Act* is already in existence, which may accelerate the development of the scheme regulations for Options 2A to 2C relative to past experience in similar schemes
- Option 3 requires the development of a levy bill, in addition to the scheme regulations, which may defer the commencement of this option relative to Options 2A to 2C, and
- Option 3 needs to comply with World Trade Organisation (WTO) requirements regarding tariffs, which may defer the commencement of this option.

It should be noted that Option 3 and the CDS options (Options 4A and 4B) are assumed to include a tariff. However, the definition of liable parties under these schemes are assumed to include packaging importers, so none of the options are expected to affect imported products to a different extent than domestically produced products.

There is a significant degree of uncertainty in developing recycling and litter initiatives for each option due to the relatively short timeframe of planning documents prepared by industry organisations such as the APC[5] or the National Bin Network.[6] This is a reflection of the uncertainty regarding future packaging issues that will need to be targeted by the initiatives and a desire by industry organisations to maintain flexibility to address problems as they arise. This is not problematic where initiatives are assumed to be ongoing for the entire appraisal period. However, a number of initiatives may experience diminishing marginal returns prior to the end of this period and new initiatives will need to be implemented.

For the purposes of the CBA, funding for additional initiatives which are yet to be determined has been included over the period 2021-2035. These initiatives will depend on the relative recycling rates of different materials and consumption locations, but may include:

5 For example, the current Australian Packaging Covenant Action Plan covers the period July 2010 to June 2015

6 For example, the timeframe proposed by the National Bin Network is 5 years, followed by a review, then a further 5 years.

- Widespread adoption by states and territories of energy from waste and refuse derived fuel policies. These may provide a platform for initiatives aimed at the manufacture of fuel from plastic and cardboard packaging residues
- Further development of precinct based recycling concepts to capture increased materials including packaging from both commercial and industrial (C&I) recycling and laggard domestic recycling precincts
- National extension of business recycling programs (as described in Option 2c), and
- End market development (as described in Option 2c).

The funding per year assumed for each recycling and litter initiative is presented in Chapter 4 C.

Option 1: National Waste Recycling Strategy

The *Packaging Option Report* described the recycling and litter initiatives assumed to be included in Option 1.[7] For the purposes of this CBA Report, WCS have estimated the years of operation of each of these initiatives, as outlined in the table below. Option 1 is assumed to commence in **2014** assuming that it takes one year to develop the DRIS (2012) and one year to develop the national packaging waste strategy (2013).

Table 2 – Option 1 recycling and litter initiative assumptions

Initiative	Indicative years of operation
Recycling initiatives	
National recycling education/advertising initiative	2014 - 2020
National program to improve away from home recycling at mass consumption areas though improved bin labelling	2014 - 2020
Information sharing between state and local governments	2014 – 2020
Consistent labelling of recycling bins	2014 – 2035
Development of non-regulatory standards for end products and recycling labelling for packaging	2014-2025
Additional initiatives (yet to be defined – based on needs at time of implementation)[1]	2021-2035
Litter initiatives	
National education program for litter prevention	2014-2020
National litter count methodology	2014
Additional initiatives (yet to be defined - based on needs at the time of implementation) [1]	2021-2035

Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 26

Note: 1. Additional initiatives apply from 2021 to 2035. The exact nature of these initiatives will depend on the success of the earlier initiatives and the prevailing issues at the time of implementation (i.e. 2021 onwards). These additional initiatives are discussed above, and could include some of the initiatives proposed in subsequent, more costly options.

7 PwC and Wright Corporate Strategy (2011) *Packaging option report*, prepared for the Environment Protection Heritage Council, p 26.

Option 2A: Co-regulatory Product Stewardship

The *Packaging Option Report* described the recycling and litter initiatives assumed to be included in Option 2A.[8] For the purposes of this CBA Report, WCS have estimated the years of operation of each of these initiatives, as outlined in the table below. Option 2A is assumed to commence in **2015** assuming one year to develop the DRIS (2012) and two years to develop the scheme regulations and establish the PSO(s) (2013-2014).

Option 2A is assumed to include additional recycling initiatives relative to the base case between 2021-2035. Under the *Product Stewardship Act*, the regulations are assumed to specify obligations on liable parties, requiring recycling targets to be met. The current APC, a co-regulatory arrangement, has been relatively successful in encouraging participation of companies that market their products in packaging. However, the co-regulatory approach in Option 2A is assumed to be administered by the Commonwealth instead of multiple State and Territory jurisdiction, thereby increasing compliance and enforcement and increasing the number of liable parties captured by the scheme. The resultant increase in funding could be used for additional initiatives relative to the base case.

Table 3 – Option 2A recycling and litter initiative assumptions

Initiative	Indicative years of operation
Recycling initiatives	
As per the base case	2015-2020
Additional initiatives (yet to be defined – based on needs at the time of implementation)[1]	2021-2035
Litter initiatives	
As per the base case	2015-2035

Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 30

Note: 1. Additional initiatives apply from 2021 to 2035. The exact nature of these initiatives will depend on the success of the earlier initiatives and the prevailing issues at the time of implementation (i.e. 2021 onwards). These additional initiatives are discussed above, and could include some of the initiatives proposed in subsequent, more costly options.

Option 2B: Industry Packaging Scheme

The *Packaging Option Report* described the recycling and litter initiatives assumed to be included in Option 2B.[9] For the purposes of this CBA Report, WCS have estimated the years of operation of each of these initiatives, as outlined in the table below. Option 2B is assumed to commence in **2015** assuming one year to develop the DRIS (2012) and two years to develop the scheme regulations and establish the PSO(s) (2013-2014).

Table 4 – Option 2B recycling and litter initiative assumptions

Initiative	Indicative years of operation
Recycling initiatives	
Increased public place recycling opportunities	2015-2035
Improved kerbside recycling through campaigns and education programs	2015-2025
Improved kerbside recycling through investment in appropriate bin configurations for community circumstances and needs[1]	2015-2035
Additional initiatives (yet to be defined – based on needs at the time of implementation)[2]	2026-2035
Improved regional and remote beverage container recovery through organised backload arrangements	2015-2035

8 PwC and Wright Corporate Strategy (2011) *Packaging option report*, prepared for the Environment Protection Heritage Council, p 30.

9 PwC and Wright Corporate Strategy (2011) *Packaging option report*, prepared for the Environment Protection Heritage Council, p 32.

Initiative	Indicative years of operation
Litter initiatives	
Financial incentives to reduce costs for litter clean-up[3]	2015-2035
Litter prevention campaigns and education campaigns	2015-2035
Increased funding for litter enforcement[4]	2015-2035

Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 26

Note:

1. In the Options Report, this was described as 'improvements to kerbside recycling to ensure that what is collected is actually useable'
2. Additional initiatives apply from 2026 to 2035. The exact nature of these initiatives will depend on the success of the earlier initiatives and the prevailing issues at the time of implementation (i.e. 2026 onwards). These additional initiatives are discussed above, and could include some of the initiatives proposed in subsequent, more costly options.
3. This initiative involves providing community organisations with funding for clean up campaigns
4. Funding is assumed to be provided to Local Government (who are currently primarily responsible for litter enforcement at a local level) to fund extra resources to enforce anti-litter regulations. This could include empowering parking inspectors or employing Council rangers to enforce litter regulations.

It should be noted that Option 2B is essentially an industry proposed scheme. WCS has had considerable discussion with the industry proponents:

- The details of the option as proposed by industry were predominantly accepted by WCS unless otherwise specified (e.g. start dates were based on time taken for the development of the DRIS, design and implementation of the regulations and establishment of the PSO(s)).

- The design and specification of the option was reviewed by WCS as an independent check on the feasibility of the recycling level being attained with the scheme. This involved WCS examining, with industry, the proposed deployment of infrastructure and services. WCS formed the view that this option was capable of meeting the recycling targets proposed.

- The cost estimates put forward by the proponent were reviewed by WCS (as far as possible) as an independent check on estimated costs. This involved WCS examining, with the industry proponents, the detailed cost estimates. WCS formed the view that the estimated costs associated with Option 2b were reasonable.

It is recognised that the projections and assumptions of this option, as well as a number of other options, are based on WCS analysis with significant input from stakeholders such as industry. ABARES recommended that a Bayesian network or simple Monte Carlo analysis be conducted to ensure that professional judgements of stakeholders were robustly integrated. This was not possible within the timeframes and scope of a Consultation RIS, however may be able to be included in the Decision RIS.

National Bin Network

The development of Option 2B has been informed by the recently proposed National Bin Network[10], which shares a number of similar initiatives, as outlined in the table below. All relevant assumptions of Option 2B have been benchmarked against this proposal including costs, recycling rates, period of operation and material coverage.

Table 5 - Comparison of Option 2B recycling and litter initiatives and the proposed National Bin Network

Option 2B	National Bin Network
Increased public place recycling – 5,000 stainless steel indoor bins/year 2015-2035	Installation of 6,000 public place recycling bins per year for five to ten years.
Improved kerbside recycling through campaigns and education	Improved kerbside through education and market development,

[10] National Bin Network (2011) *National Bin Network Plan*, October

Option 2B	National Bin Network
2015-2025	particularly glass. Partner with local government, recycling and waste organisations to develop initiatives to reduce contamination, stimulate secondary use of materials, collect additional packaging materials reduce costs of kerbside recycling
Improved kerbside recycling through investment in appropriate bin configurations 2015-2035	N/A
Yet to be determined initiatives 2026-2035	N/A
Improved regional and remote beverage container recovery through back loading	Packaging design improvements – reduction of raw material usage, light weighting and re-engineering

Option 2C: Extended Packaging Stewardship Scheme

The *Packaging Option Report* described the recycling and litter initiatives assumed to be included in Option 2C.[11] For the purposes of this CBA Report, WCS have estimated the years of operation of each of these initiatives, as outlined in the table below. Option 2C is assumed to commence in **2015** assuming one year to develop the DRIS (2012) and two years to develop the scheme regulations and establish the PSO(s) (2013-2014).

Table 6 – Option 2C recycling and litter initiative assumptions

Initiative	Years of operation
Recycling initiatives[1]	
As per option 2B and:	See Table 4
Improved kerbside recycling through national uniformity of bin types and colours and information on materials accepted for recycling	2015-2035
National extension of kerbside recycling to SMEs on a commercial basis[2]	2015-2025
Precinct-based commercial/industrial recycling	2015-2035
National extension of business recycling programs	2015-2035
Extension of recycling opportunities in rural and remote LGAs	2015-2035
End market development support to create new markets	2015-2025
End market development through standard setting for recycled products	2015-2025
Additional initiatives (yet to be defined – based on needs at the time of implementation)[3]	2026-2035
Litter initiatives	
As per Option 2B	2015-2035

Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 34

Note:

1. The Options Report included an initiative called 'Special education and advice program'. This has been excluded for the purposes of the CBA Report given that Option 2B already includes a similar initiative ('improved kerbside recycling through campaigns and education programs') and Option 2C subsumes the Option 2B recycling initiatives
2. National extension of kerbside recycling to SMEs: There are currently around 170,000 services provided to businesses by local government on a commercial basis. This initiative aims to fund local government to recruit new SMEs to utilise the service where access is available, in order to extend the number of SMEs undertaking recycling.
3. Additional initiatives apply from 2026 to 2035. The exact nature of these initiatives will depend on the success of the earlier initiatives and the prevailing issues at the time of implementation (i.e. 2026 onwards). These additional initiatives are discussed above, and could include some of the initiatives proposed in subsequent, more costly options.

[11] PwC and Wright Corporate Strategy (2011) *Packaging option report*, prepared for the Environment Protection Heritage Council, p 34.

Option 3: Mandatory Advanced Disposal Fee

The *Packaging Option Report* described the recycling and litter initiatives assumed to be included in Option 3.[12] For the purposes of this CBA Report, WCS have estimated the years of operation of each of these initiatives, as outlined in the table below. Option 3 is assumed to commence in **2015** assuming 1 year to develop the DRIS (2012) and 2 years to develop the scheme regulations and establish the PSO(s) (2013-2014).

This option is similar to Option 2C. However, Option 3 is funded by a levy at the point of sale, whereas Option 2C is funded from contributions from liable parties. Additionally, the scheme is administered by the Commonwealth Government, who decide appropriate recycling and litter initiatives to meet government targets. For the purposes of the CBA, it has been assumed that:

- Total government expenditure on recycling and litter initiatives is the same as Option 2C
- The government would decide to fund the same type of recycling and litter initiatives as in Option 2C, and
- The levy is designed so that sufficient funds are raised to fund these initiatives.

It is arguable that government may not fund the same types of initiatives as a PSO(s) given that it is not privy to the same level of industry insight, which could enable industry to efficiently target specific problems as they arise. In addition, the public sector is not subject to the same commercial pressure to drive down costs. As such, there may be higher costs for Option 3 to reach the same level of recycling as Option 2C or the same level of expenditure may not achieve the same outcomes. However, the relative cost-effectiveness of Options 2c and 3 will depend on the detailed institutional designs adopted. There are incentives for private manufacturing firms to minimise packaging costs but the incentives faced by the new institutions, whether a PSO or public sector authority set up for this purpose, which would be designed to also account for packaging externalities and other sources of market failure, have not been detailed. A PSO may have incentives to minimally satisfy objectives to increase recycling.

General sensitivity testing regarding the impact of increasing and decreasing costs and benefits by 30% will inform whether these assumptions are fundamental to the CBA results of this option.

Table 7 – Option 3 recycling and litter initiative assumptions

Initiative	Years of operation
Recycling initiatives	
As per option 2C	See Table 4
Litter initiatives	
As per option 2C	See Table 4

Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 37

Options 4A and 4B: Container deposit schemes

There are no recycling and litter initiatives included in Options 4A and 4B. However, CDS infrastructure is assumed to operate from 2016-2035. This is assumed to increase beverage container recycling and leave less packaging available to be littered.

Table 8 – Option 4A and 4B recycling and litter initiative assumptions

Initiative	Years of operation
Recycling initiatives	
Container deposit infrastructure	2016-2035

[12] PwC and Wright Corporate Strategy (2011) *Packaging option report*, Draft Version 2, 19 August, prepared for the Environment Protection Heritage Council, p 37.

Initiative	Years of operation
Litter initiatives	
Container deposit infrastructure	2016-2035

Option 4A was proposed by Boomerang Alliance (BA), who have done considerable work in specifying the scheme and estimating costs associated with the scheme. WCS had considerable discussion with BA regarding this option:

- The specification of the option was accepted as proposed, unless otherwise stated. This includes the BA distribution of infrastructure such as hubs, spokes and RVMs (as outlined in Chapter4), the distribution of redemptions specified by BA to each of these return points.

- The design and specification of the scheme proposed by BA was reviewed by WCS (as far as possible given the information provided) as an independent check on the feasibility of the recycling level proposed for the scheme. This involved WCS examining, with the BA, the proposed deployment of infrastructure and services. WCS formed the view that the scheme was capable of meeting the recycling targets proposed (as outlined in Chapter 3).

- The cost estimates put forward by BA for the scheme were reviewed by WCS (as far as possible) as an independent check on estimated costs. This involved examining, with the proponent, the detailed cost estimates. WCS formed the view that the costs associated with Option 4a as proposed by BA were lower than contemporary costs and were lower than the most recent published CDS study (as outlined in Chapter 4).[13]

The BA option was also benchmarked against the outcomes of the CDS in SA.

- Recycling is projected to reach 85% for Option 4A (as outlined in Chapter 3). This is consistent with BA projections, and exceeds the SA redemption rates for 2009-10 of 80.1%.

- Consistent with BA assumptions and the assumptions of the BDA Container Investigation Report, WCS has assumed that 8% of redeemed containers are redeemed via kerbside collection and 92% are redeemed direct from consumers. SA EPA data indicates that about 6% of containers are recovered via kerbside recycling. WCS assumed a slightly higher proportion of CDS containers would remain in kerbside nationally than in SA since the SA scheme is longstanding and households are very accustomed to the scheme.

For Option 4B, which is a hybrid of a proposal by MS2 and some aspects of the SA CDS, WCS has adopted the MS2 configuration of supercollecters, depots and RVMs, which makes it different from the way that SA operates its scheme. After discussion with MS2, redemption points were increased to 1,900 as more representative of the number of redemption points required to ensure easy access and for consistency with the BA proposal.

Infrastructure requirements

Increased public place recycling opportunities

Option 2B (Industry Packaging Scheme), Option 2C (Extended Packaging Stewardship Scheme) and Option 3 (Mandatory ADF) include an initiative to increase public place recycling opportunities, as outlined in the tables above. This initiative is assumed to include an additional 5,000 to 6,000 stainless steel indoor bins per year for the first five years. Additional bins would be provided over the next five years and beyond as necessary, with replacement bins provided progressively during the project period.

[13] BDA Group and Wright Corporate Strategy (2009). *Beverage Container Investigation*

Container deposit schemes

Option 4A: Boomerang Alliance CDS

The Packaging Option Report specified the number of hubs, collection centres and reverse vending machines (RVMs). For the purposes of this CBA Report, WCS have assumed that an additional 700 rural and remote collection centres will be required based on consultation with BA.

Table 9: Option 4A infrastructure requirements

Infrastructure type	Number	Source
Hubs	250	Consultation with Boomerang Alliance
Collection depots (spokes)	310	Consultation with BA
RVMs (spokes)	640	Consultation with BA
Rural/remote collection centres (spokes)	700	Consultation with BA
Total	**1900**	

Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 40

Option 4B: Hybrid CDS

The Packaging Option Report suggested that there could be 850 depots nationally. Based on discussions with M2S and considering the SA CDS depot configuration, it has been assumed that there will be 250 consolidation depots, 600 collection depots, 350 RVMs and 700 rural and remote collection centres.

Table 10: Option 4B Infrastructure Requirements

Infrastructure type	Number	Source
Consolidation depots	250	Packaging Option Report: Approximately 850 depots are assumed to be provided nationally.
Collection depots	600	
RVMs	350	
Rural/remote collection centres	700	
Total	**1900**	

Source: WCS (2011) based on discussions with M2S and the South Australian CDS depot configuration

It is recognised that having 1,900 deposit locations across Australia will lead to a higher level of deposit locations per capita than SA currently has. This number of redemption points is considered by both BA and WCS to be appropriate for a national CDS striving for a high level of beverage container returns through ease of access.

The CDS proposed by BA (Option 4A) also differs from the SA model in that there is an increased focus on providing RVMs at convenient locations such as shopping centres as opposed to collection depots. Similarly, Option 4B is assumed to include a relatively higher proportion of 'shop front' style collection centres. These differences will have implications for CBA assumptions based on the SA experience.

2. General assumptions

A set of general assumptions have been outlined to guide development of the CBA. These are used to ensure the costs and benefits of each option are measured in a comparable manner. These are assumed across all the options.

- **Incremental basis** – Based on the Australian Government's *Best Practice Regulation Handbook* all option costs and benefits are measured incrementally relative to the base case. This enables assessment of the potential impact on society relative to the status quo scenario.[14]
- **Base year of the appraisal** – **2011**. This is a practical assumption given that information collected on costs is from 2011, and projections have been developed on underlying consumption data to represent 2011 as the base year. All monetised values are expressed in 2011 dollars unless otherwise stated. All years are calendar years unless otherwise stated.
- **Evaluation period** – **2011 to 2035**. The *Best Practice Regulation Handbook* states that '[t]he total period [of evaluation] needs to be long enough to capture all potential costs and benefits of the proposal' and provides guidance that, '[in] view of the difficulty of forecasting costs and benefits over long periods, exercise caution when adopting an evaluation period longer than…20 years'.[15] Accordingly, an evaluation period allowing for an operational period of 20 years for the latest to commence options (Option 4A and 4B) is applied in the CBA.[16] All options are evaluated over the period 2011-2035.
- **Real discount rate** – **7% real**. All future cost and benefit cashflows will be discounted to 2011 dollars using a real discount rate of 7% in line with the requirements of the *Best Practice Regulation Handbook*, which also recommends sensitivity testing using 3% and 10% discount rates.[17]

  As the CBA is being prepared in line with the requirements of the Australian Government Office of Best Practice Regulation (OBPR), the general assumptions have been selected based on the *Best Practice Regulation Handbook*. However, lower discount rates are often advocated in cases of very long-term projects with impacts lasting for more than one generation, such as those addressing climate change and other environmental problems. This is because higher discount rates result in relatively less weight being given to benefits accruing further into the future and lower discount rates give relatively more weight to benefits accruing further in the future. For example:

  - The US Environmental Protection Agency recommends that for intergenerational discounting, a rate of 2%-3% be used, with sensitivity analysis of alternative discount rates in the range of 2%-3% as well as at 7% (the requirement of the Office of Management and Budget).[18]
  - In 2003 the United Kingdom (UK) Treasury changed its discount rate approach from a producer rate of 6%[19] to a consumer rate of 3.5% (based on a social time preference rate considering consumer's utility of consumption over time).[20] This appears to reflect a policy decision to give more weight to longer term benefits in projects with intergenerational impacts. A hyperbolic discount rate is also applied.
  - In the Garnaut Climate Change Review, which projected the impacts of climate change out to 2100,

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14 Australian Government (2010) *Best Practice Regulation Handbook*, p 62.

15 Australian Government (2010) *Best Practice Regulation Handbook*, p 63.

16 The first full years of benefits of 2014/15 corresponds to the latest commencement date of all the options (relating to Options 4A and 4B) to ensure comparability between the options. For further detail, see Table 1.

17 Australian Government (2010) *Best Practice Regulation Handbook*, p 66.

18 Zhuang, Liang, Lin and De Guzman (2007) *Theory and Practice in the Choice of Social Discount Rate for Cost-Benefit Analysis: A Survey*, Asian Development Bank, May, p 6

19 Sources have suggested this rate was equal to the UK Government's estimated cost of capital. See Abu Dhabi Department of Transport, *STMP Discount Rate for Economic Appraisal,* available at <http://www.dot.abudhabi.ae/download.do?loc=stmp/3%20Technical%20Notes/&file=TN26%20Discount%20Rate%20for%20Economic%20Appraisal.pdf>, accessed 22 May 2011

20 Evans (2006) *Social Discount Rated for the European Union*, Milan European Economy Workshops, Working Paper 2006-20, p 2

discount rates of 1.35% and 2.65% were used.[21]

In addition to the Australian Government requirements to apply a core discount rate of 7%, with sensitivity testing of 3% and 10% discount rates, a sensitivity test of a discount rate of 1.35% will be conducted. This rate of 1.35% corresponds to the lower bound in the Garnaut Climate Change Review.

Table 11: Summary of general CBA assumptions

Assumption	Value	Source
Base year	2011	
Values	June 2011	
Evaluation period	2011 to 2035	Operational period of 20 years for the latest to commence option. *Best Practice Regulation Handbook*, p 63
Discount rate	• Core: 7% • Sensitivity:1.35%, 3%, 10%	• Best Practice Regulation Handbook, p 66 • Garnaut Climate Change Review

[21] Garnaut (2008) *The Garnaut Climate Change Review*, Chapter 1: A decision-making framework, p 19

3. Consumption, recycling, landfill and litter projections

Introduction

Underlying projections (in tonnes) for the level of packaging consumption, recycling, landfill and litter nationally are required for each option and the base case. This is because a number of the costs and benefits that will be dependent on the quantity of packaging that is recycled, landfilled or consumed. At times, this will be a key distinguisher between two different options. The projections below have been prepared by WCS taking into consideration stakeholder consultation and feedback provided by the SCEWWG and Packaging Waste SOOG.

Projected consumption trends

An estimate of the future consumption of packaging in Australia was required to understand the size of the packaging sector over time. Estimates of packaging consumption directly relate to the quantities of packaging that are recycled, landfilled or littered. The projections capture key trends that could affect tonnages in different packaging types or materials used to manufacture packaging. **Packaging consumption projections are the same for all options.**

Historic packaging consumption growth (2003-2010)

The packaging consumption projections are based on population projections and historical packaging consumption growth rates. As shown on the below table, growth in terms of packaging consumed per annum has historically been slower than overall population growth (2003-2010).

Table 12 – A comparison of historic population and packaging consumption growth rates

Assumption	Compound annual growth	Notes
Population growth	1.66%	Historic population growth (2003- 2010) was sourced from the Australian Bureau of Statistics (ABS)[22].
Packaging consumption growth	0.84%	Historic packaging consumption growth (2003-2010) was sourced from the NPC Annual Report[23]. The APC collects consumption data from packaging manufacturers and packaging industry organisations.[24]
Relative growth (packaging:population)	0.51:1	Tonnes consumed has grown at around half the rate of population growth (a ratio of 0.51:1).

Projected packaging consumption growth (2011-2035)

It has been assumed that there will be a slight reduction in the ratio of consumption to population to reflect light weighting of packaging material (which will decrease the tonnes of packaging produced). It should be noted that although it is not quantified, the co-regulation and ADF options would ideally be designed to provide dynamic incentives for reductions in the total social costs of packaging which would likely reduce packaging intensity. This may also affect the composition of packaging with a possible shift towards more-recyclable and biodegradable/packaging.

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22 Australian Bureau of Statistics (2011) *Australian Demographic Statistics, Dec 2010*, Table 4: Estimated resident population, States and territories; Australian Bureau of Statistics (2011) *Australian Demographic Statistics, Dec 2006*, Table 3: Estimated resident population, States and territories

23 Australian Packaging Covenant (2011) *The National packaging Covenant – 2010*, Annual Report, p 11

24 For detail on the methods of data collection, see National Packaging Covenant Council (2009) *Packaging Data Collection Methodologies*

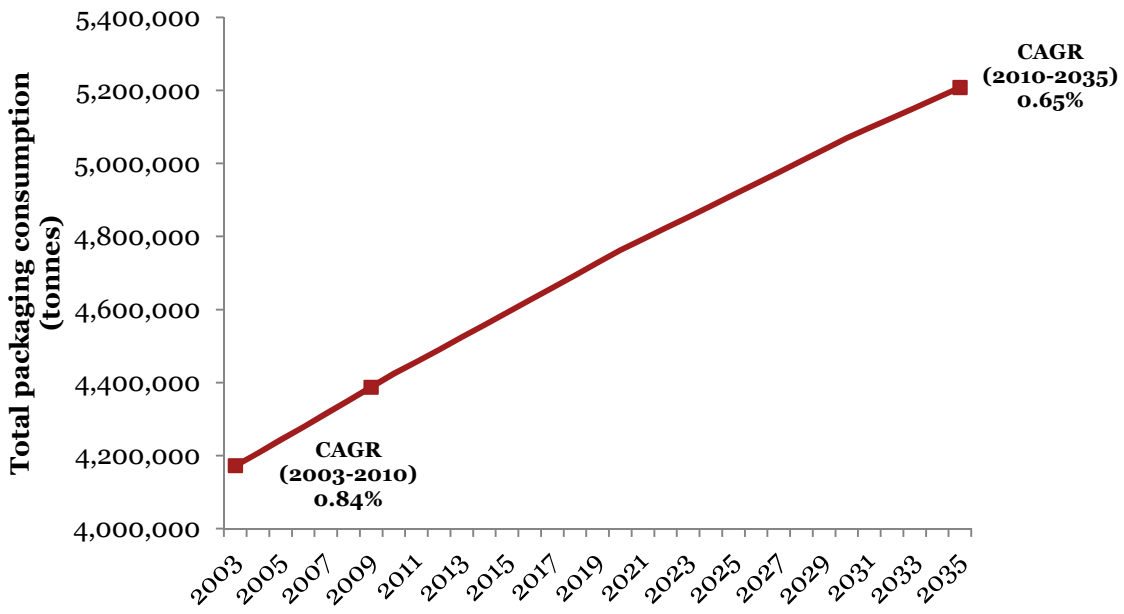
Table 13 – Summary of packaging consumption growth assumptions

Time period	Population growth (%)	Consumption tonnage growth (%)	Ratio (population growth : consumption growth)
2003-2010	1.66	0.84	0.51:1
2011-2015	1.47	0.75	0.51:1
2016-2020	1.47	0.73	0.50:0
2020-2030	1.28	0.63	0.49:1
2031-2035	1.11	0.54	0.49:1

Source: Australian Government (2010) *Australia to 2050: future challenges, the 2010 intergenerational report: overview*, p 5
Note:
1. Percentages presented for population and consumption tonnage growth represent compound annual growth rates
2. The 2010 Intergeneration Report estimates that the Australian population will grow from 22.2 million in 2010 to 30.9 million in 2035.

The figure below presents projections of the total tonnes of package consumed per annum. Total consumption is forecast to grow from the current 4.4 million in 2010 to 5.2 million in 2035, at a CAGR of 0.65% per annum.

Figure 1 – Historical tonnes of packaging consumed (2003-2009) and projections of total tonnes consumed (2010-2035)



Source: Table 13

Material composition

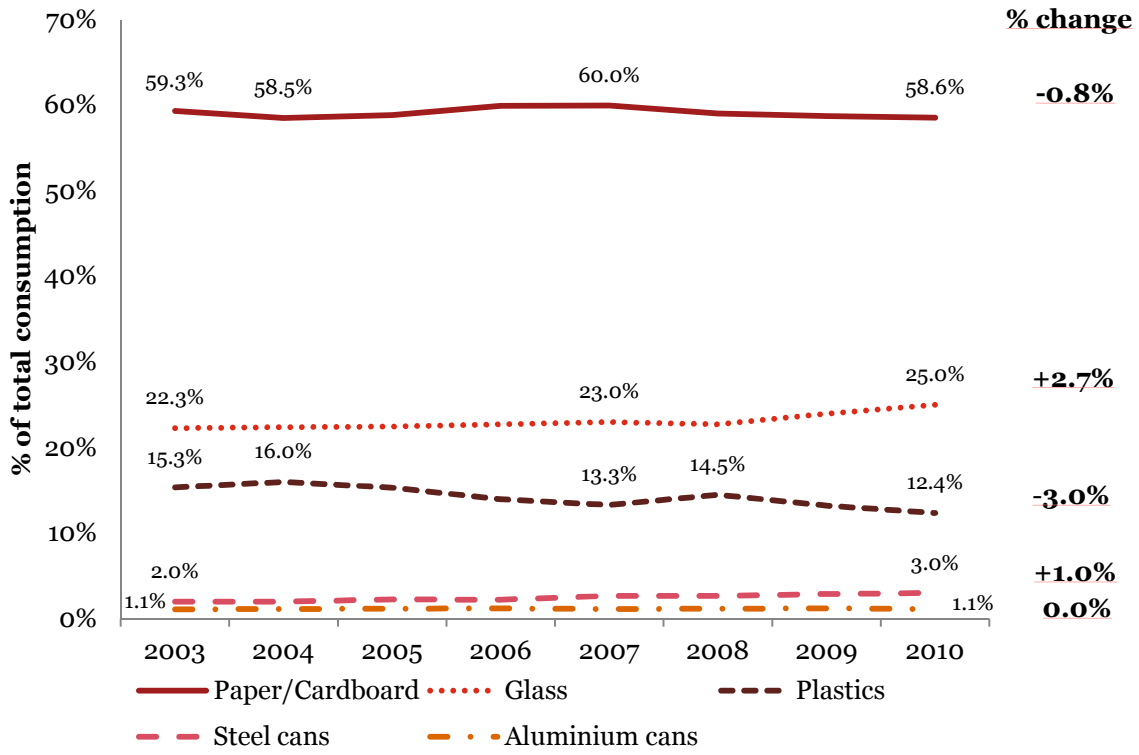
The 2010 distribution of total consumption by material, as presented in the figure below, is assumed to remain constant over time. This is consistent with historic observations by the APC (noting a relatively small increase in glass consumption and a relatively small decrease for plastics). It should be noted that this assumption is expected to have a minimal impact on the results of the CBA given that the cost and benefit parameters predominantly apply to the total weight of packaging and do not distinguish between packaging materials. The exception is the benefit of the market value of resources, for which a unique approach has been developed in Chapter 5 and Appendix F.

The APC notes that there have been recent developments in plastic packaging technology, materials and design, as well as processing infrastructure and these are likely to impact on future trends for plastic consumption

tonnes.[25] The trends identified by the APC include:

- Light weighting
- Multi layer plastics (primarily films)
- Gradual shift from rigid plastics to flexible pouches and sachets
- An increase in single serve packs
- The costs and purchase prices associated with plastic recyclates[26], and
- Changes in plastic processing.

Figure 2 – Proportion of total packaging consumption by material: 2003-2010 (tonnes)



Source: National Packaging Covenant Annual Reports, various years

Product composition

WCS estimates of the future distribution of total consumption (tonnes) by product type (non-beverage containers, beverage containers and flexible packaging) are stable and are not assumed to change over time.

Consumption location

The split of consumption by location (at-home versus away-from-home) is not assumed to change over time.

Impact of prices

The costs of the options may be passed on to consumers in the form of higher prices. This is particularly the case for Option 3 (where an ADF is levied on all packaging) and the CDS options (Options 4A and 4B-which impose a deposit on beverage containers). Increased costs associated with the co-regulatory options are also expected to be passed on to some extent. This may suppress consumption of packaging, although the extent to which this occurs will depend on the elasticity of demand with respect to price. Estimating such an elasticity is

[25] Australian Packaging Covenant (2011) *The National packaging Covenant – 2010*, Annual Report, p 13

[26] Recyclate is recycled packaging material that has been collected, sorted and prepared (e.g. by removing contaminants) for incorporation into a new product (not necessarily packaging).

beyond the scope of the CRIS, so this impact has not been included in the consumption projections.

Some Options could have scope to target reducing consumption as well as increasing recycling. For example, Option 1 and 2 could include initiatives to reduce excess packaging, such as standards for packaging design. Such initiatives could likely lead to a reduction in tonnes of packaging consumed. As the options have been designed they do not include such initiatives and therefore, consumption under each option is assumed to be in line with the base case. In the design of the co-regulatory and mandatory options the incentives created by any levies or fees would need to be carefully considered.

Although it is not quantified, the co-regulation and ADF options (Option 2 and 3) would ideally be designed to provide dynamic incentives for reductions in the total social costs of packaging which would likely reduce packaging intensity. This may also affect the composition of packaging with a possible shift towards more-recyclable and or biodegradable/packaging.

Projected recycling trends

Recycling is a multi-step activity in which post-consumer products are recovered and sorted to material type. The recyclate is then sold to the manufacturers of feedstock for new products. The recycling supply chains for household kerbside collection, C&I sector recycling and CDS are described in more detail in **Appendix A**.

Recycling projections were developed by WCS for each option by consumption location (at-home versus away-from-home) and for each product type (beverage containers, non-beverage containers) based on:

- The initiatives identified in Chapter 1
- Packaging industry plans and targets
- Experience in other jurisdictions
- The assumption that the maximum recycling rate by product or material is 90%[27], and
- The assumption of a continuing, stable level of funding for initiatives appropriate to each option.

The initiatives targeting current packaging issues are assumed to be over a period of 5 to 15 years. However, it is difficult to predict future packaging issues and initiatives beyond 2015 given the relatively short term nature of existing planning documents. Therefore it is considered inappropriate to nominate specific initiatives for continued funding beyond the initial 5 to 15 years. Funding has been allocated for initiatives that could be introduced in the future, which may include:

- Widespread adoption by the States and Territories of broad energy from waste and refuse derived fuel policies
- Further development of precinct based recycling concepts to capture increased materials including packaging from C&I recycling
- National extension of business recycling programs (as described in Option 2C), and
- End market development, particularly for glass (as described in Option 2C).

Forecast recycling rates for each option were developed on a five-year basis and projections were interpolated between these periods. The overall recycling rate for each option was built up from the assumed home and away- from-home recycling rates estimated for each of the main product types. Consideration was given to the types of products/materials targeted by the option and the likely yield of the initiatives assumed to be included in the option given their proposed funding allocation, to ensure that the relative recycling rates of the options matched expectations based on these assumptions.

[27] PwC and Wright Corporate Strategy (2011) *Problem statement for packaging*, prepared for the Environment Protection and Heritage Council, p 36

The funding proposed for initiatives covered in Options 1 to 3 is relatively small compared to the current cost of collecting used packaging, and recycling or disposing of packaging materials. WCS estimates that the cost of post-consumer management of packaging materials is in the order of $800 million/year. This expenditure includes collection, transport, MRF processing and disposal of packaging materials discarded to residual waste bins, as well as recycling program initiatives already underway. Thus, the differences in expenditure on initiatives between the options are relatively modest in comparison to the total current expenditure. This reflects a maximum incremental difference in expenditure on recycling initiatives of $2 million/year for Option 2a to $42.4 million/year for Options 2C and 3 (see Table 49 to Table 52 for details of recycling and litter initiative costs for each option). As a result, recycling estimates have necessarily taken account of industry and consumer behavioural change arising from regulatory and governance changes, particularly the move from the present voluntary APC arrangement to a co-regulatory scheme with improved compliance and reduction of free-riders. The sections below highlight the key recycling projection assumptions by option. All options assume continuation of recycling and litter activities undertaken in the base case. However, the following risks exist and may impact on the achievement of the projections.

- Local Governments are responsible for a significant proportion of existing recycling activity through kerbside recycling services. There is the potential that some local councils may reduce or withdraw these services as a result of increased responsibility for recycling shifting to the private sector (particularly the national extension of kerbside recycling to SMEs on a commercial basis). It is assumed that there will not be a reduction in the quantity or tonnes of materials recycling through kerbside under all options except the CDS options.

- Regulatory obligations may result in liable parties withdrawing from the APC and other non-regulatory associations such as the Packaging Stewardship Forum.

- Unlike the current APC, option 2A is assumed to not involve government membership but to include liable parties that are involved in the packaging supply chain.

Although sensitivity testing of a number of alternative recycling and litter projection scenarios reflecting key risks would be informative, development of these projections is a level of complexity that is beyond the scope of the current CBA given the tight timeframes involved. As a proxy, sensitivity testing will be undertaken on the impacts of increasing/decreasing total benefits given that the vast majority of benefits are driven by the projections.

Australia already has relatively high recycling rates, particular for at home recycling. Therefore, for many material types there is not scope for significant increases in recycling. In addition, the results of the CBA compare plausible costs with benefits based on significant uptake of the proposed initiatives, although the potential take up of the initiatives is an area that may warrant further consideration and development.

Base case

The base case scenario assumes the current local, State and Commonwealth Government arrangements continue and the APC arrangements under the NEPM also continue.

In 2010, total recycling was 62.5%, slightly lower than the target set in the APC Strategic Plan of 65%. It has been assumed that recycling continues to fall slightly below the APC targets. In 2015 the APC target for recycling is 70%. The base case has assumed that recycling will reach 67.5% in 2015. A further gradual increase in recycling is assumed by WCS over the period 2020 to 2030, peaking at 79% and remaining stable until 2035.

It is assumed that, in the absence of additional regulatory drivers, beverage container recycling will improve slowly, from the current 48.7%, to peak at nearly 70% by 2030. This recycling rate reflects:

- Historical trends that recycling has been higher for beverage containers than non-beverage containers

- That the current APC has significantly more initiatives targeting beverage container recycling (particularly in away from home setting), and the beverage industry has been active in targeting recycling

- That SA and NT have already implemented their own CDS scheme which should increase beverage container recycling.

This means that the CDS in SA and NT have been taken into account in the national projections of recycling.

It is assumed that non-beverage container recycling will increase slowly from the current estimated 40.2% to 50% by 2025. This is due to improved community motivation and information on recycling of non-beverage containers. It is assumed that non-beverage container recycling will remain lower than beverage container recycling as the APC does not have any initiatives that specifically target non-beverage containers. However, it is assumed that the general recycling initiatives of the APC would lead to an improvement in non-beverage container recycling.

It is assumed that the already relatively high rate of flexible packaging recycling will increase gradually from 70.2% to almost 86% by 2030 based on the market demand for used cardboard as feedstock and an expected future reduction of composite packaging. As mentioned above, it is assumed that recycling cannot exceed 90%.

Option 1 – National Packaging Waste Strategy

This non-regulatory option is based on the development and implementation of a national packaging waste strategy. The strategy will coordinate jurisdictional actions relating to packaging waste. It is envisioned that the strategy will focus on improved use of current infrastructure through increased knowledge, education and information sharing. It is assumed that there is no additional capital expenditure.

The National Packaging Waste Strategy is assumed to commence in 2014, taking 1 year to develop the DRIS (2012) and a further year to develop the strategy (2013).

The Option 1 scenario is based on recycling increasing at a slightly more rapid rate than the base case, with nearly 69% recycling or 3,16 million tonnes reached by 2015.

The increased rate of beverage container recycling is assumed to be slightly more rapid than in the base case. This is due to the coordinated and targeted initiatives, to reach 0.86 million tonnes or 70% by 2025 and 0.95 million tonnes or 75% by 2030, with this recycling rate maintained to 2035. It is assumed that non-beverage container recycling will grow to 0.19 million tonnes or 50% or by 2020, slightly ahead of the base case, as a result of improved funding for recycling education and the development and notification of a national standard for acceptable recycling materials. It is assumed that recycling of flexible packaging will increase slightly ahead of the base case to reach 87% or 2.96 million tonnes by 2030, remaining at this level to 2035.

Option 2A – Co-regulatory Packaging Stewardship

Under 2A the current APC and National Environment Protection Measures (NEPM) arrangements would transition under the co-regulatory provisions of the *Product Stewardship Act*. This option is designed to maintain a similar level of industry commitment under current APC arrangements and targets packaging 'brand owners' as the liable parties. This would mean some change to the current arrangement and involve enforceable targets based on overall achievement of targets identified in the APC Strategic Plan 2010-2015.

Liable parties under Option 2A would be consumer packaging brand owners (based on the NEPM definitions of 'consumer packaging' and 'brand owner'). As the Act only applies to constitutional corporations, state, territory and local governments would not be able to join an approved arrangement. However, these parties would continue to contribute to the national packaging recycling and litter rates.

The scheme is assumed to commence in 2015 assuming 1 year to develop the DRIS (2012) and 2 years to design and implement the scheme regulations and establish the PSO(s) (2013-2014).

Under this option, recycling rates could increase at a slightly faster pace than in the base case, with a 75% recycling rate (3.59 million tonnes) achieved by 2020. The slightly increased recycling rate is due to the potential for more set recycling targets under the *Product Stewardship Act 2011*, as well as greater industry/PSO responsibility, likely to result in a slight improvement in outcomes. The current APC has been

relatively successful in encouraging participation of companies that market their products in packaging. The APC has advised that the Covenant currently captures 90% of tonnage and 80% of brands.[28] The co-regulatory approach in Option 2A is administered by the Commonwealth alone unlike the current APC which is administered under the various State and Territory legislations. Having one national regulatory framework could lead to more parties joining the covenant and liable parties preparing more robust Action Plans, as well as greater compliance in achieving the outcomes in these Action Plans. This would result in improved recycling outcomes compared to the base case and Option 1 (a National Strategy not underpinned by regulation).

The industry stakeholders agreed that having one national regulatory framework could provide higher recycling rates than in the base case. However, the difference in recycling rates may be small as the APC increases its membership over time.[29]

To capture the impact of increased participation and compliance, overall recycling was increased by 4% (=(65%-62.5%)/62.5%) relative to the base case in 2020, reflecting the difference between industry targets and actual recycling levels in 2010, as discussed above. However, over time the difference between the base case and Option 2A is expected to reduce as the APC increases membership based on advice from State Government agencies regarding brands that have not become signatories to the Covenant. As such, the increase relative to the base case is assumed to decrease to 3% by 2025 and 3% by 2030 (continuing until 2035).

The pace of increase in beverage container recycling is assumed to be more rapid than in the base case, with beverage container recycling reaching 70% or 0.86 million tonnes by 2025, and 75% or 0.95 million tonnes by 2030, with this recycling rate maintained to 2035. As described above, this is considered by WCS to be a probable maximum beverage container recycling rate in the absence of financial incentives for beverage consumers and/or development of alternative markets for used packaging materials.

It is assumed that non-beverage container recycling will increase to 50% or 0.19 million tonnes by 2020, slightly ahead of the base case but in line with Option 1. It is assumed that the co-regulatory approach will also serve to increase the rate of flexible packaging recycling slightly more rapidly than in Option 1, to reach 86% or 2.84 million tonnes by 2025.

Option 2B – Industry Packaging Stewardship Scheme

Option 2B has been proposed by industry and is based on the development of a new product stewardship scheme to tackle specific problem issues including (in the first five year period) beverage container recycling and litter prevention. The APC suggests that this scheme could commence within 1 year of agreement.[30]

This Option builds on Option 2A and includes an enhanced focus on away-from-home beverage container recycling and packaging litter reduction. It deals with all packaging materials, but with targeted initiatives on beverage containers and glass market development.

It is based on the National Bin Network proposal made by members of the packaging industry to expand the existing APC to focus on key problem areas. The focus of these additional initiatives is on away from home recycling through national bin rollout in public places and other initiatives to improve recovery and recycling of beverage containers, particularly of glass, PET and aluminium, consumed away-from home. In regard to reduced litter, the focus is on impacts from all types of packaging, of all material types including fast-food packaging, confectionary packaging, cigarette packaging and beverage packaging.

As per Option 2A, Option 2B involves transitioning the current APC and NEPM arrangements under the co-regulatory provisions of the *Product Stewardship Act*. However, the regulations would specify higher outcome targets for the product class of beverage packaging, consistent with this part of the industry undertaking additional actions and in specific problem areas related to take on away-from-home beverage container recycling and packaging litter. In addition, the litter reduction outcomes would be strengthened.

The scheme is assumed to commence in 2015 assuming 1 year to develop the DRIS (2012) and 2 years to design and implement the scheme regulations and establish the PSO(s) (2013-2014). Given the preliminary focus of

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[28] Australian Packaging Covenant (2011) *Personal communication*, 24 October 2011.

[29] Australian Packaging Covenant (2011) *Personal communication*, 24 October 2011.

[30] Based on discussions with the proponent, Alec Wagstaff, July 2011.

this option and the additional funding, the pace of increase in beverage container recycling can be expected to be more rapid than in the base case and Options 1 and 2A.

Given the focus of this option, the pace of increase in beverage container recycling can be expected to be more rapid than in the Base Case and Options 1 and 2A. WCS accepted the industry claim of 70% beverage container recycling after five years of operation (significantly in excess of options discussed above). In the circumstances, a 70% beverage container recycling rate by 2020 (0.83 million tonnes) is assumed, increasing to 80% (0.98 million tonnes) by 2025 and stabilising at 80% to 2035.

As a result of the proposed early increase in beverage container recycling, the overall ramp-up of recycling is slightly more rapid than option 2a, with the 77% recycling (3.68 million tonnes) by 2020, 82% by 2025 and 81% maintained to 2035.

It is assumed that non-beverage container recycling will increase to 50% or 0.19 million tonnes by 2020 and the flexible packaging will increase to 2.84 million tonnes or 86% by 2025. This is consistent with Option 2A.

These recycling rates are similar to those proposed by the industry proponents of this option (70% within 5 years of introduction and 80% within 10 years). These recycling rates were considered broadly reasonable due to the initiatives included in this option and their probable recycling yields. In order to be conservative, it has been assumed that these recycling rates are achieved slightly later than the industry proponents have assumed.

Option 2C – Extended Packaging Stewardship Scheme

Option 2C is based on a co-regulatory approach, with the APC being regulated under the *Product Stewardship Act*. It is assumed that this option will have significantly greater industry funding than Option 2B and therefore, could involve a significant increase in recycling litter initiatives. Initiatives are assumed to cover development of infrastructure, end markets, practices, and education for improved recycling. The scheme focuses on improving the recycling performance of all packaging, with a focus on recycling and litter where there are identified problems areas such as lagging recycling rates. It has more ambitious recycling outcome targets for the broader packaging industry than option 2b. It involves substantially increased funding and industry action to achieve a step change in packaging recovery and litter reduction.

With Option 2A and 2B, the approved arrangement(s) would have the flexibility to achieve specified outcomes. The outcomes set in the regulations would focus a broad range of barriers to increased packaging recycling and litter reduction, determined on the basis of the analysis of key problem areas. It is likely that this option may involve additional support for local government kerbside collection and litter cleanup activities.

This option has been developed to build on the outcomes identified for option 2b and hence is implicitly based on target commitments identified in the *APC Strategic Plan 2010-2015*.

The scheme is assumed to commence in 2015 assuming 1 year to develop the DRIS (2012) and 2 years to design and implement the scheme regulations and establish the PSO(s) (2013-2014). Due to the co-regulatory approach and the substantial funding, it is assumed that this option would result in a recycling rate greater than the previous options and would reach 83% recycling by 2025. This recycling rate could also be achieved due to considerable end market development, particularly for glass and composites.

As a result of the early increase in beverage container recycling (assumed to be 0.86 million tonnes or 72% in 2020), the overall increase in recycling is significantly more rapid than the base case, with an 83% recycling rate or 4.09 million tonnes of recycling achieved by 2025.

It is assumed that non-beverage container recycling will increase to 0.24 million tonnes or 60% by 2025 and flexible packaging recycling will increase to 87.1% or 2.87 million tonnes by 2025.

This option results in significantly greater recycling outcomes than previous options for both beverage containers and non-beverage containers. However, the recycling rate for flexible packaging remains in line with previous options. As flexible packaging quantities are very high compared to beverage and non-beverage container quantities, even this significant increase in beverage and non-beverage container recycling outcomes only increases the overall recycling performance by a small amount.

Option 3 – Mandatory Advanced Disposal Fee

This option is assumed to be funded through the application of a mandatory ADF on packaging. The funds are assumed to be collected and administered by the Commonwealth Government. These funds would be used for similar initiatives to Option 2c.

The scheme is assumed to commence in 2015 assuming 1 year to develop the DRIS (2012) and 2 years to design and implement the scheme regulations and establish the PSO(s) (2013-2014). Projected recycling assumptions are the same as for Option 2c.

Option 4A – Boomerang Alliance Container Deposit Scheme

BA has proposed a national CDS that is assumed to be mandatory and to be regulated under the *Product Stewardship Act*. It is assumed that the co-regulatory approach is not applied to packaging other than beverage containers, and that outcomes for non-beverage packaging are consistent with the base case.

With start-up assumed in 2016, beverage container recycling to 2015 is assumed to be in line with the base case. Following CDS commencement, beverage container recycling is assumed to be 0.95 million tonnes or 80% by 2020, climbing to 1.04 million tonnes or 85% by 2025 and steady at that level to 2035. This recycling rate is slightly higher than that achieved in SA in 2009/10. With a national CDS in place, it is reasonable to assume there would be greater community awareness of the scheme and therefore, a recycling rate of 85% seems achievable. This recycling rate is slightly lower than that assumed by BA.

It is recognised that in a high income country such as Australia, behaviour is less sensitive to small financial incentives. For this reason, the projected beverage container recycling rate is based primarily on the SA recycling rate. It would be useful in the Decision RIS for there to be greater analysis of the impact of CDS on consumer behaviour.

In line with the base case, it is assumed that non-beverage container recycling will increase slowly to 0.20 million tonnes or 50% by 2025, and that the rate of flexible packaging recycling will reach 2.92 million tonnes or 85% by 2030.

It should be noted that data from SA indicates that the introduction of a CDS may create a 'culture of recycling' which leads to an increase in recycling of non-beverage items. This 'co-benefit' is detailed qualitatively in section 5C. However, because unlike the other options, the CDS does not involve any initiatives that directly target non-beverage items, it was assumed that the recycling of non-beverage items would be in line with the base case.

Additionally, the CDS depots can be used for the recycling of non-deposit items, both packaging and non-packaging items. This creates a network of infrastructure for recycling, particularly of material that cannot practically be recycled through kerbside. This is also discussed in section 5C.

Beverage containers in a CDS can be recycled using either kerbside recycling services (assumed to be 7.1% of total beverage container recycling), C&I recycling services (10.1%) or 'drop-off' at CDS infrastructure (82.8%).[31]

Option 4B – Hybrid Container Deposit Scheme

This option is assumed to be an industry managed, mandatory CDS scheme operating under the *Product Stewardship Act*. The scheme combines features of the British Columbia CDS and some aspects of the SA CDS, however, it differs from the SA CDS in the configuration of the CDS infrastructure. The liable parties are filler/importer/distributors of packaging.

[31] BDA and Wright Corporate Strategy (2010) *Beverage Container Investigation – Revised*, Table B1.2, p 87.

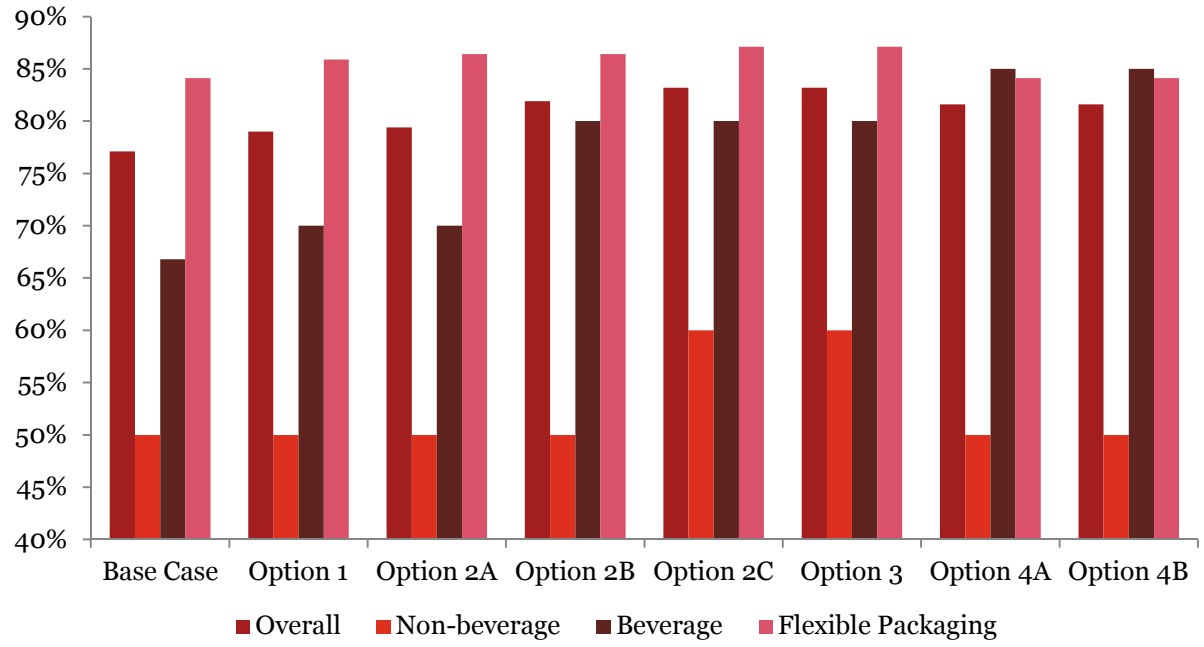
The key point of difference between the BA CDS and the Hybrid CDS is the assumed infrastructure requirements as identified in Chapter 4. WCS have not estimated that this will have any impact on the recycling outcomes, which are assumed to be in line with Option 4A.

Like for Option 4A, it has been assumed that non-beverage container recycling is in line with the base case.

Summary

The following table presents the overall packaging recycling rate assumptions, and by packaging product, every 5 years from 2015 to 2035. To provide an illustration of the relative recycling performance between options and products, the figure below illustrates the recycling projections for the year 2025.

Figure 3 – Recycling projections with the base case and options (2025)



Source: WCS (2011)

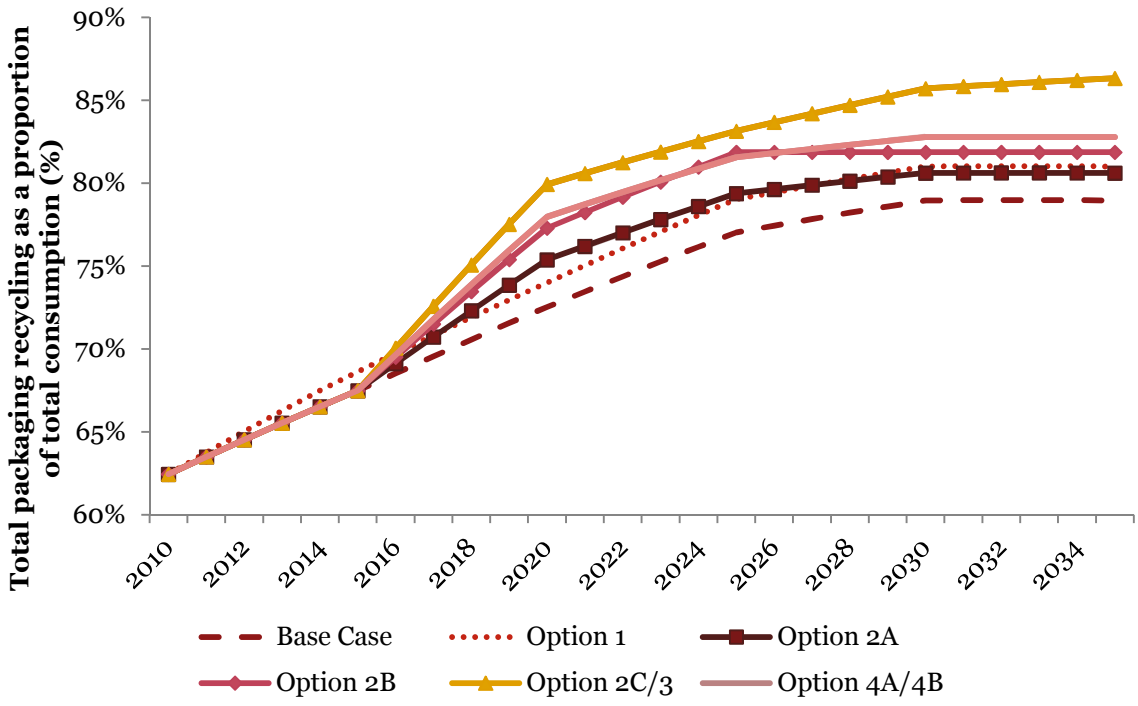
Table 14 – Packaging recycling rate assumptions

	2010	2015	2020	2025	2030	2035
Base Case						
Overall	**62.5%**	**67.5%**	**72.5%**	**77.1%**	**79.0%**	**79.0%**
Non-bev	40.2%	44.2%	49.2%	50.0%	50.0%	50.0%
Bev	48.7%	53.8%	58.1%	66.8%	69.7%	69.7%
Flex packaging	70.2%	75.4%	80.7%	84.1%	85.9%	85.9%
Option 1						
Overall	**62.5%**	**68.8%**	**74.0%**	**79.0%**	**81.1%**	**81.1%**
Non-bev	40.2%	44.9%	50.0%	50.0%	50.0%	50.0%
Bev	48.7%	58.8%	63.5%	70.0%	75.0%	75.0%
Flex packaging	70.2%	75.4%	80.7%	85.9%	87.1%	87.1%
Option 2A						
Overall	**62.5%**	**67.5%**	**75.4%**	**79.4%**	**80.6%**	**80.6%**
Non-bev	40.2%	44.2%	50.0%	50.0%	50.0%	50.0%
Bev	48.7%	53.8%	62.3%	70.0%	75.0%	75.0%
Flex packaging	70.2%	75.4%	83.3%	86.4%	86.4%	86.4%
Option 2B						
Overall	**62.5%**	**67.5%**	**77.3%**	**81.9%**	**81.9%**	**81.9%**
Non-bev	40.2%	44.2%	50.0%	50.0%	50.0%	50.0%
Bev	48.7%	53.8%	70.0%	80.0%	80.0%	80.0%
Flex packaging	70.2%	75.4%	83.3%	86.4%	86.4%	86.4%
Option 2C						
Overall	**62.5%**	**67.5%**	**80.0%**	**83.2%**	**85.7%**	**86.4%**
Non-bev	40.2%	44.2%	55.0%	60.0%	60.0%	60.0%
Bev	48.7%	53.8%	72.5%	80.0%	82.5%	85.0%
Flex packaging	70.2%	75.4%	85.7%	87.1%	90.0%	90.0%
Option 3						
Overall	**62.5%**	**67.5%**	**80.0%**	**83.2%**	**85.7%**	**86.4%**
Non-bev	40.2%	44.2%	55.0%	60.0%	60.0%	60.0%
Bev	48.7%	53.8%	72.5%	80.0%	82.5%	85.0%
Flex packaging	70.2%	75.4%	85.7%	87.1%	90.0%	90.0%
Option 4A						
Overall	**62.5%**	**67.5%**	**77.9%**	**81.6%**	**82.8%**	**82.8%**
Non-bev	40.2%	44.2%	49.2%	50.0%	50.0%	50.0%
Bev	48.7%	53.8%	80.0%	85.0%	85.0%	85.0%
Flex packaging	70.2%	75.4%	80.7%	84.1%	85.9%	85.9%
Option 4B						
Overall	**62.5%**	**67.5%**	**77.9%**	**81.6%**	**82.8%**	**82.8%**
Non-bev	40.2%	44.2%	49.2%	50.0%	50.0%	50.0%
Bev	48.7%	53.8%	80.0%	85.0%	85.0%	85.0%
Flex packaging	70.2%	75.4%	80.7%	84.1%	85.9%	85.9%

Source: WCS (2011)

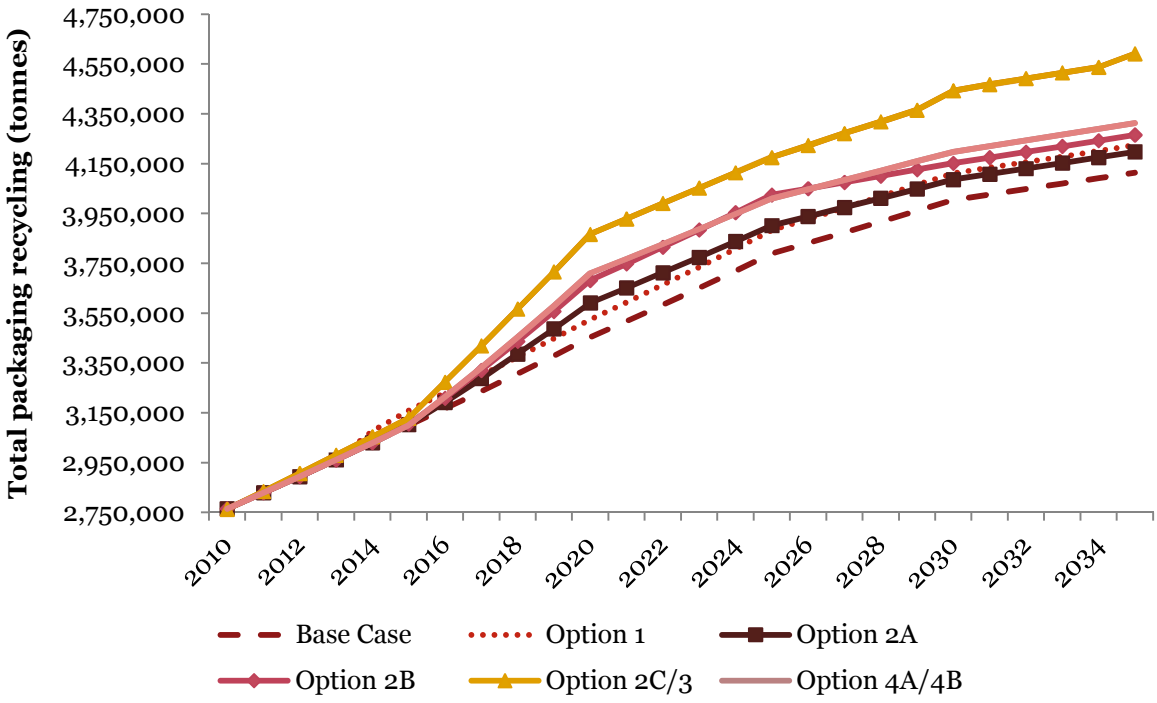
Figure 4 – Projections of total recycling for the base case and options (2011-2035)

A. Percentage basis (total packaging recycling as a proportion of total consumption (%))



Source: WCS (2011)

B. Tonnage basis



Source: WCS (2011)

Projections by material type, relevant to the calculation of the quantification of the market value of resources, are presented in **Appendix F**.

Projected litter trends

Litter projections were developed by WCS based on an estimate of the proportion of packaging that may be available to be littered, which was estimated to be around 1 million tonnes in 2010 in the *Problem Report for Packaging*. Total litter per annum was estimated to be between 40,000 – 160,000 tonnes, implying litter rates of 4%-16% of total packaging available to be littered. However, as noted in the Problem Statement for Packaging, these estimates are high level and indicative only. This is because there is currently no data on the amount of litter nationally or the composition of litter by weight.[32]

Litter projections are presented on a per tonne basis to ensure consistency with consumption and recycling projections. This enables analysis of the entire supply chain to test that all packaging that is consumed is either recycled, littered or landfilled, in other words, to check there is internal consistency in the modelling of projections.

Using Keep Australia Beautiful (KAB) data on litter on surveyed sites may appear on the surface to be more robust. However, robust estimates based on the KAB data of the average weight per unit of packaging litter are only available for beverage containers. Assuming an average weight of 89 grams per unit of packaging litter[33] results in a total litter estimate in the range of 450 million – 1.8 billion items.

Most existing litter data is in items and volume and therefore, assumptions (such as the average weight of packaging litter being 89 grams) have been assumed to convert the project litter from items and volume into tonnes.

The sections below highlight the key litter projection assumptions by option. It should be noted that these projections are largely based on initiatives directly targeting litter. However, relatively higher recycling also means less packaging available to be littered. As such, litter could be indirectly impacted by recycling initiatives.

Base case

WCS assumes that packaging litter quantities were approximately 60,000 tonnes in 2010. This is in the range of the 40,000-160,000 tonnes of litter estimated in the *Problem Report for Packaging* and is judged to represent a relatively realistic estimate. The material available to be littered is based on the amount landfilled in the base case, which is a function of consumption minus the amount recycled. In 2010, there were 1.7 million tonnes of packaging sent to landfill, of which around 1 million tonnes (60%) was estimated by WCS to be available to be littered. The estimate of 60,000 tonnes littered in 2010 represents 6% of the total available to be littered.

Under the base case it is assumed that litter slowly reduced by 5% by 2015 and 10% for the period 2025 to 2035. The APC *Strategic Plan 2010-2015*, contains three specific litter reduction strategies, and it is assumed in the base case that these are progressively implemented.

The impact of these assumptions on litter as a proportion of packaging available to be littered is presented in the table below.

Table 15 – Litter reduction assumptions (2011-2035) – base case

Year	Litter reduction assumption by weight (%)	Litter as a proportion of packaging tonnes available to be littered (%)
2010	0%	6.0%
2015-2024	5%	5.7%
2025-2035	10%	5.4%

Source: WCS (2011)

[32] PwC and Wright Corporate Strategy (2011) *Problem report for packaging*, prepared for the Environment Protection and Heritage Council, 19 August, p 16

[33] BDA Group and WCS (2010) *Beverage container investigation – revised final report*, prepared for the EPHC Beverage Container Working Group, Table A6.5, p 68

Option 1 – National Packaging Waste Strategy

Option 1 is assumed to result in a modest reduction in the rate of littering over the base case. The assumed outcome is that the litter rate reduces by 5% by 2015, 10% by 2020, and 15% for the period 2025 to 2035 as a result of the national education campaigns and enforcement. The impact of these assumptions on litter as a proportion of packaging available to be littered is presented in the table below.

Table 16 – Litter reduction assumptions (2011-2035) – Option 1

Year	Litter reduction assumption (%)	Litter as a proportion of packaging available to be littered (%)
2010	0%	6.0%
2015	5%	5.7%
2020	10%	5.4%
2025-2035	15%	5.1%

Source: WCS (2011)

Option 2A – Co-regulatory Packaging Stewardship

Option 2A is assumed to target litter in a similar manner to Option 1. Therefore, the reduction in litter is assumed to be the same for Options 1 and 2A.

The impact of these assumptions on litter as a proportion of packaging available to be littered is presented in the table below.

Table 17 – Litter reduction assumptions (2011-2035) – Option 2A

Year	Litter reduction assumption (%)	Litter as a proportion of packaging available to be littered (%)
2010	0%	6.0%
2015	5%	5.7%
2020	10%	5.4%
2025-2035	15%	5.1%

Source: WCS (2011)

Option 2B – Industry Packaging Stewardship Scheme

Option 2B targets litter through increased beverage container recovery and a range of specific litter initiatives. The overall outcome of Option 2B is that litter reduces by 5% by 2015, 11% by 2020, 15% for the period 2025 to 2035.

For non-beverage containers the assumed reductions in litter rates are: 5% reduction in 2015, 10% reduction in 2020, and 15% reduction in 2025 remaining steady until 2035. For beverage containers the assumed reductions in litter rates are: 5% reduction in 2015, 15% reduction in 2020, and 20% reduction in 2025 remaining steady until 2035. For flexible packaging, the assumed reductions in litter rates are: 5% reduction in 2015, 10% reduction in 2020, and 15% reduction in 2025 remaining steady until 2035.

The impact of these assumptions on litter as a proportion of packaging available to be littered is presented in the table below.

Table 18 – Litter reduction assumptions (2011-2035) – Option 2B

Year	Litter reduction assumption (%)	Litter as a proportion of packaging available to be littered (%)
2010	0%	6.0%
2015	5%	5.7%
2020	11.1%	5.3%
2025-2035	15.4%	5.1%

Source: WCS (2011)

Option 2C – Extended Packaging Stewardship Scheme

As option 2C involves the same litter initiatives as Option 2B, the reduction in litter is also the same.

The impact of these assumptions on litter as a proportion of packaging available to be littered is presented in the table below.

Table 19 – Litter reduction assumptions (2011-2035) – Option 2C

Year	Litter reduction assumption (%)	Litter as a proportion of packaging available to be littered (%)
2010	0%	6.0%
2015	5%	5.7%
2020	11.1%	5.3%
2025-2035	15.4%	5.1%

Source: WCS (2011)

Option 3 – Mandatory Advanced Disposal Fee

It is assumed that litter reduction under Option 3 is the same as under Option 2B and 2C because the initiatives targeting litter are the same. The impact of these assumptions on litter as a proportion of packaging available to be littered is presented in the table below.

Table 20 – Litter reduction assumptions (2011-2035) – Option 3

Year	Litter reduction assumption (%)	Litter as a proportion of packaging available to be littered (%)
2010	0%	6.0%
2015	5%	5.7%
2020	11.1%	5.3%
2025-2035	15.4%	5.1%

Source: WCS (2011)

Option 4A – Boomerang Alliance Container Deposit Scheme

It is assumed that Option 4A leads to an overall reduction in the rate of littering of almost 12% by 2025, mainly as a result of targeted beverage container recovery.

For non-beverage containers, the assumed reductions in litter rates are: 5% reduction in 2015, and 10% reduction in 2025, remaining steady until 2035. For beverage containers, the assumed reductions in litter rates are: 5% reduction in 2015, 25% reduction in 2020, and 30% reduction in 2030 remaining steady until 2035. For flexible packaging, the assumed reductions in litter rates are: 5% reduction in 2015, and 10% reduction in 2025 remaining steady until 2035.

KAB data indicates that on the sites surveyed SA was 18.2% below the national average of litter items and 5.6% below the national average of litter volumes. It is recognised that this includes beverage and non-beverage containers. However, this data does indicate that a reduction of up to 30% in beverage container litter may be possible.

The impact of these assumptions on litter as a proportion of packaging available to be littered is presented in the table below.

Table 21 – Litter reduction as a proportion available to be littered(2011-2035) – Option 4A

Year	Litter reduction assumption (%)	Litter as a proportion of packaging available to be littered (%)
2010	0.0%	6.0%
2015	5.0%	5.7%
2020	7.2%	5.6%
2025	11.5%	5.3%
2030	12.4%	5.3%
2035	12.4%	5.3%

Source: WCS (2011)

The table below shows the litter reduction assumptions relative to tonnes of litter in 2010. In the *Beverage Container Investigation*, BDA and WCS estimated that CDS could achieve a 41% reduction in beverage container litter by volume and a 19% volume reduction in litter.[34] As the table below shows, the packaging available to be littered approach has led to a higher percentage reduction in litter relative to 2010 litter than was used in the BDA Report.

Table 22 – Litter reduction relative to 2010 under Option 4A

Year	Litter reduction relative to 2010 (%)
2010	0.0%
2015	14.5%
2020	41.1%
2025	51.8%
2030	54.0%
2035	52.7%

Source: WCS (2011)

Option 4B – Hybrid Container Deposit Scheme

Assumptions are the same as for Option 4A given that they assume implementation of the same recycling initiatives (and no litter initiatives, with the assumed litter reduction occurring as a result of the diversion of containers to recycling).

The impact of these assumptions on litter as a proportion of packaging available to be littered is presented in the table below.

Table 23 – Litter reduction assumptions (2011-2035) – Option 4B

Year	Litter reduction assumption (%)	Litter as a proportion of packaging available to be littered (%)
2010	0%	6%
2015	5%	5.7%

[34] BDA and WCS 2010, *Beverage Container Investigation*, p. 3

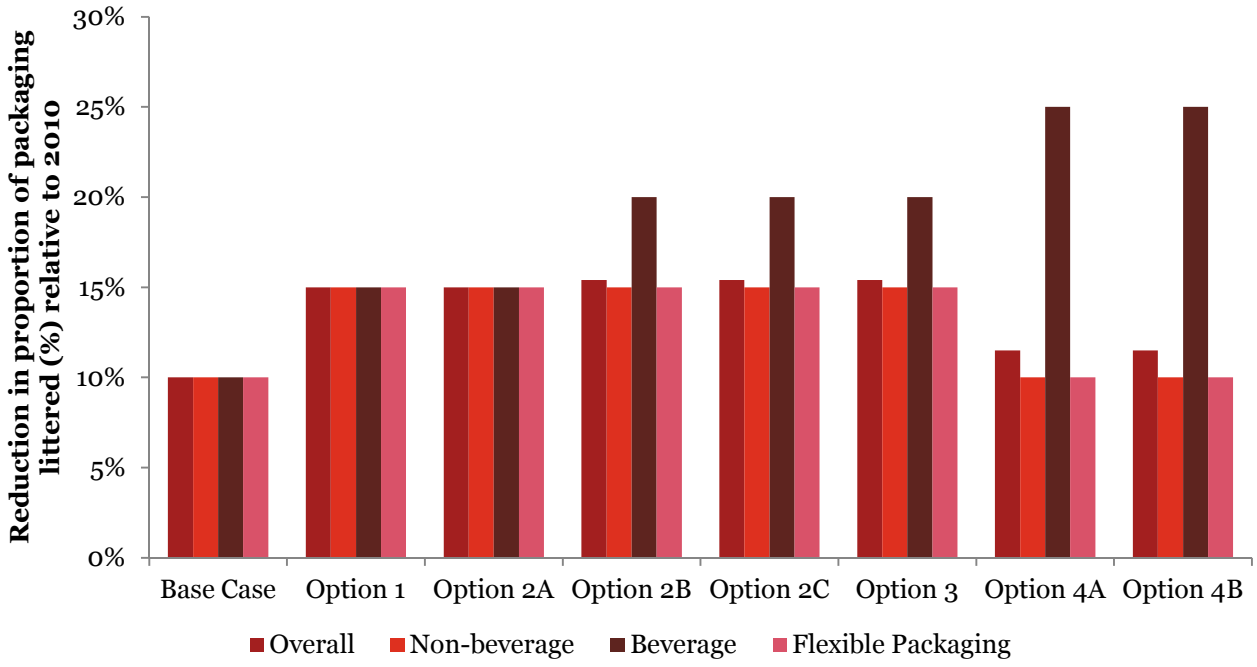
Year	Litter reduction assumption (%)	Litter as a proportion of packaging available to be littered (%)
2020	7.2%	5.6
2025	11.5%	5.3
2030	12.4%	5.3
2035	12.4%	5.3%

Source: WCS (2011)

Summary

The table on the following page presents the packaging litter reduction assumptions overall, and by packaging product, every 5 years from 2015 to 2035. To provide an illustration of the relative litter reduction performance between options and products, the figure below illustrates the litter reduction projections for the year 2025.

Figure 5 – Litter reduction projections by weight with the base case and options (2025)



Source: WCS (2011)

Table 24 – Packaging litter reduction assumptions by weight

	2010	2015	2020	2025	2030	2035
Base case						
Overall	**0.0%**	**5.0%**	**5.0%**	**10.0%**	**10.0%**	**10.0%**
Non-bev	0.0%	5.0%	5.0%	10.0%	10.0%	10.0%
Bev	0.0%	5.0%	5.0%	10.0%	10.0%	10.0%
Flex packaging	0.0%	5.0%	5.0%	10.0%	10.0%	10.0%
Option 1						
Overall	**0.0%**	**5.0%**	**10.0%**	**15.0%**	**15.0%**	**15.0%**
Non-bev	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Bev	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Flex packaging	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Option 2A						
Overall	**0.0%**	**5.0%**	**10.0%**	**15.0%**	**15.0%**	**15.0%**
Non-bev	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Bev	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Flex packaging	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Option 2B						
Overall	**0.0%**	**5.0%**	**11.1%**	**15.4%**	**15.4%**	**15.4%**
Non-bev	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Bev	0.0%	5.0%	15.0%	20.0%	20.0%	20.0%
Flex packaging	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Option 2C						
Overall	**0.0%**	**5.0%**	**11.1%**	**15.4%**	**15.4%**	**15.4%**
Non-bev	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Bev	0.0%	5.0%	15.0%	20.0%	20.0%	20.0%
Flex packaging	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Option 3						
Overall	**0.0%**	**5.0%**	**11.1%**	**15.4%**	**15.4%**	**15.4%**
Non-bev	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Bev	0.0%	5.0%	15.0%	20.0%	20.0%	20.0%
Flex packaging	0.0%	5.0%	10.0%	15.0%	15.0%	15.0%
Option 4A						
Overall	**0.0%**	**5.0%**	**7.2%**	**11.5%**	**12.4%**	**12.4%**
Non-bev	0.0%	5.0%	5.0%	10.0%	10.0%	10.0%
Bev	0.0%	5.0%	25.0%	25.0%	30.0%	30.0%
Flex packaging	0.0%	5.0%	5.0%	10.0%	10.0%	10.0%
Option 4B						
Overall	**0.0%**	**5.0%**	**7.2%**	**11.5%**	**12.4%**	**12.4%**
Non-bev	0.0%	5.0%	5.0%	10.0%	10.0%	10.0%
Bev	0.0%	5.0%	25.0%	25.0%	30.0%	30.0%
Flex packaging	0.0%	5.0%	5.0%	10.0%	10.0%	10.0%

Source: WCS (2011)

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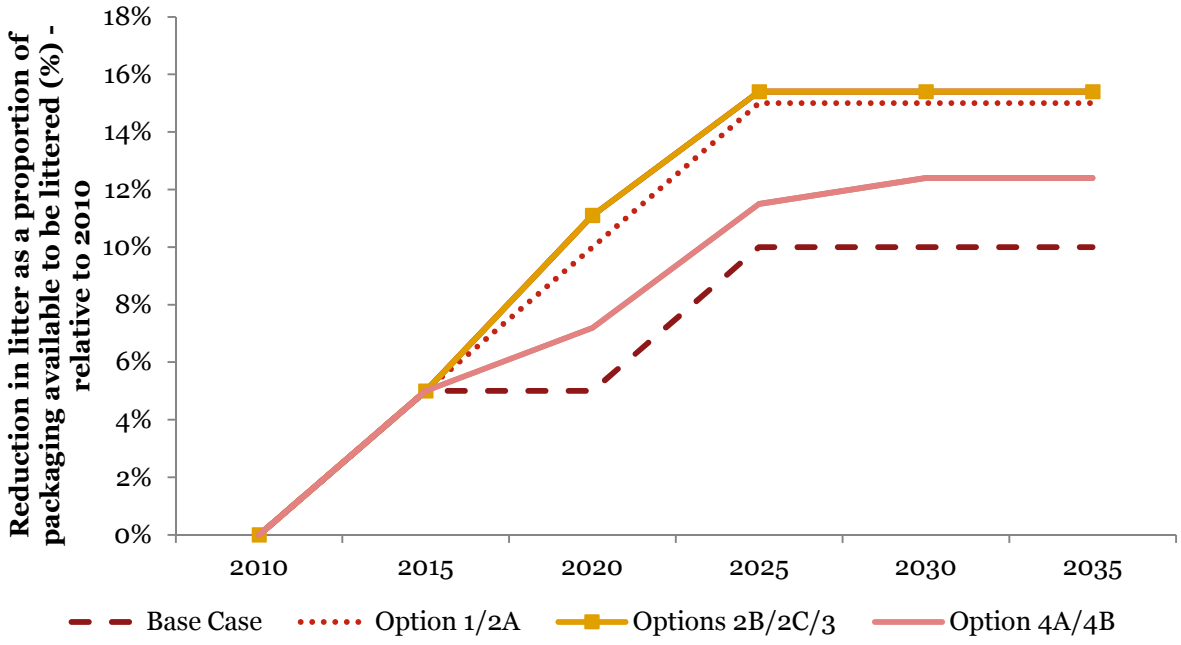
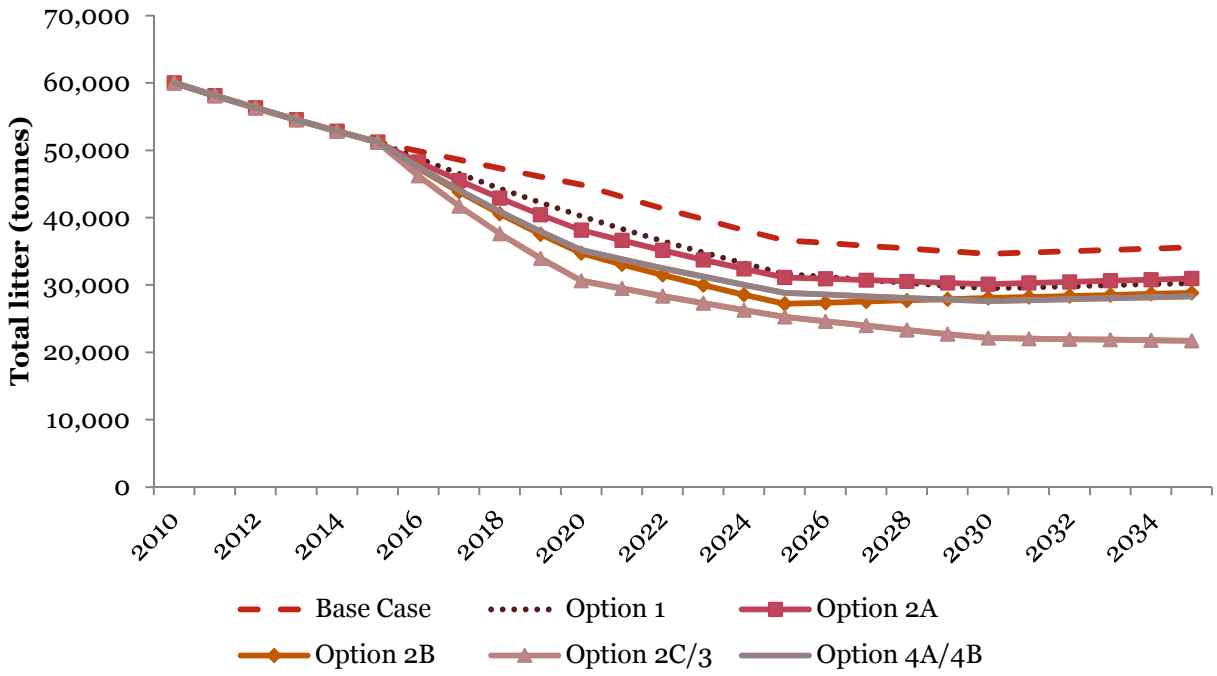
Figure 6 – Projections of reduced litter for the base case and options (2011-2035)

A. Percentage basis



Note: Projections represent the percentage reduction in litter as a proportion of packaging available to be littered (6% in 2010)
Source: WCS (2011)

B. Tonnage basis



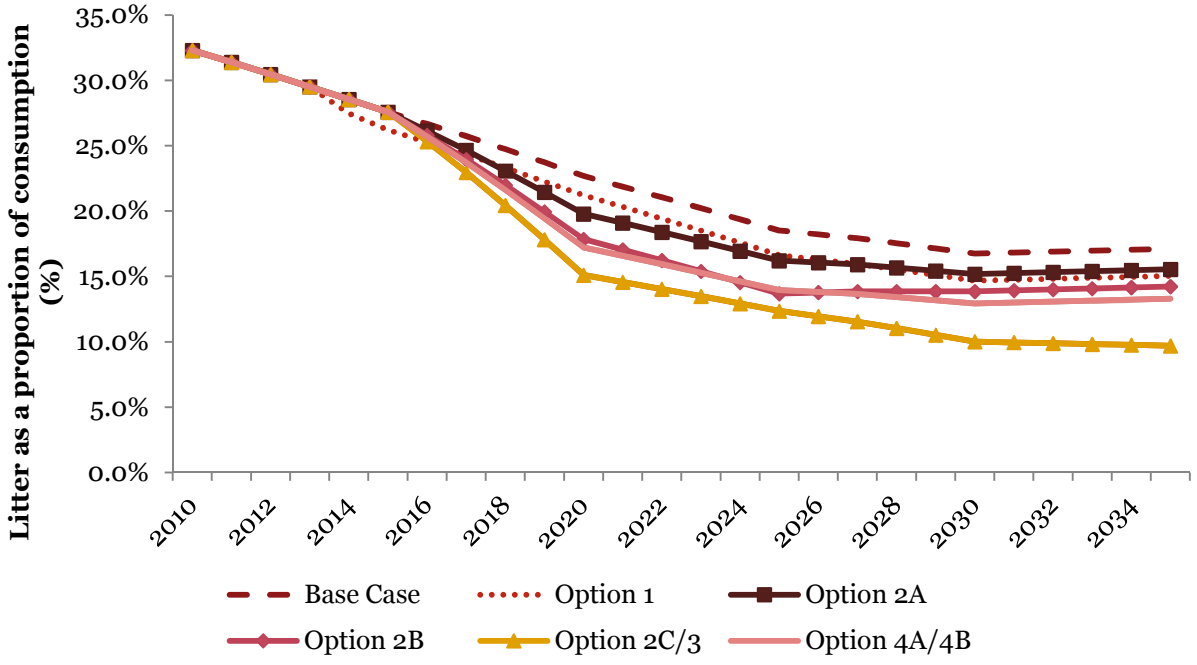
Source: WCS (2011)

Projected landfill trends

Landfill quantities are not calculated directly as they are assumed to be the difference between the quantity of consumption and the sum of recycling and litter quantities, based on the projections.

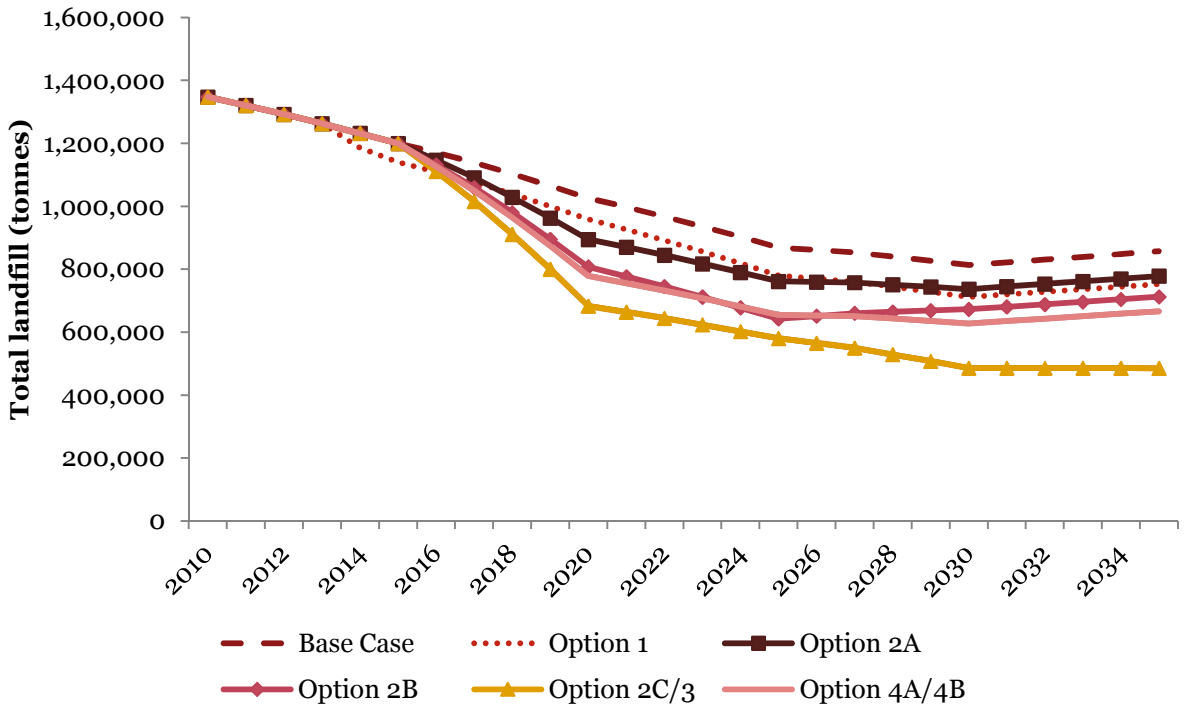
Figure 7 – Projections of landfill for the base case and options (2011-2035)

A. Percentage basis



Source: WCS (2011)

B. Tonnage basis



Source: WCS (2011)

Cost assumptions

4. Cost assumptions

There are assumed to be incremental costs to government, households, businesses and the packaging industry associated with the options. The below table summarises the costs and their different categories.

Category	Cost		Description
Scheme design and implementation	Regulation design and implementation		These include government incurred costs to design the regulation, make regulatory amendments, and then implement any varied legislation/regulation. It is expected to largely incorporate labour time and cost.
	Government participation costs		Non-regulatory government costs to implement an option including costs to develop a National Packaging Waste Strategy, develop a compliance database and prepare a cost recovery impact statement.
	Communications		Government/industry costs of a national communications campaign in the first year of the scheme and the cost of reinforcing the scheme in subsequent years.
Collection, transport and recycling	Household and business participation costs	Vehicle operating costs (VOC)	VOC incurred by households to transport packaging to collection infrastructure.
		In-vehicle travel time (IVT)	The IVT of households to transport packaging to collection infrastructure by vehicle.
		Accumulation time	The value of time of households and businesses to physically transfer packaging to accumulation points such as kerbside recycling bins. This includes time to sort packaging (or containers) from the general waste stream, walk to the accumulation point and transfer the packing.
		Container deposit redemption time	The value of time of households to walk from their vehicle to the container collection infrastructure and conduct the transaction.
	Collection and transport costs		The costs to transport packaging from collection infrastructure to a material recovery facility (MRF).
	Processing of recycling at MRFs		Costs to sort/process packaging material delivered to a MRF and the cost to landfill residual material that is rejected due to contamination.

Category	Cost	Description
Scheme operation	Government costs to administer regulations	Costs for government to administer the regulations on an ongoing basis, including costs related to pursuing industry participants to join the co-regulatory scheme and ensuring compliance with the legislation.
	Scheme administration costs	Cost of establishing an industry-run PSO(s) that will be responsible for the establishment and operation of approved arrangements under the co-regulatory options.
	Scheme initiatives and infrastructure	Costs to fund scheme initiatives and associated infrastructure such as education campaigns and increased public place recycling.
Scheme compliance	Reporting and labelling	Costs incurred by industry to report against targets and update labels in the CDS.

The core assumptions for each of these cost categories and potential data sources for sensitivity testing are discussed below.

In 2010, PwC conducted a study for TEC on approached to conducting CBAs of CDS options.[35] The study identified a range of economic and environmental costs of CDS and theoretical approaches to valuing these. Since this time, the willingness to pay study has been conducted, as well as a range of other studies. Therefore, a number of costs have been included in this CBA that were not identified in the 2010 report. Additionally, the 2010 report did not seek to quantify the costs, but identified potential approaches. Therefore, there are a number of costs that were identified in the report that have not been included in this CBA as it was not possible or practical to quantify them.

35 PwC, 2010. *Synthesis and Critique of Existing Consumer Deposit Scheme- Cost Benefit Analysis.* Prepared for the Total Environment Centre, February 2010.

Scheme design and implementation

A. Regulation design and implementation

Regulatory design and implementation costs include government incurred costs to design the regulation, make regulatory amendments and then implement any new or amended legislation/regulation. These regulatory and implementation costs are assumed to primarily consist of labour time and costs.

Regulation underpinning the APC is already in place, so no additional regulation design and implementation costs are assumed be incurred in the base case. Option 1 is a non-regulatory option so there are assumed to be no costs for regulation design and implementation.

Implementation costs of a Commonwealth Extended Producer Responsibility (EPR) Regulations under the *Product Stewardship Act 2011* are expected to take two years to develop (2012 to 2013). It has been assumed that the regulation design and implementation costs would be **$700,000** based on previous advice from the SCEW. These costs apply to Options 2A, 2B and 2C, which are co-regulatory packaging stewardship arrangements under the *Product Stewardship Act 2011*.[36] Direct costs are estimated to be $400,000 and include project team travel costs, consultation roadshow costs, consultancy fees for regulatory impact statement development and teleconferences. This does not include time spent on introducing regulatory changes by Commonwealth officers. These staff costs are estimated to be $300,000.[37]

Option 3 is assumed to involve the government placing a mandatory ADF on packaging. It is assumed to require a separate levy bill and consequential amendments to the Act related to administration of levy funds.[38] It is assumed that the Commonwealth would incur twice the staff costs because there are two sets of regulations,[39] resulting in total costs of **$1 million** over 2 years.

Options 4A and 4B involve establishing a mandatory CDS. They are assumed to have regulation design and implementation costs of **$700,000**. Depending upon the design of the scheme, it may also require a separate levy bill and consequently could require amendments to the *Product Stewardship Act related* to administration of levy funds, increasing costs to **$1 million**. Under these options, consideration could also be given to prohibiting the sale and import and manufacture of non-recyclable beverage containers.[40] This is assumed to result in an additional $300,000 in Commonwealth staff costs, increasing total costs to **$1.3 million**.

Table 25 – Regulatory design and implementation cost assumptions

Option	Cost assumption ($m/2 years)	Source	Note
Base case	0.0		Regulation underpinning the Packaging Covenant is already in place
Option 1	0.0		Non-regulatory option
Option 2A	0.7	Previous SCEW Working Group advice	
Option 2B			
Option 2C			
Option 3	1.0		Requires a separate levy bill and consequential amendments to the Act related to administration of levy funds.
Option 4A	0.7-1.3		Co-regulatory or mandatory provisions of the *Product Stewardship Act.* May also

[36] PwC and Wright Corporate Strategy (2011) *Packaging option report – draft version 2*, prepared for the Environment Protection and Heritage Council, p 29

[37] PwC and Hyder (2009) *Decision Regulatory Impact Statement: Televisions and Computers*, prepared for the EPHC, p214

[38] PwC and Wright Corporate Strategy (2011) *Packaging option report – draft version 2*, prepared for the Environment Protection and Heritage Council, p 37

[39] PwC and Hyder (2009) *Decision Regulatory Impact Statement: Televisions and Computers*, prepared for the EPHC, p214.

[40] PwC and Wright Corporate Strategy (2011) *Packaging option report – draft version 2*, prepared for the Environment Protection and Heritage Council, p 27

Option	Cost assumption ($m/2 years)	Source	Note
Option 4B			require a separate levy bill and consequently could require amendments to the *Product Stewardship Act* related to administration of levy funds. Consideration could also be given to prohibiting the sale and import / manufacture of non-recyclable beverage containers

B. Government participation costs

In addition to the labour costs to design and implement scheme regulations, there are likely to be other incremental labour costs incurred by the government to design and implement the options. These could include:

- Development of a National Packaging Waste Strategy (Option 1 only)
- Establishing a compliance database
- Development of a Cost Recovery Impact Statement, and
- Cost of renegotiating municipal kerbside recycling contracts.

The ongoing cost for government to operate each option are included in the scheme operation costs. The government participation costs seek to quantify the costs to government for implementing each option.

Option 1 includes the development of a National Packaging Waste Strategy This is assumed to cost **$140,000** in the first year and **$90,000** ongoing based on NSW Office of Environment and Heritage (NSWOEH) estimates of:

- An annual salary of $92,000 for an Environmental Officer. $118,000 for a Manager and $150,000 for a Director
- Overheads of 14.5%
- A time commitment in Year 1 of 20% for the Environmental Manager, 5% for the Manager and 1% for the Director
- A time commitment on an ongoing basis of 10% for the Environmental Manager, 5% for the Manager and 1% for the Director, and
- Equivalent costs to NSW in QLD and VIC; 50% of NSW costs in WA and SA; and 25% in TAS, NT and ACT.

Due to the challenges of monetising the other costs identified above, they have not been included in the CBA. Therefore, only the development of a National Waste Strategy has been quantified. Establishing a compliance database, development of a Cost Recovery Impact Statement and the cost of renegotiating municipal kerbside recycling contracts were not quantified.

C. Communication costs

A national communications campaign is assumed to be required to provide consumers and stakeholders with the knowledge to successfully participate in the CDS (Options 4A and 4B). These costs can be borne by either the Government or liable parties depending on the design of the scheme. This CBA will assume that these costs are borne be Government given that industry funded education campaigns are included in the cost category 'Scheme Initiatives and Infrastructure'.

It is estimated that the cost of a national communications campaign is **$8.8 million** in the first year of the scheme (2011).[41] The cost of continuing community education in the years after its introduction is assumed to be **$500,000** per year until the end of the appraisal period. These costs are assumed to apply to Options 4A and 4B.

Communication costs for Options 2B, 2C and 3 are assumed to be **50%** of the costs of Options 4A and 4B.This is assumed to be funded by liable parties as part of an approved arrangement. As such, Government communications costs should largely relate to informing consumers and stakeholders about progress achieved in the scheme, noting that the scheme initiatives for these options are significantly different from the base case.

Option 1 is a non-regulatory option with $4 million per year assumed to be allocated to funding of recycling and litter education campaigns. Industry is also assumed to retain responsibility for informing consumers and stakeholders about progress in the scheme. However, there is assumed to be Government involvement to develop the National Packaging Waste Strategy as well as an associated communications campaign to inform consumers and stakeholders about this strategy. These costs have been assumed to be **25%** of the costs in the CDS schemes ($2.2 million up front and $0.125 million ongoing).

Option 2A is assumed to be largely consistent with the base case except that the APC is assumed to be brought under the *Product Stewardship Act*. Given the initiatives are the same as in the base case, there is assumed to be no additional expenditure. As such, government communications costs are assumed to largely relate to informing consumers and stakeholders about the impact of changing the regulatory underpinning of the APC. These costs have been assumed to be **25%** of the costs of a CDS scheme ($2.2 million up front and $0.125 million ongoing).

Table 26 –Communication cost assumptions

Option	Cost assumption ($m/year)	Source	Note
Option 1	2.2 (upfront) and 0.125 (ongoing)	25% of costs for scheme with 'drop off' of packaging at central collection locations	• Non-regulatory option with limited Government involvement • Industry funding of recycling and litter education campaigns ($4 million per year) • Government communications related to National Packaging Waste Policy
Option 2A	2.2 (upfront) and 0.125 (ongoing)	25% of costs for scheme with 'drop off' of packaging at central collection locations	• Initiatives assumed to be largely consistent with the base case • Government communications related to the impact of changing the regulatory underpinning of the Packaging Covenant
Option 2B Option 2C Option 3	4.4 (upfront) and 0.5 (ongoing)	50% of costs for scheme with 'drop off' of packaging at central collection locations	• Industry funding of recycling and litter education campaigns ($4 million per year) • Scheme initiatives significantly different from the base case
Option 4A Option 4B	8.8 (upfront) and 0.5 (ongoing)	Hyder (2006), *Television EPR Scheme, Producer Responsibility Organisation – Cost Analysis*	Includes websites, printed collateral material, TV advertisements, radio advertisements, print ads, outdoor media, in store retail advertising, event management and a school education program.

The communications costs for Options 4A and 4B are based on a 'bottom up' estimate of costs for a similar scheme involving 'drop off' of televisions and computers at central collection locations. However, there is uncertainty regarding the relative costs for the other options, which have been assumed to be a proportion of the costs for the CDS options. As such, this assumption will be included in sensitivity testing to see the impact of applying the lower bound communication costs ($2.2 million up front and $0.125 million ongoing) and upper bound communication costs ($8.8 million up front and $0.5 million ongoing) to all options.

[41] This includes websites, printed collateral material, TV advertisements, radio advertisements, print ads, outdoor media, in store retail advertising, event management and a school education program. See Hyder (2006), *Television EPR Scheme, Producer Responsibility Organisation – Cost Analysis, prepared for the NSW Department of Environment and Conservation and Product Stewardship Australia,* pp 16-17

Collection, transport and recycling

A. Household participation costs

Households face scheme participation costs due to the time it takes to accumulate packaging and transport it by vehicle to collection infrastructure points. These are listed below.

- **Vehicle operating costs (VOC):** VOC incurred by households to transport packaging to collection infrastructure.
- **In-vehicle travel time (IVT)**: The IVT of households to transport packaging to collection infrastructure by vehicle.
- **Accumulation time:** The value of time of households to physically transfer packaging to accumulation points such as kerbside recycling bins. This includes time to sort packaging (or containers) from the general waste stream, walk to the accumulation point and transfer the packing.
- **Container deposit redemption time:** The value of time of households to walk from their vehicle to the container collection infrastructure and conduct the transaction.

Given the uncertainty that surrounds these estimates, sensitivity testing will be undertaken to determine the impact of increasing and decreasing household participation costs by both 25% and 50% and the results of these tests are summarised in Chapter 5.

There are a range of components of the household participation costs, such as VOC and IVT, that could also be individually subjected to sensitivity analysis. These potential sensitivities are identified in the following sections. The results of these sensitivity tests on individual components have not been reported in the CBA results. This is because the sensitivity testing of increasing and decreasing the household participation costs by both 25% and 50% will capture changes in these individual components.

Vehicle operating costs

Options 1, 2A, 2B, 2C and 3 are not anticipated to result in additional vehicle trips given that under these options household recycling is primarily conducted using kerbside recycling. Options 4A and 4B require households to transport containers to collection infrastructure to redeem financial deposits. When this activity cannot be coordinated with existing trips (e.g. weekly grocery shopping), there are incremental costs resulting from the additional trips.

VOC are a function of assumptions regarding:

- VOC per km
- Distance to infrastructure
- Trips per week
- Trips by infrastructure type
- Proportion of new trips.

Estimates based on these assumptions are assumed to be the maximum costs achieved in 2035, with VOC in earlier years calculated based on beverage container recycling at CDS collection points in that particular year as a proportion of the level of CDS recycling projected for 2035.

Vehicle operating cost parameter

VOCs are routinely included in CBAs of transport initiatives. The VOCs are based on parameters ($/vehicle km travelled (VKT)) sourced from economic appraisal guidelines in the various jurisdictions. As outlined in the

table below, VOC are expected to be **15.4 cents/km** based on the resource costs of fuel[42] and vehicle repair and maintenance costs.

Table 27 – Vehicle operating cost input assumptions

Cost assumption	Value	Source	Note
Fuel Consumption (cents/km)	**10.3**		Calculated as average rate of fuel consumption multiplied by fuel resource costs = (11.3/100)*90.9
Average rate of fuel consumption (L/100km)	11.3	Australian Bureau of Statistics (ABS), *Survey of Motor Vehicle Use, 2010*	Average rate of fuel consumption for passenger vehicles in 2010
Fuel resource cost (c/L)	90.9*	Austroads *Guide to Project Evaluation*	Inflated from June 2007 prices (80.33 c/L) to June 2011 prices using ABS (2011) *Consumer Price Index, Australia, Jun 2011*, Table 1
Vehicle repair and maintenance cost (cents/km)	**5.1**	Austroads *Guide to Project Evaluation*	Inflated from June 2007 prices (4.5 c/km) to June 2011 prices using ABS (2011) *Consumer Price Index, Australia, Jun 2011*, Table 1
Total (c/km)	15.4	= (10.3+5.1)	Calculated as fuel consumption plus vehicle repair and maintenance costs = (10.3 + 5.1)

Note: *Fuel costs for the purposes of an economic appraisal are measured as resource costs, which exclude transfers between parties such as taxes, explaining why the estimated fuel cost is relatively lower than observed retail prices.

Appendix B presents more detail on the source of these assumptions and presents alternative data sources. Sensitivity testing could be undertaken to determine the impact of increasing the VOC estimate to 23 cents per km, in line with the NSW Road and Traffic Authority's *Economic Analysis Manual*.

Distance to infrastructure

VOC are assumed to depend on the average distance travelled from households to CDS infrastructure. The table below outlines the types of infrastructure assumed for Options 4A and 4B and the assumed distance from consumption point to infrastructure.

As outlined in the *Packaging Options Report*, the CDS will distribute collection centres geographically to ensure coverage and consumer convenience. Preliminary infrastructure requirements have been estimated, but these are subject to verification based on a population/geographical analysis.

As outlined in Appendix J, there are currently 109 collection depots in South Australia, which currently has a population of around 1.65 million.[43] This implies a catchment of 15,176 people per collection depot or 5,837 households based on an average household size of 2.6 people.[44] This catchment is likely to be higher in urban areas (assumed to be 7,500 households) and lower in regional areas (assumed to be 5,000).

ABS data on population density by Statistical Local Area was used to estimate the catchment area of each unit of infrastructure applying the estimated household catchment based on the SA analysis. The average distance to each unit of collection infrastructure was estimated as half the radius of a circle with the same area as the catchment area, thereby assuming that households are distributed equally within the catchment area.

[42] Resource costs exclude transfers such as taxes, which are not economic costs and should be excluded from a CBA

[43] ABS (2011) *3101.0 – Australian Demographic Statistics, Mar 2011*

[44] ABS (2011) *3218.0 Regional Population Growth, Australia*, Tables 1-10; ABS (2010) *Household and Family Projections, Australia, 2006 to 2031*, Table 1.2

It should be noted that the ABS also has population data for urban centres and localities, which ideally would be preferred to Statistical Local Area data, especially for regional areas. However, population density data is not provided at this level of aggregation and so the CBA assumptions have been built up from data on Statistical Local Areas.

Geoscience Australia's spatial database is available to map the location of waste transfer stations in Australia. However, estimates based on population density were preferred as they reflect the catchment assumptions that are assumed to underpin the population / geographic analysis.

Table 28 - Estimates of average distance to infrastructure based on population density

Assumption	Value	Source	Note
Population density – urban (persons/km2)	401.8	ABS (2011) *3218.0 Regional Population Growth, Australia*, Tables 1-10	Population density of all LGAs in capital city Statistical Divisions
Population density – rural/remote (persons/km2)	3.85		Median population density of LGAs outside capital city Statistical Divisions
Catchment households– urban (households/unit of infrastructure)	7,500	Analysis of population distribution of SA collection infrastructure	Catchment is based on the number of households, not population
Catchment households – rural/remote (households per unit of infrastructure)	2,500		
Average household size (population per household)	2.6	ABS (2011) *3218.0 Regional Population Growth, Australia*, Tables 1-10/ABS (2010) *Household and Family Projections, Australia, 2006 to 2031*, Table 1.2	=(22,328,847/8,527,072)
Catchment area – urban (km)	48.5	PwC calculation	=(7,500/(401.8/2.6))
Catchment area – rural/remote (km)	1,688.3	PwC calculation	=(2,500/(3.85/2.6)
Catchment radius – urban	3.9	PwC calculation (assuming catchment area is circular)	=((48.5)/π)^(1/2)
Catchment radius – rural/remote	23.2		=((1,688.3)/π)^(1/2)
Average distance to infrastructure – urban	2.0	Population assumed to be equally distributed within the catchment area, so radius divided by 2	=3.9/2
Average distance to infrastructure – rural/remote	11.6		=23.2/2

Table 29 –Average distance from point of household consumption to infrastructure: Option 4A

Cost assumption	Value
Distance to hubs (km)	2.0
Distance to collection depots (km)	2.0
Distance to RVMs (km)	2.0
Rural and remote centre collection points (km)	11.6

Table 30 –Average distance from point of household consumption to infrastructure: Option 4B

Cost assumption	Value
Distance to consolidation depots (km)	2.0
Distance to collection depots (km)	2.0
Distance to RVMs (km)	2.0
Rural and remote centre collection points (km)	11.6

Appendix B presents more detail on the source of these assumptions. It also presents alternative data sources such as the average distance from the point of waste generation to landfill in NSW based on the mapping of landfill locations. These alternative sources could be used to test the sensitivity of the CBA results to these assumptions.

Trips per week

Incremental VKTs are assumed to also depend on the frequency of trips undertaken by households to collection infrastructure. Households are assumed to take **0.04 trips per week (i.e. 2 trips per year)** based SA Environment Protection Authority (EPA) surveys of trips to CDS collection infrastructure. It is arguable that participation in the proposed CDS would be higher than in SA given the relatively higher assumed proportion of RVMs relative to depots. These are likely to encourage relatively higher levels of participation given that they are considered more convenient due to their location. However, this will be somewhat offset by the fact that other jurisdictions already have comprehensive kerbside systems in place, so it will now be relatively more difficult to change behaviour. The overall impact in the frequency of trips is uncertain.

Table 31 – Assumed frequency of household trips to container deposit infrastructure

Frequency of trips per household	Proportion of households (%)	Trips per household per week	Source
Four or more times a year	41%	0.08	EPA (2004), noting that the average frequency of trips is assumed to be 4 per year given that the upper bound of this range is not provided.
One to three times a year	25%	0.04	EPA (2004), noting that the average frequency of trip is assumed to be 2 per year (i.e. the median of range of 1-3 trips per year).
Other	34%	0.00	Residual proportion from EPA (2004) with an assumed frequency of no trips per year.
Total	100%	0.04	

Source: South Australia Environment Protection Agency (2004) Community awareness and acceptance of Container Deposit Legislation, p 4

The upper bound of the category of households taking four or more trips per year is unclear. The analysis has assumed that all households in this category take four trips per year. Sensitivity testing could be used to understand the impact of changing this upper bound on the CBA results.

Trips by infrastructure type

The distribution of household trips to different types of CDS infrastructure reflects BA estimates of beverage container redemption by infrastructure type, s outlined in the table below.

Table 32 – Assumed trips by infrastructure type (Option 4A)

Infrastructure Type	Number	Proportion (%)	Source
Hubs	250	25.5	BA estimate of redemption by infrastructure type
Collection depots (spokes)	310	50.5	
RVMs (spokes)	640	22.5	
Rural/remote collection centres (spokes)	700	1.5	
Total	**1900**	**100**	

Assumptions regarding beverage container redemption by infrastructure type were adjusted for Option 4B to reflect relative differences in the number of collection depots and RVMs.

Table 33 – Assumed trips by infrastructure type (Option 4B)

Infrastructure Type	Number	Proportion (%)	Source
Consolidation depots	250	25.5	Table 32, adjusted to reflect relative differences in the number of collection depots and RVMs
Collection depots	600	58.5	
RVMs	350	14.5	
Rural/remote collection centres	700	1.5	
Total	**1900**	**100**	

Proportion of new trips

Incremental VKTs are assumed to depend on the proportion of trips to collection infrastructure that can be combined with existing trips. When trips to deposit locations are combined with existing trips, this means no new trips have been made and therefore, no incremental costs will be incurred. Only new trips that were not undertaken in the base case are assumed to result in incremental costs to households.

The table below outlines the types of infrastructure assumed for Options 4A and 4B and the assumed proportion of new trips to collection infrastructure. This is assumed to be **50%** for most types of infrastructure. Although they are located at existing waste facilities, it is assumed that around 90% of households have access to kerbside recycling and would not take trips to this infrastructure in the base case. Experience from SA suggests that people tend to incorporate a trip to a recycling depot into a trip that includes other destinations, so a more conservative estimate of 50% has been applied in the CBA.

RVMs are assumed to be located at convenient locations such as shopping centres. It is assumed that **10%** of trips to RVMs are new trips given that:

- Not all shopping trips originate from the point of accumulation (typically the household). For example, people may conduct their weekly or fortnightly shop on the way home from work
- People may be reluctant to store containers in their car. For example, due to limited capacity or reduced amenity
- Households are not likely to make a trip for the sole purpose of returning containers unless they have a significant quantity (e.g. with a deposit of 10 cents per container, 100 containers would result in a payment of $10). However, containers are likely to be returned to RVMs in relatively lower quantities than depots given that containers need to be redeemed one at a time using an RVM.

Table 34 – Assumed proportion of new trips by households to collection infrastructure (%)

Infrastructure type	Proportion of new trips (%)	Source	Note
Hubs	50	PwC assumption	Assumed to be located at existing waste facilities, but around 90% of households are estimated to have access to kerbside recycling meaning that there are relatively few existing trips. Experience from South Australia suggests that people tend to incorporate a trip to a recycling depot into a trip that includes other destinations.
Collection centres (spokes)	50		
Consolidation points	50		
Depots	50		
RVMs	10		Assumed to be predominantly located at shopping centres, so ability to combine with existing shopping trip (noting that it may not always be possible to do so. For example, many people shop on their way home from work and may be reluctant to store containers in their car)
Rural/remote centre collection points	10		Co-location with existing recycling infrastructure, lower coverage of kerbside in regional locations and incorporation into a trip that includes other destinations.

SA and the Northern Territory (NT) have both implemented CDS, so they are already assumed to take trips to collection infrastructure in the base case (i.e. there are no incremental trips with the options). As such, total incremental trips have been reduced by 15% corresponding to their respective populations.[45]

It should be noted there is a paucity of data regarding the proportion of new trips to collection infrastructure. As such, intuitive assumptions have been made for the purposes of the CBA. The impact of increasing and decreasing these assumed proportions could be included in sensitivity in the CBA.

In vehicle travel time

The incremental VKTs generating the VOC above are assumed to also increase costs to households in the form of the IVT. This is calculated by converting the distance travelled into hours by dividing by average vehicle speed and multiplying by the value of time (**$13.01/hour**) based on the Austroads *Guide to Project Evaluation*. It should be noted that the Austroads value of time for private vehicles ($11.49/hour inflated to June 2011 dollars) is used to value all household time costs as a result of the proposed recycling schemes, including sorting time, accumulation time and time to transfer contents.

Austroads do not provide specific data on average vehicle speeds in Australia, however, some guidance is provided by the following sources:

- Austroads reports have estimated VOCs for cars based on an average speed of 100 km/hr on freeways and an average speed of 50 km/hr on other roads.[46]
- The NSW RTA bases their VOC estimates on an all-day average vehicle speed of 40km/hr on the urban road network and 85 km/hr on regional highways[47]
- The Sydney Transport Model estimates average network wide vehicle speeds of around 30 km/hr in the morning peak
- In Melbourne, the average vehicle speed on freeways are estimated to be 43 km/hr in the morning peak and 63 km/hour in the evening peak.[48]

For the purposes of the CBA, average vehicle speed has been assumed to be 50 km/hr in urban areas and 75 km/hr in regional areas, based on Austroads assumptions to develop VOC and acknowledging that:

- Regional roads include a combination of non-arterial roads, arterial roads and freeways
- Average all day vehicle speeds are expected to be higher than in the morning or evening peak
- The Sydney and Melbourne road networks are more congested than in other urban areas, decreasing average vehicle speeds in these locations.

However, the impact of increasing and decreasing these assumed speeds could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

[45] ABS (2011) *3101.0 – Australian Demographic Statistics, Mar 2011*

[46] Austroads (2006) *Update of RUC unit of values to June 2005;* Austroads (2011) *Updating Austroads RUE Unit Values and Related Methodologies*

[47] NSW RTA (2009) *RTA Economic Analysis Manual, Version 2,* Appendix B: Economic Parameters for 2009,

[48] VicRoads (2011) *Traffic Monitor 2009/2010*, May; The Age (2011) *Roadworks blamed as freeways slow to a crawl*, May 31

Table 35 – In-vehicle travel time assumptions

Cost assumption	Value	Source	Note
Value of time ($/hour)	13.0	Austroads Guide to Project Evaluation	Inflated from June 2007 prices ($11.49/hour) to June 2011 prices using ABS (2011) *Consumer Price Index, Australia, Jun 2011*, Table 1.
Average vehicle speed (km/hr) - urban	50	Austroads (2006)	Assumption of vehicle speed used by Austroads to develop vehicle operating cost estimates.
Average vehicle speed (km/hr) - regional	75	Austroads (2006)	Median of the Austroads assumptions for freeways and other roads used to develop VOC estimates.

Accumulation time

Households are assumed to sort and temporarily store recyclable packaging items inside their home or apartment (e.g. in a container beneath the sink). It is assumed that households would each make multiple walking trips to a larger accumulation point outside the home, such as a kerbside recycling bin, each time the capacity of the temporary storage device is reached. There are currently around 8.5 million households in Australia.[49]

The costs of accumulating packaging are estimated to be a function of assumptions regarding:

- Increased sorting time
- Additional trips per week
- Walk time per trip
- Time to transfer contents, and
- Behavioural change by households.

Estimates based on these assumptions are assumed to be the maximum costs in 2035. Accumulation costs in years prior to 2035 calculated based on recycling in that particular year as a proportion of recycling projected for 2035.

Sorting time

The higher the quantity of recycling per household, the more time per week that each household is expected to have to spend sorting recyclable from non-recyclable material (or CDS from non-CDS material). Additional sorting time of **one minute per household per week** has been assumed for Options 2C and 3, which are projected by WCS to achieve the highest recycling rates. It should be noted that this is assumed to be the maximum achieved in 2035, with the assumption in earlier years calculated based on recycling in that particular year as a proportion of recycling projected for 2035. The assumption for other options has been calculated based on the relative incremental recycling quantities (i.e. relative to the base case) as outlined in the tables below:

Table 36 – Projected incremental recycling quantities (tonnes) relative to the base case

Option	Year 1	2020	2025	2030	2035
Option 1	46,000	71,000	97,000	105,000	108,000
Option 2A	22,000	135,000	114,000	84,000	86,000
Option 2B	40,000	227,000	237,000	147,000	151,000
Option 2C	64,000	354,000	299,000	342,000	384,000
Option 3	64,000	354,000	299,000	342,000	384,000
Option 4A	50,000	258,000	225,000	194,000	199,000

[49] ABS (2011) *32360DO001_20062031 Household and Family Projections, Australia, 2006 to 2031*

Option	Year 1	2020	2025	2030	2035
Option 4B	50,000	258,000	225,000	194,000	199,000

Note: Projected recycling quantities have been rounded to the nearest thousand

Table 37 – Projected incremental recycling quantities relative to Options 2C and 3 (%)

Option	2020	2025	2030	2035
Option 1	20%	32%	31%	28%
Option 2A	38%	38%	25%	22%
Option 2B	64%	79%	43%	39%
Option 4A	73%	75%	57%	52%
Option 4B	73%	75%	57%	52%

Household sorting time costs are valued at **$13.01/hour** based on the Austroads value of time for private vehicle ($11.49) inflated to June 2011 prices.

It should be noted that there is uncertainty regarding households' additional sorting time. However, the impact of increasing and decreasing these assumptions could be included in sensitivity testing in the CBA.

Additional trips per week

Additional trips to the accumulation point of **one trip per household per week** has been assumed for Options 2C and 3, which are projected by WCS to achieve the highest recycling rates. It should be noted that these are assumed to be the maximum costs achieved in 2035, with costs in earlier years calculated based on recycling in that particular year as a proportion of recycling projected for 2035. It should be noted that this is assumed to be the maximum achieved in 2035, with the assumption in earlier years calculated based on recycling in that particular year as a proportion of recycling projected for 2035. The assumption for other options has been calculated based on the relative incremental recycling quantities (i.e. relative to the base case) in each year of the appraisal period.

Walk time per trip

As outlined in the table below, the average walk time per trip depends on:

- the average distance from each dwelling type to an accumulation point such as a kerbside recycling bin
- the proportion of each dwelling type, and
- the average walk speed.

Household walk time costs are valued at **$13.01/hour** based on the Austroads value of time for private vehicle ($11.49) inflated to June 2011 prices.

Table 38 – Accumulation walk time assumptions

Cost assumption	Value	Source	Note
Distance from house to accumulation point (m)	30	PwC assumption	
Distance from apartment to accumulation point (m)	60	PwC assumption	
Proportion of houses	87%	ABS *2006 Census of Population and Housing*, Dwelling Structure by Household Composition and Family Composition	Houses are assumed to include separate houses and semi-detached, row or terrace houses
Proportion of apartments	13%		Apartments are assumed to also include flats and units
Weighted average walk distance (m)	67.8	Calculation = 2*((30*87%)+(60*13%))	Multiplied by 2 to reflect that there is a round trip
Walk speed (m/s)	1.35	VicRoads *Supplement to the Austroads Guide to Road Design*, Part 6A	Average unimpeded free-flow walking speed
Weighted average walk time (s)	50.2	Calculation = 67.8/1.35	

Cost assumption	Value	Source	Note
Value of time ($/hour)	13.0	Austroads Guide to Project Evaluation	Inflated from June 2007 prices ($11.49/hour) to June 2011 prices using ABS (2011) *Consumer Price Index, Australia, Jun 2011*, Table 1.

It should be noted that there is uncertainty regarding the average distance from a house/apartment to an accumulation point. Therefore, intuitive assumptions have been made for the purposes of the CBA. However, the impact of increasing and decreasing these assumptions could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

Time to transfer contents

Households are assumed to take time to transfer contents from temporary storage containers (such as a box in the kitchen of a household) to accumulation points (such as kerbside collection bins). This is assumed to be **5 seconds per trip** for all options. With the CDS (Options 4A and 4B), it is necessary to transfer packaging to 2 separate accumulation bins (i.e. transfer non-CDS packaging to a kerbside bin and transfer containers to a separate storage bin). However, these options are assumed to have no incremental (i.e. relative to the base case) impact on non-beverage container or flexible packaging recycling, so doubling this assumption for CDS will result in double counting of costs.

Household transfer time costs are valued at **$13.01/hour** based on the Austroads value of time for private vehicle ($11.49) inflated to June 2011 prices.

Behavioural change

The extent to which additional participation costs are imposed on households is assumed to depend on:

- the extent to which their recycling activities are already relatively high in the base case, so there is limited scope for them to increase their recycling activities, and
- the extent to which they do not change their behaviour following the implementation of the option, for example, because they do not value recycling.

As such, these costs are likely to only apply to a proportion of households. Although the actual proportion is unclear. For the purposes of the CBA, accumulation time benefits are assumed to apply to 50% of all households in Australia. However, the impact of increasing and decreasing these assumed proportions could be included in sensitivity testing in the CBA.

Container deposit redemption time

Following their vehicle journey to container deposit collection infrastructure, there is assumed to be additional time associated with walking from their vehicle to the infrastructure (a function of distance and walk speed) and transaction time to redeem the deposit.

For the purposes of the CBA, assumptions of incremental trips to collection infrastructure will be the same as above, which were used to estimate vehicle operating costs.

Estimates based on these assumptions are assumed to be the maximum costs achieved in 2035, with accumulation costs in earlier years calculated based on recycling in that particular year as a proportion of recycling projected for 2035.

Container deposit redemption time costs are valued at **$13.01/hour** based on the Austroads value of time for private vehicle ($11.49) inflated to June 2011 prices.

Walk time

Walk time is calculated based on the assumed distance from vehicle parking to container deposit infrastructure and the average walk speed. BA estimated a distance of **50 metres** to walk across a car park to redeem containers using an RVM.[50] However, containers are likely to be returned in relatively larger quantities at

[50] Boomerang Alliance (2008) *Container Deposits: The Common Sense Approach – Financial Analysis of Costs & Benefits of a National Container Deposit System*, p 14

depots because they do not need to be redeemed one at a time like with RVMs. As such, people are likely to be willing to walk shorter distances with these larger loads. In addition, evidence from the SA CDS indicates that depots typically offer a 'drive-through' style service where operators at the depots remove the containers from the cars. In order to be conservative, an average walk distance of **10 metres** has been assumed for the core CBA. However, it should be noted that there is uncertainty regarding the average distance from a car park to collection infrastructure, so intuitive assumptions have been made for the purposes of the CBA. However, the impact of increasing/decreasing these assumptions could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

A 50 metre round trip to collection infrastructure is assumed to take approximately 1.2 minutes based on these assumptions, while a 10 metre round trip takes approximately 0.25 minutes.

Table 39 – Assumed walk time from vehicle to container deposit infrastructure - Option 4A

Cost assumption	Value	Source	Note
Distance to hubs (m)	10		Assumption of a larger load of beverage containers than with an RVM and the potential for 'drive-through' style services
Distance to collection centres (spokes) (m)	10		
Distance to RVMs (m)	50	BA Financial Analysis of CDS	
Distance to regional centre collection points (m)	10		Assumption of a larger load of beverage containers than with an RVM and the potential for 'drive-through' style services
Walk speed (m/s)	1.35	VicRoads *Supplement to the Austroads Guide to Road Design*, Part 6A	Average unimpeded free-flow walking speed

Table 40 – Assumed walk time from vehicle to container deposit infrastructure – Option 4B

Cost assumption	Value	Source	Note
Distance to consolidation points (m)	10		Assumption of a larger load of beverage containers than with an RVM and the potential for 'drive-through' style services
Distance to depots (m)	10		
Distance to RVMs (m)	50	BA Financial Analysis of CDS	Assumed to be the same as RVMs
Distance to regional centre collection points (m)	10		Assumption of a larger load of beverage containers than with an RVM and the potential for 'drive-through' style services
Walk speed (m/s)	1.35	VicRoads *Supplement to the Austroads Guide to Road Design*, Part 6A	Average unimpeded free-flow walking speed

Container deposit transaction time

BA estimate that the time to process containers using a RVM is 103.seconds per household per week. This is based on consumption of 12.79 containers per capita/week, 2.7 people per household and3 seconds per container to redeem via a RVM[51] and is equivalent to **1.7 minutes**. Transactions for other types of infrastructure are assumed to take twice as long (i.e. 3.4 minutes) given that they are not automated, with an additional allowance for potential wait time before being served (e.g. if there is a queue of cars at the depot) resulting in an assumption of **5 minutes** per transaction.

[51] Boomerang Alliance (2008) *Container Deposits: The Common Sense Approach – Financial Analysis of Costs & Benefits of a National Container Deposit System*, p 14

Table 41 – Container deposit transaction time assumptions

Cost assumption	Value (mins)	Source	Note
Hubs	5.0		Assumed to take twice as long as a RVM given that it is not automated and involve potential wait time.
Collection centres (spokes)	5.0		
Consolidation points	5.0		
Depots	5.0		
RVMs	1.7	Boomerang Financial Analysis of CDS	
Regional centre collection points	5.0		Assumed to take twice as long as a RVM given that it is not automated and involves potential wait time.

It should be noted that there is uncertainty regarding average transaction time, so intuitive assumptions have been made for the purposes of the CBA. However, the impact of increasing/decreasing these assumptions could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

Away from home accumulation time

When people consume packaged products away from home they can dispose of the packaging in one of two ways; litter the item, or place it in an accumulation point such as a public place recycling bin or regular waste bin. The sections below present the methodology used to estimate the away from home accumulation time assumptions for each option. It should be noted that these are the maximum costs achieved in 2035, with accumulation costs in earlier years calculated based on recycling in that particular year as a proportion of recycling projected for 2035.

Disposing of items at an accumulation point is likely to involve additional walk time, sorting time and transfer time. In addition, the extent to which additional participation costs are imposed on households will depend on the extent to which:

- Their recycling activities are already relatively high in the base case, so there is limited scope for them to increase their recycling activities
- They do not change their behaviour following the implementation of the option, for example, because they do not value recycling.

As such, these costs may only apply to a proportion of households, although the actual proportion to be applied is unclear. For the purposes of the CBA, accumulation time costs are assumed to apply to 50% of all households in Australia. However, the impact of increasing/decreasing these assumed proportions could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

Away from home accumulation time costs are valued at **$13.01/hour** based on the Austroads value of time for private vehicle ($11.49) inflated to June 2011 prices.

Away from home walk time

The additional walk time assumed for each option depends on:

- The number of additional trips to recycling bins per week
- Walk time per trip (which is assumed to be a function of the distance to the recycling bin, the walk speed and the proportion of new trips)
- Sorting and transfer time.

Additional trips to recycling bins per week

Additional trips to away-from-home recycling bins of **one trip per household per week** has been assumed for Options 2C and 3, which are projected by WCS to achieve the highest recycling rates. It should be noted that this is assumed to be the maximum achieved in 2035, with assumptions in earlier years calculated based on recycling in that particular year as a proportion of recycling projected for 2035. The additional trips for other options (except CDS) are assumed to be proportional to the incremental recycling for that option relative to Options 2C and 3 in each year of the appraisal period. Additional trips for the CDS (Options 4A and 4B) are reduced proportionally to reflect that over 80% of containers are redeemed at CDS collection infrastructure (as opposed to kerbside or CDS) and projected non-beverage container and flexible packaging recycling is not assumed to increase relative to the base case.

Away from home walk time costs are valued at **$13.01/hour** based on the Austroads value of time for private vehicle ($11.49) inflated to June 2011 prices.

Walk time per trip

BA estimate that the distance to a rubbish bin is **30 metres**. This is also applied to recycling bins given that these bins are likely to located next to one another. Given that a high proportion of littering is likely to be unintentional,[52] the vast majority (75%) of trips to recycling bins are assumed to be diverted from waste bins.

It should be acknowledged that there is uncertainty regarding the proportion of new trips to away-from-home recycling infrastructure, with intuitive assumptions used for the purpose of the CBA. However, the impact of increasing/decreasing these assumed proportions could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

Table 42 – Away-from-home walk time per trip

Cost assumption	Value	Source	Note
Distance to recycling bin (m)	30	BA Financial Analysis of CDS	
Proportion of new trips	25%	PwC assumption	Away from home recycling infrastructure is assumed to be largely be collocated with existing rubbish bins
Walk speed (m/s)	1.35	VicRoads *Supplement to the Austroads Guide to Road Design*, Part 6A	Average unimpeded free-flow walking speed

Away-from-home sorting and transfer time

There is assumed to be additional sorting and transfer times for all options (assumed to be **5 seconds per trip**) given the need to separate packaging and transfer items to separate bins.

With the CDS (Options 4A and 4B), it is necessary to transfer packaging to 2 separate bins. However, these options are assumed to have no incremental (i.e. relative to the base case) impact on non-beverage container or flexible packaging recycling, so doubling this assumption for CDS will result in double counting of costs.

Away-from-home sorting and transfer time costs are valued at **$13.01/hour** based on the Austroads value of time for private vehicle ($11.49) inflated to June 2011 prices.

It should be acknowledged that there is uncertainty regarding away from home sorting and transfer time, with intuitive assumptions used for the purpose of the CBA. However, the impact of increasing/decreasing these assumed proportions could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

[52] See, for example, Keep America Beautiful (2007) Literature Review - Litter: A Review of Litter Studies, Attitude Surveys and Other Litter-related Literature, p 3.4

B. Business/workplace participation costs

Business/workplace participation costs may be incurred by employees taking packaging to temporary storage infrastructure and cleaners/other staff consolidating packaging in larger storage infrastructure such as skip bins. There are currently around **8 million full time employees** in Australia. [53] The value of time for all business/workplace participation costs is assumed to be **$42.75 / hour** based on the Austroads *Guide to Project Evaluation* value of time for business vehicles ($37.76/hour) inflated to June 2011 dollars.

Employees

Employees will take packaging to temporary storage infrastructure in their workplace, which will involve additional trips and sorting time.

There is assumed to be **1 additional trip per day** (with additional sorting and transfer time of **1 second per employee per** trip) for Options 2C and 3, which achieve the highest recycling rates in 2035 relative to the other options. It should be noted that this is assumed to be the maximum achieved in 2035, with assumptions in earlier years calculated based on recycling in that particular year as a proportion of recycling projected for 2035. It is assumed that 50% of employees will change their behaviour.

The additional trips for other options (except CDS) are assumed to be proportional to the incremental recycling for that option relative to Options 2C and 3 in each year of the appraisal period. With the CDS, recycling of non-beverage containers and flexible packaging is projected to be the same as the base case, so incremental trips will be as a result of increased beverage container recycling. In line with the experience in South Australia, participation by employees in workplace based CDS is assumed to be 10% with an additional 0.5 trips per employee per day.

Temporary waste and recycling bins in workplaces are assumed to be co-located, so no additional walk time is assumed (i.e. a trip to the recycling bin related to packaging is assumed to be combined with trips related to disposal or recycling of other products).

It should be acknowledged that there is uncertainty regarding the number of trips and sorting time, with intuitive assumptions used for the purpose of the CBA. However, the impact of increasing/decreasing these assumed proportions could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

Cleaners / other staff

Many businesses employ cleaners to transfer the contents of temporary storage infrastructure to larger accumulation points (such as skip bins). There are nearly **125,000 businesses** in Australia with a turnover of more than $2 million per year[54] (i.e. excluding small businesses). Approximately 50% of large businesses are assumed to employ cleaners who make an additional trip to larger accumulation points every second day by 2035 with Options 2C and 2C (which achieve the highest recycling rates relative to other options). It should be noted that this is assumed to be the maximum achieved in 2035, with assumptions in earlier years calculated based on recycling in that particular year as a proportion of recycling projected for 2035. The additional trips for other options (except CDS) are assumed to be proportional to the incremental recycling for that option relative to Options 2C and 3 in each year of the appraisal period.

There is assumed to be additional transfer times for all options (assumed to be **5 seconds per trip**) given the need to separate packaging and transfer items to separate bins. Larger accumulation points are assumed to be co-located, so no additional walk time is assumed.

Time for cleaners/other staff to consolidate packaging in larger storage infrastructure is valued at **$42.75/hour** based on the Austroads value of time for business vehicles ($37.76/hour) inflated to June 2011 prices.

It should be acknowledged that there is uncertainty regarding the number of trips and transfer time, with intuitive assumptions used for the purpose of the CBA. However, the impact of increasing/decreasing these

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[53] ABS (2011) *6202.0 – Labour Force, Australia, Sep 2011*

[54] ABS (2011) *Counts of Australian Businesses, including Entries and Exits, Jun 2007 to Jun 2009*, Table 1

assumed proportions could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

C. Packaging materials collection and transport costs

As outlined in the table below, there are estimated to be costs associated with household kerbside collection (**$187/tonne**) and C&I sector collection (**$26/tonne**) to collect and transport used packaging from accumulation points such as recycling bins to MRFs. These types of collection are assumed to occur in all options, although to a varying extent as reflected in recycling projections. For example, kerbside and C&I collection should occur in tandem with a container deposit scheme (Options 4A and 4B).

Appendix C presents more detail on the source of these assumptions and presents alternative estimates/data sources. Sensitivity testing could be undertaken to determine the impact of changing these assumptions on the CBA results.

It should be noted that the reduction in contamination of kerbside and C&I recycling as a result of the CDS options has been reflected in the CBA in the estimates of the market value of resources. A 'price premium' has been estimated for certain materials with a CDS to reflect the relatively higher value of items recovered as a result of reduced contamination.

Table 43 – Packaging material collection and transport cost assumptions

Cost assumption	Value	Source	Note
Kerbside ($/tonne)	187	WCS (2011)	See Appendix C
Away from home ($/tonne)	26	WCS (2011)	See Appendix C

The core CBA directly applies the kerbside and away from home recycling projections to the cost parameters ($/tonne) presented above. It should also be noted that the CDS should divert packaging away from kerbside and away-from-home recycling, which may reduce the costs of kerbside and away from home collection (i.e. there could be a negative costs in the CBA).

It is estimated that beverage containers in a CDS can be recycled using either municipal (kerbside) recycling services (assumed to be 7.1% of total beverage container recycling), C&I recycling services (10.1%) or 'drop-off' at CDS infrastructure (82.8%).[55] In addition, non-packaging paper makes up nearly 40% of the total quantity (tonnes) of kerbside collection[56]. Recycling services are assumed to be maintained for paper/cardboard, flexible packaging and non-beverage containers.

In the core CBA, total beverage container recycling projections for CDS will be multiplied by the proportion recycled using kerbside (7.1%) and C&I (10.1%) services. These projections are expected to be lower than the base case, where all packaging is recycled using either kerbside or C&I services. These incremental projections will be applied to the parameter values above to estimate negative or avoided costs.

It is arguable that many of these costs will be relatively fixed in the shorter term given that the number of bin lifts should not change. However, the reduction in total quantities collected may reduce the number of times that a truck has to return a load to the MRF. The table below presents assumptions used to estimate potential avoided kerbside collection costs of up to **$10 million per** year (by 2035) with a CDS based on:

- Projected at home recycling with a CDS (Options 4A and 4B) relative to the base case between 2016 and 2035 based on the proportion of beverage containers recycled using municipal kerbside recycling services (7%)
- MRF trips saved due to CDS based on the reduction in kerbside recycling and the assumed tonnes per MRF load
- Estimated average time to do a MRF trip and return
- Cost to run a truck for one hour.

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[55] BDA and Wright Corporate Strategy (2010) *Beverage Container Investigation – Revised*, Table B1.2, p 87.

[56] Environment Protection and Heritage Council (2010) *2009-10 Annual Report*

This alternative estimate of avoided kerbside collection costs could be included in sensitivity testing to understand the impact of changing this assumption on the CBA results. This methodology could also be replicated for away-from-home recycling.

Table 44 – Avoided kerbside collection cost assumptions

Cost assumption	Value	Source
Load to MRF (tonnes/truck)	10	WCS assumption
Average return trip (hours)	1.5	
Truck operating costs ($/hour)	120	

It is noted that there may also be longer term savings in the cost of kerbside recycling under CDS options. For example, estimates provided by SA from East Waste indicated that a recent upgrade of their fleet cost approximately $1 million or 17% less than it would have without a CDS. These savings have not been included in the CBA given that they would not be realised each year, but when each recycling company upgraded its fleet. However further investigation of these savings may be warranted and could be conducted for the Decision RIS.

There may also be avoided kerbside residual waste collection costs based on reduced discard of beverage containers to the residual waste bin. Unpublished NSW bin audits undertaken between 2003 and 2008 indicate that containers comprise around 6% of the residual bin. Based on the estimates prepared for the *Problem Report*, beverage containers might comprise around 3 to 4 % of the 6%. While the quantity of beverage containers discarded to the residual bin may decline slightly, to say 2% the impact on collection costs is unlikely to be significant in any LGA.

D. Processing of recyclate at Material Recovery Facilities

Following kerbside and C&I sector collection and transport of recyclate, the recyclate is processed at a MRF at an estimated cost of $**85/tonne**. Processing of recyclate at MRFs is assumed to occur in all options, although to a varying extent reflecting differences in recycling projections. For example, a CDS diverts a significant proportion of beverage container recycling away from kerbside and C&I recycling. Beverage containers collected using CDS collection infrastructure avoid the need for processing at a MRF. Kerbside and away-from-home recycling projections for Options 4A and 4B are estimated to be lower than the base case, resulting in negative costs relative to the base case.

MRF processing costs are estimated to be more variable than kerbside collection costs, so an alternative methodology to estimate these costs is not considered to be necessary for sensitivity testing.

Table 45 – MRF processing cost assumptions

Cost assumption	Value	Source	Note
Processing cost for material delivered to MRF ($/tonne)	45	Based on confidential data from operating MRF in NSW provided to WCS	Processing cost for material delivered to MRF
Assume residual/reject (%)	20*	WCS estimate of contamination in material received from public place recycling and domestic kerbside	
Assumed cost to landfill residual ($/tonne)	200	WCS estimate based on metro landfill	Assumed cost to landfill residual. See Appendix D.
Total MRF processing cost (including residual disposal) ($/tonne)	**85**		Total MRF processing cost including residual disposal

Source: WCS (2011) based on the sources identified in the table above
Note: * The assumed 20% residual/reject from MRF facilities represents a weighted average of the contamination in recyclables collected from both domestic kerbside collection and public place recycling. A residual level of 50% can be assumed from public place recycling, and a residual level of 15% is assumed from domestic kerbside collection.

It should be noted that the MRF residual (ie. the materials contaminated and not recycled) is assumed to be landfilled and will therefore be reflected in estimates of avoided landfill operating costs and externalities.

Scheme operation

A. Government costs to administer regulations

Direct government administration costs relate to costs for government to administer the regulation on an ongoing basis, and also include costs related to following up with industry participants to join the co-regulatory schemes. These costs should be distinguished from scheme administration costs (Section B) which relate to the costs of establishing an industry run PSO(s) that could be responsible for the establishment and operation of approved arrangements under the co-regulatory options (noting that the Australian Government is assumed to fulfil this role under Option 3).

Government costs to administer regulations have been found to generate significant costs for the National Packaging Covenant (**$640,000 per year**)[57], and as a result **six hours of labour per liable party** is assumed. A gross salary of $129,000 was previously estimated by the Department of Sustainability, Environment, Water, Population and Communities[58] and on-costs were calculated using the 2009/10 NPP Standard Departmental Staff Costing Template, resulting in an estimate of **$180,000 per year.**[59] Assuming 52 weeks per year and a 30% taxation rate results in an estimate of **$380** per liable party.

The results of NEPM follow up and enforcement for the current APC are presented in the table below. This data spans four years, implying that the Government investigates around 246 companies per year. Given the relatively short timeframe for which this data is available, the fact that the number of companies may change over time and that some options (e.g. Option 2A) may result in more companies being captured, the impact of increasing/decreasing these assumed proportions could be included in sensitivity testing.

Table 46 - Results of NEPM follow-up and enforcement (2005-08)

Status of firms	Number of firms
Signed NPC	272
Exempt (under $5m pa turnover)	111
Pending	326
NEPM applies (already)	112
Unknown company	71
Not applicable	91
Total firms investigated	983
Years	**4**
Firms investigated per year	**246**

Source: Environment Protection and Heritage Council (2010) Decision Regulatory Impact Statement: Used Packaging Materials, p 16

57 Environment Protection and Heritage Council (2010) Decision Regulatory Impact Statement: Used Packaging Materials, p 23; citing Hyder (2008) *National Packaging Covenant: Mid-term Review*

58 Then the Department of Environment, Water, Heritage and the Arts

59 PwC and Hyder Consulting (2009) *Decision Regulatory Impact Statement*, prepared for the Environment Protection and Heritage Council, p 215

The administration costs per liable party assumed for each of the options are summarised in the table below.

Table 47 –Assumed government costs to administer regulations

Option	Cost assumption ($/liable party)	Source	Note
Option 1	0	Non-regulatory option	Development of a National Packaging Waste Strategy.
Option 2A	$380	Previous SCEW Working Group advice	Co-regulatory packaging stewardship arrangements under the *Product Stewardship Act 2011*
Option 2B			
Option 2C			
Option 3	$380		Requires a separate levy bill and consequential amendments to the Act related to administration of levy funds.
Option 4A	$380		Co-regulatory or mandatory provisions of the *Product Stewardship Act.* May also require a separate levy bill and consequently could require amendments to the *Product Stewardship Act* related to administration of levy funds. Consideration could also be given to prohibiting the sale and import / manufacture of non-recyclable beverage containers.
Option 4B			

B. Scheme administration costs

This cost item relates to administrative costs of an industry-run PSO(s) that is assumed to administer the program initiatives in all schemes but Option 3 (where the Australian Government will fulfil this function).

Administration costs for the APC were approximately $750,000 in 2008-09 [60] and this value is assumed to continue for the base case.

Option 1 assumes the establishment of a national body made up of representatives from Commonwealth, State, Territory and local governments. The national body is assumed to oversee the strategy and facilitate the information sharing required for coordinated action. It is envisioned that the body would operate in a broadly similar manner to the APC Industry Association.[61] Scheme administration costs of $**750,000** have been assumed, making no adjustment for the relative efficiency of government versus private administrators.

For each co-regulatory sub-option (Option 2A to 2C) is it envisioned that industry would establish a body responsible for administering an approved co-regulatory arrangement. Such bodies are often referred to as a PSO. The PSO(s) are assumed to be responsible for implementing and directing initiatives that would be designed to meet the specified outcomes.[62] Scheme regulations are likely to permit multiple approved parties to act as PSOs, which is likely to involve the duplication of fixed costs and increase the scheme administration costs. For these options, scheme administration costs are assumed to increase by 50% when there are multiple PSOs operating.

Option 3 is assumed to involve the government placing a mandatory ADF on packaging. Initiatives implemented under this program could be broadly similar to those outlined for sub-option 2C. However, the key difference that the fund created by the ADF would be collected and managed by the Commonwealth Government.[63] As such, there is assumed to be a single Commonwealth body administering the scheme. No adjustment has been made to account for the relative efficiency of government versus private sector administrators.

The CDS (Options 4A and 4B) options are assumed to be administered by a PSO(s), with regulations permitting multiple approved parties to act as PSOs, in the same manner as the co-regulatory sub-options.

60 Environment Protection and Heritage Council (2010) *Decision Regulatory Impact Statement: Used Packaging Materials, p* 20

61 PwC and Wright Corporate Strategy (2011) *Packaging option report – Draft version 2*, 19 August, p 27

62 PwC and Wright Corporate Strategy (2011) *Packaging option report – Draft version 2*, 19 August, p 30

63 PwC and Wright Corporate Strategy (2011) *Packaging option report – Draft version 2*, 19 August, p 37

The table below sets out the scheme administration cost assumptions for each of the options.

Table 48: Scheme administration cost assumptions

Option	Value ($/year)	Source	Note
Base case	$750,000	APC administration costs for 2008-09	
Option 1	$750,000		Costs assumed to be the same as the APC Industry Association given that this is also a non-regulatory option.
Option 2A	$1,125,000	PwC assumption	Scheme administration assumed to increase by 50% due to the possibility of multiple PSOs
Option 2B	$1,125,000		
Option 2C	$1,125,000		
Option 3	$750,000		Administered by a single government body. No adjustment has been made to account for the relative efficiency of government versus private administrators.
Option 4A	$1,125,000	PwC assumption	Scheme administration assumed to increase by 50% due to the possibility of multiple PSOs
Option 4B	$1,125,000		

It should be noted that there is uncertainty regarding the costs implications of Government administration of Option 3 and the potential for multiple PSOs in Options 2A to 2C and 4A to 4B. As such, sensitivity testing could be undertaken to determine the impact of changing these assumptions on the CBA results.

C. Scheme initiatives and infrastructure

Chapter 1 sets out the recycling and litter initiatives included in Options 1 to 2C and their assumed years of operation over the period 2011-2035. The following sections outline the assumed infrastructure and operating costs for each of these initiatives.

Option 1: National Waste Recycling Strategy

The Packaging Option Report described the recycling and litter initiatives assumed to be included in Option 1.[64] For the purposes of this CBA Report, WCS have estimated the infrastructure and operating costs of each of these initiatives, as outlined in the table below. It should be noted that these cost estimates are on an annual basis over the period of operation.

Table 49 – Option 1 recycling and litter initiative cost assumptions

Initiative	Cost ($m/year)
Recycling initiatives	
National recycling education/advertising initiative	2.0
National program to improve away from home recycling at mass consumption areas though improved bin labelling	1.0
Information sharing between state and local governments[1]	1.0
Consistent labelling of recycling bins	0.5
Development of non-regulatory standards for end products and recycling labelling for packaging	2.0
Additional initiatives (yet to be defined – based on needs at the time of implementation)[2]	6.0
Litter initiatives	
National education program for litter prevention	2.0
National litter count methodology	1.0

64 PwC and Wright Corporate Strategy (2011) *Packaging option report*, Draft Version 2, 19 August, prepared for the Environment Protection Heritage Council, p 26.

Initiative	Cost ($m/year)
Additional initiatives (yet to be defined)	2.0

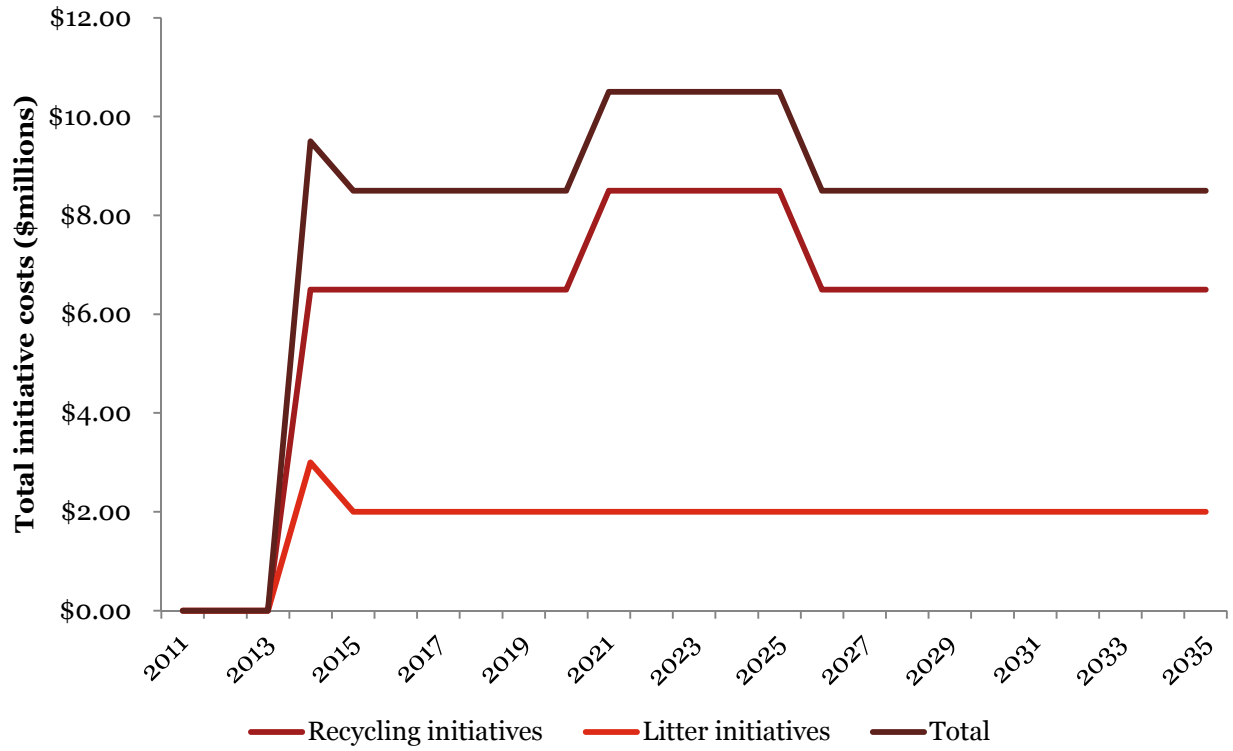
Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 26

Note:

1. Information sharing between state and local governments: this $1m per year is only incurred from 2015 to 2020. It is considered appropriate based on the amount of travel, meetings and coordination required for effective information sharing systems to be established.
2. Additional initiatives apply from 2021 to 2035. The exact nature of these initiatives will depend on the success of the earlier initiatives and the prevailing issues at the time of implementation (i.e. 2021 onwards). These additional initiatives are discussed Chapter 3, and could include some of the initiatives proposed in subsequent, more costly options.

The figure below illustrates the distribution of total costs over time for Option 1 based on the assumed years of operation of the initiatives. It should be noted that the spike in 2014 represents the development of a national litter count methodology, which is assumed to occur in 2014.

Figure 8 – Total cost assumptions over time (2011-2035): Option 1



Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 26

Option 2A: Co-regulatory Product Stewardship

The Packaging Option Report described the recycling and litter initiatives assumed to be included in Option 2A.[65] For the purposes of this CBA Report, WCS have estimated the infrastructure and operating costs of each of these initiatives, as outlined in the table below.

Table 50 – Option 2A recycling and litter initiative cost assumptions

Initiative	Cost (m/year)
Recycling initiatives	
As per the base case and:	0.0

65 PwC and Wright Corporate Strategy (2011) *Packaging option report*, Draft Version 2, 19 August, prepared for the Environment Protection Heritage Council, p 30.

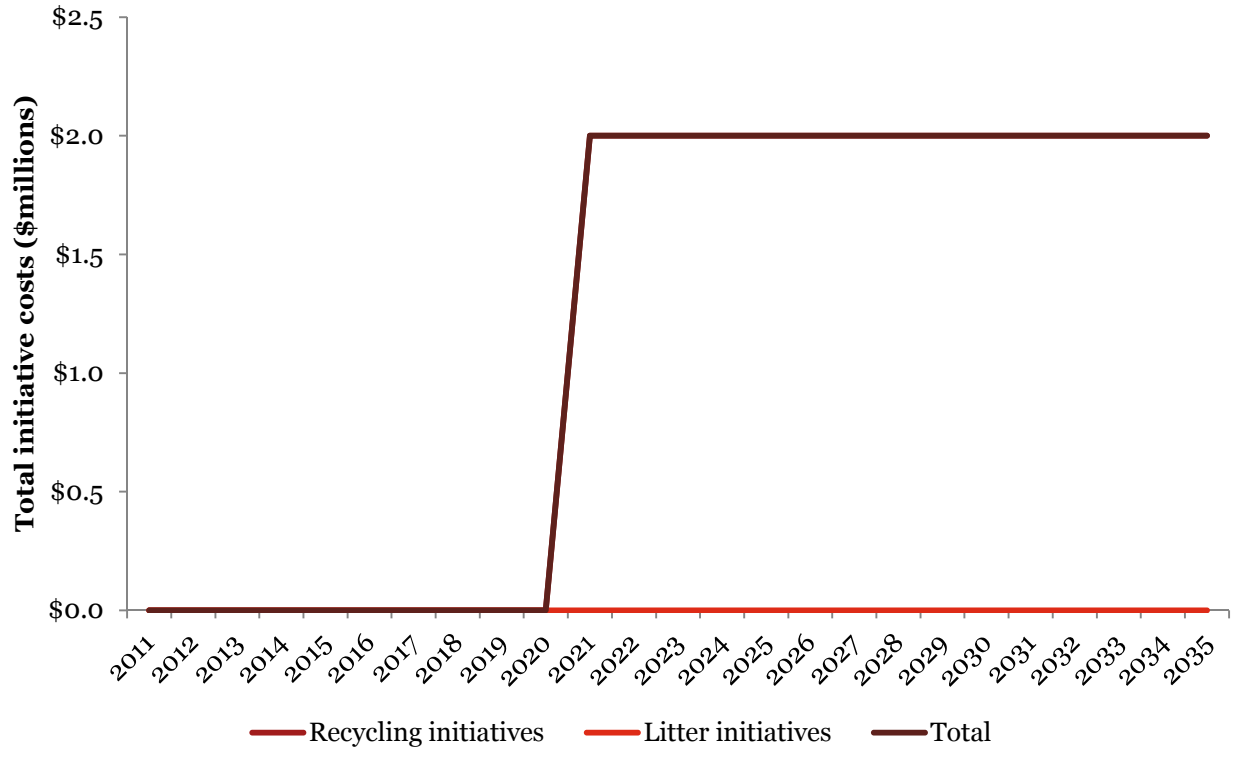
Initiative	Cost (m/year)
Additional initiatives (yet to be defined – based on needs at time of implementation)*	2.0
Recycling initiatives	
As per the base case	0.0

Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 30

Note: * Additional initiatives apply from 2021 to 2035. The exact nature of these initiatives will depend on the success of the earlier initiatives and the prevailing issues at the time of implementation (i.e. 2021 onwards). These additional initiatives are discussed at Chapter 3 above, and could include some of the initiatives proposed in subsequent, more costly options.

The figure below illustrates the distribution of total costs over time for Option 2A based on the assumed years of operation of the initiatives. It should be noted that the assumed expenditure on initiatives for this option is relatively low, with an additional $2 million in recycling initiatives assumed from 2021 onwards. Recycling and litter projections for this option are not driven by expenditure on initiatives, but instead by improved compliance and enforcement as a result of administration by a single jurisdiction (Commonwealth Government) instead of multiple state and territory jurisdictions.

Figure 9 – Total cost assumptions over time (2011-2035): Option 2A



Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, , prepared for the Environment Protection Heritage Council, p 30

Option 2B: Industry Packaging Scheme

The Packaging Option Report described the recycling and litter initiatives assumed to be included in Option 2B.[66] For the purposes of this CBA Report, WCS have estimated the infrastructure and operating costs of each of these initiatives, as outlined in the table below.

66 PwC and Wright Corporate Strategy (2011) *Packaging option report*, Draft Version 2, 19 August, prepared for the Environment Protection Heritage Council, p 32.

Table 51 – Option 2B recycling and litter initiative assumptions

Initiative	Cost ($m/year)
Recycling initiatives	
Increased public place recycling opportunities	10.0*
Improved kerbside recycling through campaigns and education programs	2.0
Improved kerbside recycling through investment in appropriate bin configurations for community circumstances and needs*	2.0
Additional initiatives (yet to be defined – based on needs at time of implementation. For example, glass end market development)	2.0
Improved regional and remote beverage container recovery through organised backload arrangements	1.0
Litter initiatives	
Financial incentives to reduce costs for litter clean-up	5.0
Litter prevention campaigns and education campaigns	
Improved litter enforcement	

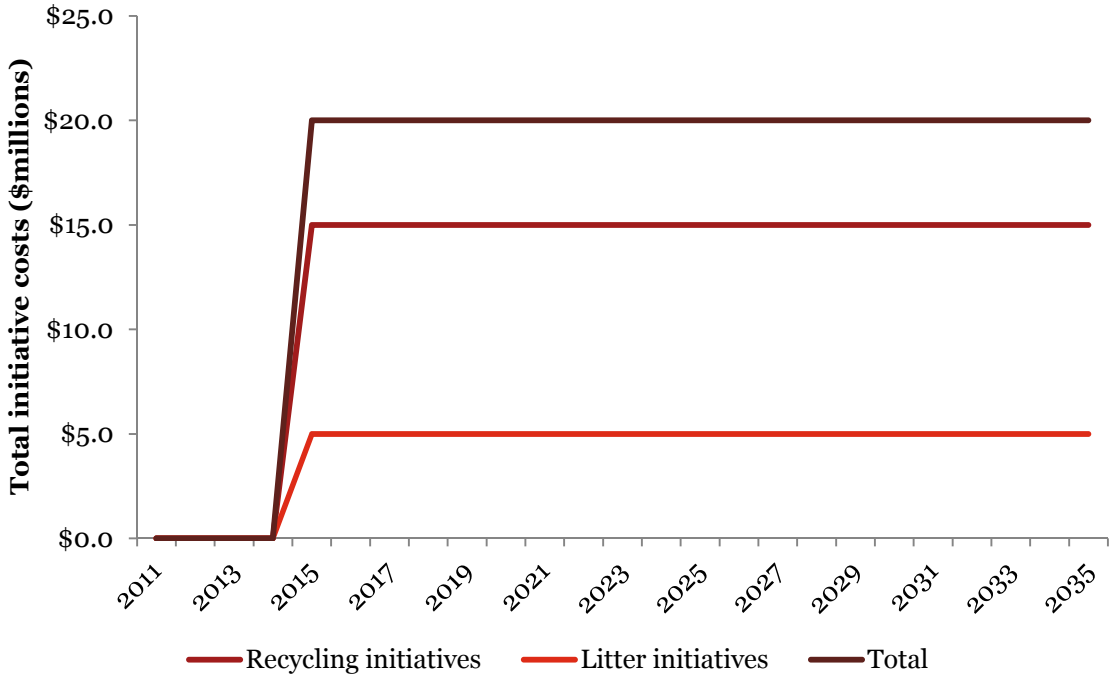
Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 26

Note: *Estimate of costs of $10 million for 'increased public place recycling opportunities' is based on an additional 5,000 to 6,000 stainless steel indoor bins at a capital cost of up to $2,000 per bin based on discussions with David Carter (Packaging Council of New Zealand) and the National Bin Network. It should be noted that there are not assumed to be additional operating costs for facility owners because this cost is assumed to be incurred in the base case for beverage containers discarded to the residual waste bin and collected on a commercial contract.

Additional initiatives apply from 2021 to 2035. The exact nature of these initiatives will depend on the success of the earlier initiatives and the prevailing issues at the time of implementation (i.e. 2021 onwards). These additional initiatives are described in Chapter 3, and could include some of the initiatives proposed in subsequent, more costly options.

The figure below illustrates the distribution of total costs over time for Option 2B based on the assumed years of operation of the initiatives.

Figure 10 – Total cost assumptions over time (2011-2035): Option 2B



Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 26

Option 2C: Extended Packaging Stewardship Scheme

The Packaging Option Report described the recycling and litter initiatives assumed to be included in Option 2C.[67] For the purposes of this CBA Report, WCS have estimated the infrastructure and operating costs of each of these initiatives, as outlined in the table below.

Table 52 – Option 2C recycling and litter initiative assumptions

Initiative	Cost ($m/year)
Recycling initiatives	
As per option 2B and:	15.0
Improved kerbside recycling through national uniformity of bin types and colours and information on materials accepted for recycling	2.0
National extension of kerbside recycling to SMEs on a commercial basis (see Table 53)	0.9-9.0
Precinct-based commercial/industrial recycling	2.0
National extension of business recycling programs	4.0
Extension of recycling opportunities in rural and remote LGAs	0.24-24.0
End market development support to create new markets	2.0
End market development through standard setting for recycled products	1.0
Additional initiatives (TBC)	3.0
Litter initiatives	
Financial incentives to reduce costs for litter clean-up	5.0
Litter prevention campaigns and education campaigns	
Improved litter enforcement	

Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 34

Note: The Options Report included an initiative called 'Special education and advice program'. This has been excluded for the purposes of the CBA Report given that Option 2B already includes a similar initiative ('improved kerbside recycling through campaigns and education programs') and Option 2C subsumes the Option 2B recycling initiatives

The table below presents the WCS assumptions to derive the estimated costs for 'national extension of kerbside recycling to SMEs on a commercial basis'.

Table 53 – Assumptions for national extension of kerbside recycling to SMEs on a commercial basis

Cost assumption	Value	Source	Note
New clients per year	20,000	WCS assumption	
Weight/client (kg/yr)	150		Mostly beverage containers (recognising that cardboard recycling from SMEs is well established)
Annual yield (tonnes/year)	3,000		Estimated annual yield of 3,000 tonnes/year cumulative, to add 30,000 tonnes/year from 200,000 clients after 10 years, 2015 to 2025
Marginal increase in cost ($/tonne)	$300		Net of waste transport operating and disposal cost
Total cost ($m/year)	0.9-9.0		Approximately $0.9 million/year cumulative each year for 10 years until reaching $9 million/year and continuing at $9 million/year to 3035.

Source: WCS (2011)

[67] PwC and Wright Corporate Strategy (2011) *Packaging option report*, Draft Version 2, 19 August, prepared for the Environment Protection Heritage Council, p 34.

The table below presents the WCS assumptions to derive the estimated costs for 'extension of recycling opportunities in rural and remote LGAs.

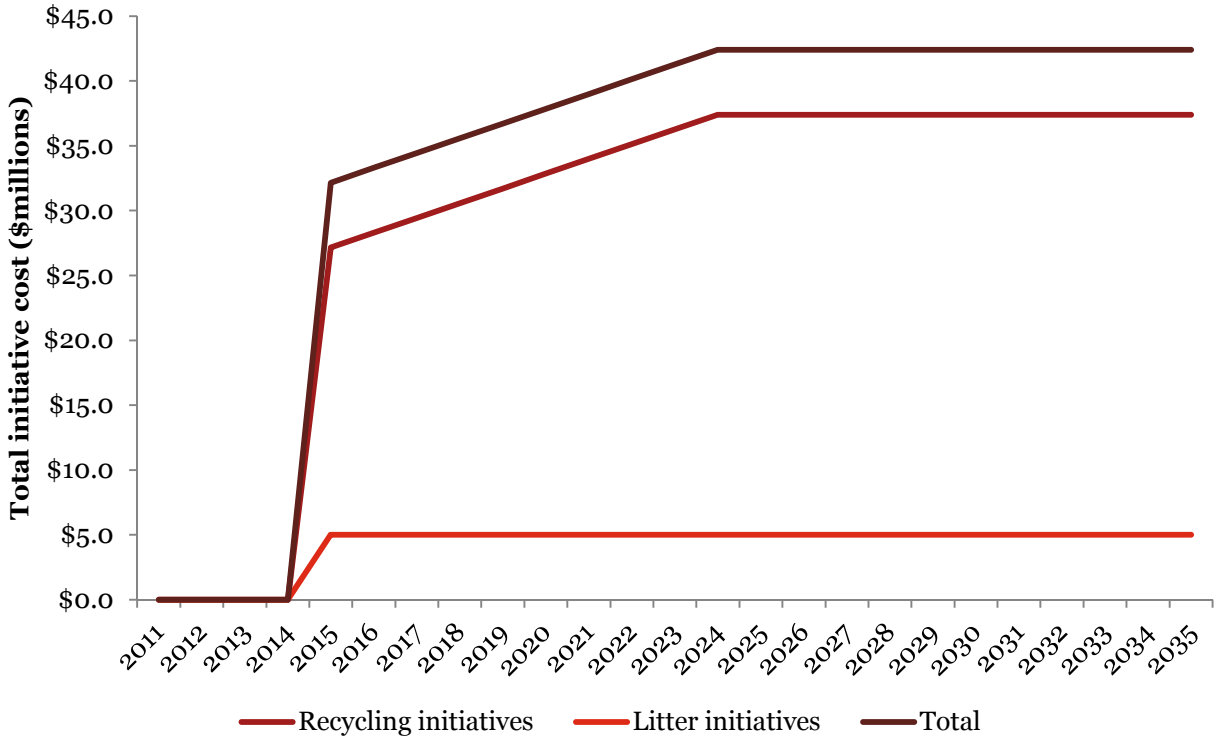
Table 54: Extension of recycling opportunities in rural and remote LGAs

Cost assumption	Value	Source	Note
New client / year	2,000	WCS assumption	Progressive expansion of recycling drop-off opportunities where no kerbside service is available at the rate of 2,000 new clients/year
Yield (kg/year/client)	400		All packaging types
Annual yield (tonnes/yr)	800		Estimated annual yield of 800 tonnes/year cumulative, to add 8,000 tonnes/year from 20,000 households after 10 years.
Estimated capital cost for bins and setup ($m/year)	5		Rollout 2015-2035
Operating cost ($/tonne)	300		Inclusive of collection, transport and MRF less avoided waste collection and disposal cost
Total operating cost ($m/year)	0.24-2.4		$0.24 million/year cumulative for 10 years until reaching $2.4 million/year and then continuing at $2.4 million/year to 2035.

Source: WCS (2011)

The figure below illustrates the distribution of total costs over time for Option 2C based on the assumed years of operation of the initiatives.

Figure 11 – Total cost assumptions over time (2011-2035): Option 2C



Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 34

Option 3: Mandatory Advanced Recycling Fee

The Packaging Option Report described the recycling and litter initiatives assumed to be included in Option 3.[68] For the purposes of this CBA Report, WCS have estimated the infrastructure and operating costs of each of these initiatives, as outlined in the table below.

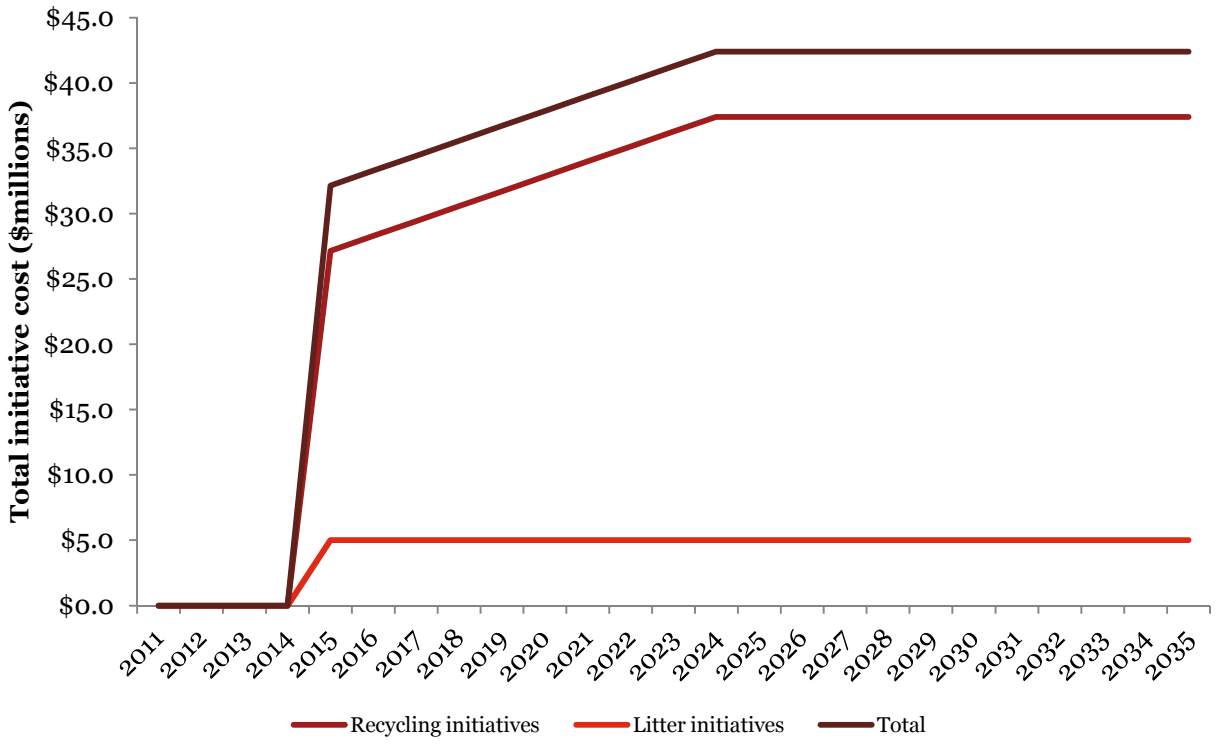
Table 55 – Option 3 recycling and litter initiative assumptions

Initiative	Cost ($m/year)
Recycling initiatives	
As per option 2C	32.1-42.4
Litter initiatives	
As per option 2C	5.0

Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 37

The figure below illustrates the distribution of total costs over time for Option 3 based on the assumed years of operation of the initiatives.

Figure 12 – Total cost assumptions over time (2011-2035): Option 2C



Source: WCS (2011) based on PwC and Wright Corporate Strategy (2011) Packaging option report, prepared for the Environment Protection Heritage Council, p 37

68 PwC and Wright Corporate Strategy (2011) *Packaging option report*, Draft Version 2, 19 August, prepared for the Environment Protection Heritage Council, p 37.

Options 4A and 4B CDS

There are no recycling and litter initiatives included in Options 4A and 4B, which are CDS options. However, additional infrastructure is required as outlined in Chapter 4.

The BA cost model was provided to WCS on a confidential basis.[69] Their model adopted the conventional approach to estimating the cost of CDS arrangements whereby estimates are made of the various cost elements on a per container basis. Further, consistent with current normal practice for estimating costs for CDS arrangements in Australia, there was no separation of capital and operating costs. Instead one unit cost is used and is fully inclusive of both capital and operating costs.

The model contains the following elements:

- **service areas –** such as the cost to consolidate containers, the cost of transport, the cost of RVMs etc.
- **localities for services –** such as kerbside, RVM sites, regional depots and rural and remote depots etc.
- **unit costs –** the cost per container for delivery of the relevant service at the designated locality, as a fully inclusive capital and operating cost.

In the BA model, detailed supporting estimates were provided of the distribution of containers throughout the system covering the number of containers likely to present for re-aggregation at each of the localities where services are provided. Using this data, the BA model estimated the cost to deliver CDS services at each of the localities and to aggregate the containers to centralised locations for reprocessing.

WCS also prepared cost estimate models for two CDS options in the same format, with the same distribution of containers around the system, the same number of localities for re-aggregation of containers, but using different estimates for unit costs, which were considered by WCS to be more representative of the current unit costs.[70]

The value adopted for Option 4A was 4.5 cents/container and 6.0 cents/container in rural and remote locations. Co-ordination across the system is 0.4 cents/container, baling and transport from collection centres, RVMs and rural and remote collection points to hubs (urban and rural) is 0.72 cents/container, and rural and remote transport from hubs to reprocessors is estimated at $106.30 per tonne. It should be noted that these estimates are based on the economic costs of the CDS infrastructure (i.e. include capital and operating costs) and exclude the payment of financial incentives to rural and remote infrastructure operators.

The *handling cost* adopted for Option 4B was 5.0 cents/container reflecting the smaller number of RVMs proposed for this option, and 6.0 cents/container for rural and remote locations. Co-ordination across the system is 0.4 cents/container. Baling for transport is 0.3 cents/container, transport (rural and remote collection point to consolidation depot) is 0.5 cents/container, allowing for backloading efficiencies. Transport from collection depots and RVMs to consolidation depots is 0.4 cents/container. Remote transport from consolidation depots to reprocessors is estimated at $106.30 per tonne.

It should be noted that these costs are consistent with the 4.0 cents/container handling cost used by BDA/WCS in the *Beverage Container Investigation*[71]. Further, the above *handling costs* are in line with the 4.25 cents/container depot handling fee estimate proposed by Stefan Gabrynowicz in his paper dated April 2009.[72]

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[69] WCS was required to execute a confidentiality undertaking regarding the handling and copying of the data in this model

[70] WCSy concluded that the Boomerang-adopted handling cost was out of date with contemporary practice despite the moderately high deployment of RVMs in the option. Additional payments proposed to remote hubs and spokes were judged to be insufficient to cover the margin to contemporary costs.

[71] BDA Group and Wright Corporate Strategy. *Beverage Container Investigation* March 2009.

[72] Stefan Gabrynowicz, EPA SA. *Economic Costs and Benefits of SA's Container Deposit System* April 2009. Note: The 4.25 cents/container is the depot handling fee estimate Gabrynowicz proposed. An estimated of 4.66 cents/container was also proposed as all-up gross cost covering handling fee, admin, transport, super-collector costs

The table below presents WCS estimates of scheme costs for Option 4A, which will be applied in the core CBA given that the BA costs are confidential and the WCS costs are estimated to be more representative of the current unit costs. However, the BA costs will be included as a sensitivity test to understand the impact of these cost assumptions on the CBA results, although the unit cost assumptions will not be explicitly stated.[73]

Table 56 – Boomerang CDS Costs (Option 4A)

Cost assumption	Value
Capital and operating costs – Hubs, collection centres and RVMs (c/container)	4.5
Capital and operating costs – Rural/remote collection points (c/container)	6.0
Coordination across system (c/container)	0.4
Baling and transport – collection centres, RVMs and rural/remote collection points to hubs, urban and rural (c/container)	0.72
Rural/remote transport: Hubs to reprocessors ($/tonne)	106.30

Source: WCS (2011)
Note:
1. WCS estimates based on "Cash for Containers" investigations during 2010/11 in support of NT Government, and recent discussions with SA CDS operators. These estimates are assumed to include the capital and operating costs of infrastructure as well as transport and administration costs.
2. This table is not intended to sum.

The table below presents WCS estimates of scheme costs for Option 4B, which will be applied in the core CBA. The estimated scheme costs have been largely obtained from SA scheme operators on a commercial in confidence basis. Data has been crosschecked with alternative sources to ensure consistency. The main costs of any CDS is the *handling cost* which covers capital and operating costs of depots, RVMs and other redemption points.

Table 57 – Hybrid CDS Costs (Option 4B)

Cost assumption	Value
Capital and operating costs – Consolidation points and collection depots (c/container)	5.0
Capital and operating costs – RVMs (c/container)	4.0
Capital and operating costs – Rural/remote collection points (c/container)	6.0
Coordination across system (c/container)	0.4
System administration covering all levels of operation (c/container)	0.1
Baling for transport (c/container)	0.3
Transport: collection depot and RVM to consolidation depot, urban and rural (c/container)	0.4
Transport: Rural/remote collection point to consolidation depot (c/container)	0.5
Rural/remote transport: consolidation depots to reprocessors ($/tonne)	106.30

Source: WCS (2011)
Note:
1. WCS estimates based on "Cash for Containers" investigations during 2010/11 in support of NT Government, and recent discussions with SA CDS operators. These estimates are assumed to include the capital and operating costs of infrastructure as well as transport and administration costs.
2. Note: This table is not intended to sum.

Industry practice is to express these container handling fees on a unit (i.e. 'per container') basis, but the projections have been estimated on a weight (i.e. 'per tonne') basis. As such, it is necessary to convert these assumptions to be on the same basis as the projections based on assumed weight per container. The methodology to convert 'per container' handling fees to a 'per tonne' basis is outlined below.

[73] It should be noted that WCS made some minor adjustments to the Boomerang cost estimates in order to reinstate some costs that were omitted.

Methodology to convert the basis of the container handling fee assumptions

Step 1: Redemption by infrastructure type

The starting point for the estimate of the container handling fee is to estimate the proportion of containers likely to be redeemed at each type of collection infrastructure as outlined above in Table 32 and Table 33. Assumptions regarding beverage container redemption by infrastructure type were adjusted for Option 4B to reflect relative differences in the number of collection depots and RVMs.

Table 58 – Assumed trips by infrastructure type (Option 4A)

Infrastructure Type	Number	Redemption Proportion (%)	Source
Hubs	250	25.5	BA estimate of redemption by infrastructure type (see Table 31).
Collection depots (spokes)	310	50.5	
RVMs (spokes)	640	22.5	
Rural/remote collection centres (spokes)	700	1.5	
Total	**1900**	**100**	

Table 59 – Assumed trips by infrastructure type (Option 4B)

Infrastructure Type	Number	Redemption Proportion (%)	Source
Consolidation depots	250	25.5	Table 32, adjusted to reflect relative differences in the number of collection depots and RVMs
Collection depots	600	58.5	
RVMs	350	14.5	
Rural/remote collection centres	700	1.5	
Total	**1900**	**100**	

Step 2: Allocation of costs by infrastructure type

Some of the CDS costs are applicable to all infrastructure types whereas others are specific to certain infrastructure types (e.g. rural/remote transport). Costs have been allocated to each infrastructure type based on the redemption assumptions in Step 1 (above).

Table 60 – Boomerang CDS Costs (Option 4A)

Cost assumption	Value	Proportion of applicable infrastructure (%)	Note
Capital and operating costs – Hubs, collection centres and RVMs (c/container)	4.5	98	Applies to hubs, collection centres and RVMS = 25% + 49% + 24%
Capital and operating costs – Rural/remote collection points (c/container)	6.0	2	Applies to rural and remote infrastructure only
Coordination across system (c/container)	0.4	100	Applies to all infrastructure
Bailing and transport – collection centres, RVMs and regional collection points to hubs, urban and rural (c/container)	0.72	100	Applies to all infrastructure
Rural/remote transport: Hubs to reprocessors ($/tonne)	106.30	2	Applies to rural and remote infrastructure only

Source: WCS (2011)
Note:
1. WCS estimates based on "Cash for Containers" investigations during 2010/11 in support of NT Government, and recent discussions with SA CDS operators. These estimates are assumed to include the capital and operating costs of infrastructure as well as transport and administration costs.
2. This table is not intended to sum

Table 61 – Hybrid CDS Costs (Option 4B)

Cost assumption	Value	Proportion of applicable infrastructure (%)	Note
Capital and operating costs – Consolidation points and collection depots (c/container)	5.0	89	Applies to consolidation points and collection depots only = 25% + 64%
Capital and operating costs – RVMs (c/container)	4.0	9	Applies to RVMs only
Capital and operating costs – Rural/remote collection points (c/container)	6.0	2	Applies to regional infrastructure only
Coordination across system (c/container)	0.4	100	Applies to all infrastructure
System administration covering all levels of operation (c/container)	0.1	100	Applies to all infrastructure
Bailing for transport (c/container)	0.3	100	Applies to all infrastructure
Transport: collection depot and RVM to consolidation depot, urban and rural (c/container)	0.4	100	Applies to all infrastructure
Transport: Rural/remote collection point to consolidation depot (c/container)	0.5	2	Applies to rural and remote infrastructure only
Remote transport: consolidation depots to reprocessors ($/tonne)	106.30	2	Applies to rural and remote infrastructure only

Source: WCS (2011)
Note:
1. WCS estimates based on "Cash for Containers" investigations during 2010/11 in support of NT Government, and recent discussions with SA CDS operators. These estimates are assumed to include the capital and operating costs of infrastructure as well as transport and administration costs.
2. This table is not intended to sum

Step 3: Estimate costs per tonne

Estimates from the BDA report were used to convert the per container cost estimates to a per tonne basis. Each container is estimated to weigh approximately 82.1 grams.

Table 62 – Assumed weight per container

Material	Proportion redeemed (%)	Containers per tonne	Weight per unit (grams)
Glass	30.6	4,784	209
Aluminium	36.8	66,821	15.0
PET	21.6	29,205	34.2
HDPE	7.1	20,008	50.0
Steel	0.0	13,875	72.1
LPB	3.8	24,060	41.6
		Weighted average	**82.1**

Source: BDA and WCS (2010) Beverage Container Investigation – Revised, Tables A6.4 and A6.5

The container handling fees are converted to a per tonne basis and then weighted based on the calculations in Step 2.

Table 63 – Container handling fee assumptions ($/tonne) – Option 4A

Cost assumption	Value ($/tonne)	Proportion of applicable infrastructure (%)	Weighted value ($/tonne)
Capital and operating costs – Hubs, collection centres and RVMs	548	98	539
Capital and operating costs – Rural/remote collection points	731	2	12
Coordination across system	49	100	49
Bailing and transport – collection centres, RVMs and regional collection points to hubs, urban and rural	88	100	88
Rural/remote transport: Hubs to reprocessors	106	2	2
		Weighted total	689

Source: WCS (2011)
Note:
1. WCS estimates based on "Cash for Containers" investigations during 2010/11 in support of NT Government, and recent discussions with SA CDS operators. These estimates are assumed to include the capital and operating costs of infrastructure as well as transport and administration costs.
2. Due to rounding, this table may not add.

Table 64 – Hybrid CDS Costs (Option 4B)

Cost assumption	Value ($/tonne)	Proportion of applicable infrastructure (%)	Weighted value ($/tonne)
Capital and operating costs – Consolidation points and collection depots	609	89	544
Capital and operating costs – RVMs (c/container)	487	9	44
Capital and operating costs – Regional collection points	731	2	12
Coordination across system	49	100	49
System administration covering all levels of operation	12	100	12
Bailing for transport	37	100	37
Transport: collection depot and RVM to consolidation depot, urban and rural	49	100	49
Transport: Rural/remote collection point to consolidation depot	61	2	1
Rural/remote transport: consolidation depots to reprocessors	106	2	2
		Weighted total	749

Source: WCS (2011)
Note:
1. WCS estimates based on "Cash for Containers" investigations during 2010/11 in support of NT Government, and recent discussions with SA CDS operators. These estimates are assumed to include the capital and operating costs of infrastructure as well as transport and administration costs.
2. Due to rounding, this table may not add.

Scheme compliance costs

A. Reporting and labelling costs

Businesses that exceed the threshold for inclusion in the scheme (currently an annual turnover of $50 million – see **Appendix E** for more detail) could incur compliance costs related to preparing action plans and annual reporting. These are estimated in the table below to be around **$15,000 per liable party** on a weighted average basis. It should be noted that these compliance costs relate to the current Covenant and are therefore assumed to continue in the base case. Therefore, there will therefore only be incremental costs with the options to the extent that additional liable parties are captured by the schemes. This will not be the case for Option 1,

which is non-regulatory (and assumes continuation of the Covenant), and Options 2B and 2C, which are extensions of current arrangements (i.e. additional funding but capturing the same number of liable parties).

Option 2A brings the APC under the *Product Stewardship Act*. Increased compliance with this option as a result of administration by the Commonwealth instead of the states and territories should result in more liable parties being included in the scheme. Similarly, Option 3 is assumed to be administered by the Commonwealth to the same arguments apply.

As outlined in **Appendix E,** there are currently 567 signatories to the Covenant, of which 531 (94%) are liable parties exceeding the current threshold of $5 million turnover per year. The APC estimates that the Covenant currently includes 90% of tonnage and 80% of brands, implying the potential for an additional **59 liable parties** if these schemes result in 90% of brands being captured.

Table 65: Estimated direct costs to business signatories of Covenant (2005-2010) participation, 2006

Cost assumption	Small (turnover up to $5m/year)	Medium (turnover between $5m and $1b/year)	Large (turnover > $1b/year)
Action plan development (prepared every 3 years)	$3,000	$5,000	$10,000
Annual reporting	$3,000	$10,000	$20,000
Number of businesses	37	505	25

Source: Environment Protection and Heritage Council (2010) Decision Regulatory Impact Statement: Used Packaging Materials, p 22

There is uncertainty regarding the number of additional liable parties that will be captured with Option 2A and Option 3, how the number of liable parties will change over time and whether the mandatory options (Options 3, 4A and 4B) will result in liable parties withdrawing from the APC. As a result, the impact of increasing/decreasing the number of additional liable parties could be included as a sensitivity test to understand the impact of these assumptions on the CBA results.

It should be noted that there are currently costs to industry associations, local governments and environmental groups as outlined in the table below (which are assumed to continue in the base case). However, there is no evidence that these costs will change with the options so they have been excluded from the CBA.

Table 66: Estimated direct costs of the Covenant, 2006

Sector	Total annual cost	Typical activities
Industry associations	$504,000	Participation such as action plan development and implementation, annual reporting, meetings, etc
Local Governments	$390,000	Covenant data reporting
Environment groups	$15,360	Participation by active groups

Source: Environment Protection and Heritage Council (2010) Decision Regulatory Impact Statement: Used Packaging Materials, p 23

Some businesses could also face costs under a CDS to update labelling of their products. These are expected to be one off costs to update the design and reconfigure the printing of labels. In the absence of reliable estimates of the magnitude of these costs, they will be excluded from the CBA but discussed qualitatively.

Benefit assumptions

5. Benefit assumptions

There are assumed to be benefits and avoided costs to government, households, businesses and the packaging industry with the options. The financial benefits and avoided costs are all directly observable values, whereas the values for society are derived from a stated preference survey of households relating to the amount they are willing to pay for guaranteed levels of packaging recycling.

- **Financial benefits**
  - **Market value of resources**: The financial market value of recovered resources that are diverted from the landfill or litter stream
- **Avoided costs**
  - **Avoided regulatory costs:** Avoided duplication of regulatory design, implementation and administration costs by jurisdictions
  - **Avoided landfill externalities**: The cost of landfill externalities such as greenhouse gas emissions and disamenity which are avoided when packaging is recycled
  - **Avoided operating costs of landfill**: The direct costs associated with operating landfills including the opportunity cost of land, and other ongoing costs
  - **Avoided costs of litter clean up**: The direct costs to the government for the range of services they provide that contribute to litter prevention including municipal litter services, street sweeping and litter clean up services
- **Society's stated preference values:**
  - **Society's willingness to pay for increased recycling**: Households place a non-market value on recovering resources, for example, because they want to live in a less wasteful society or preserve resources or the environment for future generations

The core assumptions for each of these cost categories and potential data sources for sensitivity testing are discussed below.

In addition, a number of benefits which are excluded from the CBA (either to avoid double counting with other benefits, or due to challenges quantifying and monetising) are discussed qualitatively, including:

- **Co-benefits:** Benefits for the recycling of non-packaging recycling such as avoided costs of collection infrastructure
- **Society's willingness to pay for litter avoidance**: Households place a value on litter avoidance due to its negative impacts on society. The value that households place on litter can be considered a non-market value and includes visual amenity, danger to human health due to injuries from broken glass, the opportunity cost of litter clean up and danger to wildlife.
- **Avoided resource costs**: The cost of carbon, electricity and water required for virgin production of packaging relative to recycling
- **Avoided costs of contaminated mixed waste**: The avoided costs of removing packaging contaminants from mixed waste

In 2010, PwC conducted a study for TEC on approached to conducting CBAs of CDS options.[74] The study identified a range of economic and environmental benefits of CDS and theoretical approaches to valuing these. Since this time, the willingness to pay study has been conducted, as well as a range of other studies. Therefore, a number of benefits have been included in this CBA that were not identified in the 2010 report. Additionally, the 2010 report did not seek to quantify the benefits, but identified potential approaches. Therefore, there are a

[74] PwC, 2010. *Synthesis and critique of existing Consumer Deposit Scheme- Cost Bnefit Analysis.* Prepared for the Total Environment Centre, February 2010.

number of benefits that were identified in the report that have not been included in this CBA as it was not possible or practical to quantify them.

Financial benefits

Market value of resources

The disposal of packaging in landfill means that reprocessors are not able to capture the financial market value of these resources.

The table below estimates the medium-term prices of packaging materials, which range between $30 - $1,560 per tonne depending on the material. There is estimated to be a price premium for certain materials collected through a CDS due to the reduced contamination of kerbside under CDS, as discussed in **Appendix F**. These values will be applied in the core CBA for Options 4A and 4B, while the values in the table below will be applied to all other options.

Table 67 – Market value of packaging materials ($/tonne) – current prices

Material	Market value ($ per tonne)
Paper/cardboard	$181[1]
Glass	$30[2]
Aluminium Cans	$1,560[3]
Streamed plastics	$560[4]
Plastics – mostly sorted	$530
Plastics – fully mixed	$372[5]
Steel Cans	$280[6]
Liquid paperboard	$150[7]

Source: WCS (2011) – based on the following inputs :

1. PPI Asia for OCC and Mixed Grade (Visy) and Paper Fibre Network
2. Owens Illinois and BDA/MMA (2007)
3. LME and Metals Price Archive (Letsrecycle.com)
4. Streamed plastics (assuming 40% PET, 20% HDPE, 20% LDPE, 20% mixed) –Recycling industry sources
5. Fully mixed plastics (assuming 30% HDPE, 30% PET, 40% mixed) – Recycling industry sources
6. Recycling industry sources
7. Recycling industry sources

Application of these market value estimates in the CBA is not straight forward and must reflect the following:

- The distribution of materials recycled is not likely to remain fixed over the appraisal period, particularly given that:
  - The recycling of some materials (e.g. paper/recycling) is relatively high and there may be diminishing marginal returns for the future recycling of these materials
  - The options target different products/materials, particularly those with relatively low current recycling levels
  - Recycling levels in excess of 90% by material are not likely to be feasible.[75]

  Estimates of the material composition of additional recycling with the options are presented in **Appendix F** and will be applied in the CBA.
- It is uncertain that all recyclate quantities will be cleared in the market, particularly given that there are currently stockpiling of glass fines. It should be noted, however, that:
  - Recycled packaging is likely to only makes up a relatively small proportion of the total quantity of materials recycled. For example, steel cans only make up less than 0.1% of total used steel[76]

[75] PwC and Wright Corporate Strategy (2011) *Problem statement for packaging*, prepared for the Environment Protection and Heritage Council, p 50

- Options 2C and 3 explicitly include initiatives to develop end markets and it is likely that glass fines will be targeted given that this has already been identified as an issue
- Companies such as Australian Glass Technology and Colmax are developing new applications such as glass sand for the fines fraction. Currently these markets are relatively low quantity but there is potential for uses in higher quantity products, such as in road construction. There are a growing number of fines processing plants
- Stockpiling may be undertaken so MRFs can take advantage of higher market prices in the future, which could change when these benefits are realised.

Sensitivity testing could be undertaken on the impact of reducing the assumed market value of glass in line with estimated levels of stockpiling (40%).

Appendix F presents more detail on the source of these assumptions and presents alternative data sources which could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results.

Avoided costs

A. Avoided regulatory costs

There is a broad regulatory failure stemming from fragmented and inconsistent resource recovery and litter management frameworks, as discussed in the *Problem Statement for Packaging*.[77]

Each jurisdiction has its own waste minimisation legislation or policies. The broad powers provided to each jurisdiction by waste minimisation legislation – for example the NSW Government's *Waste Avoidance and Resource Recovery Act 2001* – means that there is a tangible risk that each jurisdiction will implement a different approach to the packaging problem in the absence of a national approach. In fact, specific packaging responses have already begun to vary in different jurisdictions including a CDS in existence in SA and soon to be implemented in the NT. Relative to a national approach a state/territory based approach could result in the duplication of planning, administration and effort, which would impose additional costs on society.

Similar arguments regarding duplication of effort can be applied to state policies and programmes to address litter and local government initiatives to address packaging waste and litter. Although specific estimates of these cost savings are unavailable.

The National Waste Policy Regulatory Impact Statement recently estimated the potential gains from a national approach, as opposed to state/territory based approach. These gains are based on savings from reduced duplication of planning, administration and effort at the jurisdictional level.[78] The avoided regulatory costs were calculated following the approach in the *Decision Regulatory Impact Statement for Televisions and Computers*, as outlined below. This approach indicates that a state based approach has the potential to result in additional government administration costs in the order of $3 million per annum.

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76 BDA Group and Wright Corporate Strategy (2010) *Beverage Container Investigation – Revised final report*, p. 48.

77 PwC and Wright Corporate Strategy (2011) *Problem Statement for Packaging*, prepared for the Environment Protection and Heritage Council, 19 August, p 48

78 The Allen Consulting Group (2009) *National Waste Policy: Regulatory Impact Statement*, p 41; citing PwC and Hyder Consulting (2009) *Decision Regulatory Impact Statement: Televisions and Computers*.

Table 68 - A comparison of State/Territory and Commonwealth Government costs for the National Waste Policy

Cost type	Commonwealth based (millions/annum)	State based (millions / annum)
Regulatory design and implementation costs	$0.35	$0.4
Direct government administration costs	$0.6	$3.5
Total	$0.95	$3.9

Source: The Allen Consulting Group (2009) National Waste Policy: Regulatory Impact Statement, p 41; citing PwC and Hyder Consulting (2009) Decision Regulatory Impact Statement: Televisions and Computers, pp 113-114

B. Avoided landfill externalities

Landfill of packaging imposes external costs on third parties, such as greenhouse gases (which impact the entire planet), leachate (which imposes health costs on adjacent communities and habitats) and amenity impacts (which decreases the utility of adjacent communities).

There were at least 665 landfills operating in Australia in 2008, although it is likely that more landfills, both operational landfills and closed landfills, may exist.[79] In 2006/07, total waste generated was 43.8 million tonnes, of which 21.1 million tonnes or 48% was disposed of in landfill. [80]In 2010, 1.7 million tonnes of packaging were disposed of in landfill, accounting for around 8% of total landfill.

Landfill can impact on air, water and soil in a number of ways through:

- Landfill gas which is created by the decomposition of organic waste and consists mainly of methane. When released to the air this contributes to local smog and global warming, and
- Leachate, which is formed when water moves from or through waste, and has the potential to contaminate nearby surface and ground water.[81]

There are also social impacts of landfill on third parties. Landfill may affect the host community, including through noise, odour, dust, increased traffic and exposure to the environmental impacts. In addition, un-managed litter can create amenity impacts in the immediate vicinity of the landfill. The report *Australian Landfill Capacities into the Future* found that community objections to landfill are a significant and increasing constraint on the supply of landfills.[82]

Over the past decade there has been stringent environmental regulation at some landfills, combined with collection of landfill gas and the use of landfill gas in energy generation (which displaces fossil fuels). This has meant that, over time, the externalities of landfill are reducing.[83] However, in the Waste Management Association of Australia's national landfill survey, they note that there is:

- Inadequate use in small landfills of landfill liners and leachate collections systems to prevent contamination to groundwater. Limited use of landfill gas capture systems to minimise release of greenhouse gas emissions. This applies particularly to small and medium sized landfills for which the survey response rate was 'low'. The survey response for large landfills was just one step higher at 'low to moderate'.[84]

[79] Waste Management Association of Australia (2009) *National Landfill Survey, 2007-08* cited in DEWHA and EPHC (2010) *national Waste Report 2010*, Chapter 3L Impacts and opportunities, p 149

[80] Hyder (2008) *Waste and Recycling in Australia,* p 7

[81] DEWHA and EPHC (2010) *National Waste Report 2010*, Chapter 3: Impacts and opportunities, p 150

[82] Hyder (2008) *Australian landfill capacities into the future*, p 5.

[83] BDA Group (2009) *The full cost of landfill disposal in Australia,* p 18

[84] Wright Corporate Strategy (2010) *Review of the Application of Landfill Standards*, p 8

Each material type has a range of impacts. Greenhouse gases are created by paper and cardboard, which are organic wastes and can take between 10 to 17 years to break down.[85] Leachate results from the disposal of aluminium, steel[86] and oxo-degradable plastics.[87] All materials are assumed to contribute to disamenity.

The table below presents estimates of the external costs of landfill for large landfills. As discussed in the *Packaging Problem Report*, large landfills constituted more than 70% by weight in the National Landfill Survey conducted by the Waste Management Association of Australia.[88]

Table 69 - External costs of landfill disposal for large urban and rural landfills ($ per tonne)

External cost type	External cost value ($/tonne)1
Greenhouse gas emissions	(-$5.3)[2] – $13.5
Other air emissions	$0.2-$1.0
Leachate	$0.0[3]
Disamenity	$1.0 - $10.0

Source: BDA (2009) The full cost of landfill disposal in Australia, pp 76

Note:

1. The range of estimates reflects differences in location (urban versus rural), climate (dry temperate, wet temperate and wet tropical) cost controls (best versus poor)
2. Negative values reflect the capture of landfill gas, which can be used as a fuel
3. Most modern engineered landfills control leachate through a combination of landfill liners and collection systems and are generally required to be in suitable locations to avoid risks to groundwater.

Appendix G presents more detail on the source of the estimate of the external costs of landfill disposal for large urban and rural landfills. It should be noted that the core CBA has adopted the estimates for large landfills for the reasons outlined above, but larger externality costs are expected at smaller landfills, which have less stringent controls. Weighting the estimate in the table above to account for these differences could also potentially be included in sensitivity testing.

C. Avoided operating costs of landfill

There are also avoidable direct costs associated with operating landfills including the opportunity cost of land, and other ongoing operating costs that vary with landfill volumes.

The private costs of landfill include:

- land purchase
- the approval process
- equipment and buildings
- construction costs such as excavation and lining of landfill bases to minimise leaching
- on-sight gas recovery and flaring
- fencing and other measures to prevent waste from being blown into neighbouring properties
- operational costs like fuels and materials
- monitoring and reporting
- capping landfills and landscaping

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85 Warnken (2007) *The Potential Greenhouse Gas Liability from Landfill in Australia: An examination of the Climate Change Risk from Landfill Emissions to 2050*, p 10 cited in DEWHA and EPHC (2010) *National Waste Report 2010*, Chapter 3: Impacts and opportunities, p 150

86 DEWHA and EPHC (2010) *National Waste Report 2010*, Chapter 3: Impacts and opportunities, p 151

87 See, for example, UK Department for Environment, Food and Rural Affairs (2010) *Assessing the Environmental Impacts of Ox-degradable plastics across their life cycle*

88 Waste Management Association of Australia (2009) *National Landfill Survey 2007-08* cited in DEWHA and EPHC (2010) *National Waste Report 2010*, Chapter 3: Impacts and opportunities, pp155-156

- rehabilitation and aftercare
- employee costs, and
- contractors costs.[89]

The table below presents estimates of the direct costs of landfill for small, medium and large landfills with either poor controls (for example, no lining or gas recovery) or 'best practice' controls.

Table 70 –Operating costs of landfill ($/tonne)

	Best practice controls	Poor controls
Small	$100	$74
Medium	$60	$44
Large	$40	$30

Source: BDA (2009) The full cost of landfill disposal in Australia, Attachment C

Given that large landfills constituted more than 70% by weight in the National Landfill Survey conducted by the Waste Management Association of Australia,[90] private costs of landfill are expected to range from $30 - $40 per tonne.

Appendix H presents more detail on the source of this assumption and presents alternative data sources which could be included in sensitivity testing to understand the impact of changing these assumptions on the CBA results. It should be noted that the core CBA has adopted the estimates for large landfills for the reasons outlined above, but higher operating costs are expected at smaller landfills due to decreased economies of scale. Weighting the estimate in the table above to account for these differences could also potentially be included in sensitivity testing.

D. Avoided costs of litter cleanup

Governments also offer a range of services that contribute to litter prevention. For example, in Victoria in 2008/09 there were 19,498 litter bins provided in metropolitan areas at a cost of $9,724,500 and 18,186 bins provided in non-metropolitan areas at a cost of $7,112,335.[91]

It was estimated that in 2008/09 the total cost of providing municipal litter services, street sweeping and litter clean up services in Victoria was $74 million or $13.90 per person. The largest portion of this was for street sweeping which accounted for 67% of total costs .[92] Assuming that the cost per person for litter services in Victoria is similar to other jurisdictions, it is reasonable to say that the cost of litter services nationally could be approximately $300 million to $350 million annually. Arguably without the significant spend on litter reduction nationally, the negative visual impact of litter could be significantly greater.

The core CBA reduces litter clean up costs in proportion with the percentage reduction in litter tonnes relative to 2011 (See Figure 6) and packaging litter as a proportion of all litter.

Whilst packaging makes up a significant portion of litter in terms of volume (estimated at 87%)[93], it makes up an estimated 37% in terms of number of items.[94] This is because packaging litter tends to be higher volume items such as food and beverage containers. In contrast, cigarette butts make up nearly 50% of items in the litter stream and are very low proportion of the total volume of litter.

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89 DEWHA and EPHC (2010) *National Waste Report 2010*, Chapter 3: Impacts and opportunities, p 157

90 Waste Management Association of Australia (2009) *National Landfill Survey 2007-08* cited in DEWHA and EPHC (2010) *National Waste Report 2010*, Chapter 3: Impacts and opportunities, pp155-156

91 Sustainability Victoria, 2010. *Victorian Local Government Annual Survey 2008-09*

92 *Ibid.*, p 46.

93 Note that this estimate excludes illegal dumping

94 Calculated from Keep Australia Beautiful (2010) *National Litter Index: Annual Report 2009/10*, pp 141- 143.

Estimates of the average weight of litter items are not currently available. In order to be conservative, the core CBA will assume that packaging accounts for 37% of total litter cleanup costs, with potential sensitivity testing to understand the impact of increasing this proportion to 87%.

Society's stated preference values

Society's willingness to pay for increased packaging recycling

Households place a value on recovering resources, for example, because they want to live in a less wasteful society and preserve resources or the environment for future generations.

In 2010 the Environment Protection and Heritage Council (EPHC) (now the SCEW) commissioned a study to quantitatively estimate households' willingness to pay for improvements to packaging and beverage container waste management. Based on a national sample of 3,432 households from 15 regions within Australia (including eight capital cities and seven regional areas) it was estimated that households are willing to pay, on average, $2.77 per year for every 1% increase in the quantity of waste packaging recycled above the current national recycling level (with a 95% confidence interval of $2.19 to $3.77).[95]

The table below presents the recycling projections as a proportion of consumption (%) used to estimate the willingness to pay for increased recycling. For example, the recycling rate for Options 2C and 3 in 2035 represents a 23.9%increase relative to current (2010) recycling levels of 62.5%. This is multiplied by a willingness to pay parameter of $2.77 for every 1% increase in recycling , an 80% aggregation factor to account for drop-outs and people in remote areas that were not sampled as part of the study[96] and a total of 8.5 million households in Australia to derive a total willingness to pay estimate of $451.6 million in 2035. This same calculation is replicated for each option in each year.

Table 71 – Recycling projections as a proportion of consumption (%) used to estimate willingness to pay for increased recycling

	2010	2015	2020	2025	2030	2035
Base Case	62.5%	67.5%	72.5%	77.1%	79.0%	79.0%
Option 1	62.5%	68.8%	74.0%	79.0%	81.1%	81.1%
Option 2A	62.5%	67.5%	75.4%	79.4%	80.6%	80.6%
Option 2B	62.5%	67.5%	77.3%	81.9%	81.9%	81.9%
Option 2C	62.5%	67.5%	80.0%	83.2%	85.7%	86.4%
Option 3	62.5%	67.5%	80.0%	83.2%	85.7%	86.4%
Option 4A	62.5%	67.5%	77.9%	81.6%	82.8%	82.8%
Option 4B	62.5%	67.5%	77.9%	81.6%	82.8%	82.8%

Source: WCS (2011)

[95] PwC (2010) *Estimating consumers' willingness to pay for improvements to packaging and beverage container waste management*, p iii

[96] PwC (2010) *Estimating consumers' willingness to pay for improvements to packaging and beverage container waste management*, p 40

Table 72 – Percentage point increase in recycling relative to 2010

	2010	2015	2020	2025	2030	2035
Base Case	0.0	5.0	10.0	14.6	16.5	16.5
Option 1	0.0	6.3	11.5	16.5	18.6	18.6
Option 2A	0.0	5.0	12.9	16.9	18.1	18.1
Option 2B	0.0	5.0	14.8	19.4	19.4	19.4
Option 2C	0.0	5.0	17.5	20.7	23.2	23.9
Option 3	0.0	5.0	17.5	20.7	23.2	23.9
Option 4A	0.0	5.0	15.4	19.1	20.3	20.3
Option 4B	0.0	5.0	15.4	19.1	20.3	20.3

Source: WCS (2011)

Table 73 – Annual recycling willingness to pay estimates by option ($M, undiscounted)

	2010	2015	2020	2025	2030	2035
Base Case	0.0	5.0	10.0	14.6	16.5	16.5
Option 1	0.0	94.5	189.0	275.9	311.8	311.8
Option 2A	0.0	119.0	217.3	311.8	351.5	351.5
Option 2B	0.0	94.5	243.8	319.3	342.0	342.0
Option 2C	0.0	94.5	279.7	366.6	366.6	366.6
Option 3	0.0	94.7	330.1	390.4	439.0	450.7
Option 4A	0.0	94.7	330.1	390.4	439.0	450.7
Option 4B	0.0	94.5	291.0	360.9	383.6	383.6

Qualitative discussion of other benefits

The following section qualitatively discusses other benefits which will not be quantified as part of the CBA. The existence and extent of some of these benefits is debateable, however, for completeness sake it is appropriate that even contentious benefits are included in the discussion.

A. Co-benefits

Each of the options could have a range of benefits for recycling of non-packaging items (referred to as 'co-benefits'). For example, other products such as televisions and computers, mobile phones and batteries could also be collected at CDS collection infrastructure. In addition, initiatives targeting increased packaging recycling or reduced packaging litter may also impact recycling or litter reduction more generally.

While potential co-benefits are an important consideration, these are an indirect benefit of proposed options and have been difficult to quantify in the tight timeframes associated with this Consultation RIS. Factors contributing to this complexity include:

- There would be additional costs associated with collecting and storing non-packaging products. Quantifying these benefits in the absence of quantifying the associated costs would overstate the net impact of these co-benefits. This would effectively require additional CBAs for each of the products that could potentially be collected at CDS infrastructure, imposing an additional layer of complexity that is not necessary warranted for the purposes of a Consultation RIS

- A television and computer recycling scheme will be rolled out in 2012. Collection infrastructure associated with this scheme has reportedly been designed to derive co-benefits from the collection of other products in addition to televisions and computers. As a result, many of the potential benefits of the proposed packaging options may be captured by this scheme

- The experience in South Australia is not directly applicable to Options 4A and 4B given that the proposed models rely to a far greater degree on RVMs and smaller 'shop front' collection centres, which are likely to be less suited to accepting other products

As such, a high level qualitative discussion has been included in the CBA Report to assist decision makes understand the relativities between the Options.

Option 1

Recycling initiatives

A national recycling education/advertising initiative is likely to result in increased awareness of the importance of recycling more generally, resulting in increased recycling of non-packaging items.

A national program to improve away-from-home recycling at mass consumption areas through improved bin labelling and consistent labelling of recycling bins may reduce contamination which would increase the amount of non-packaging items, as well as packaging items, recovered.

Litter initiatives

A national education program for litter prevention may impact litter behaviour more generally. A national litter count methodology would also help jurisdictions understand litter issues more generally.

These co-benefits can be considered 'spill-over' effects, in that they are benefits that are derived from the investment but do not require additional funding.

Option 2A

Option 2A is likely to have minimal impact on the recycling or litter of non-packaging items given that recycling and litter initiatives are assumed to be the same as the base case, with the exception of additional initiatives which are yet to be defined, but will be based on needs at the time of implementation.

Option 2B

Recycling initiatives

Increased public place recycling opportunities and improved recycling through campaigns and education programs is likely to increase the awareness of the benefits of recycling more generally, benefiting non-packaging products through increased recycling.

Improved kerbside recycling through investment in appropriate bin configurations is not targeted at packaging specifically and will benefit non-packaging products (such as newspapers) that are also accepted as part of this service. However, improved regional and remote beverage container recovery through improved backload arrangements is targeted at a sub-set of packaging alone and is not likely to have co-benefits for other products.

Litter initiatives

Financial incentives to reduce costs for litter cleanup (through providing community organisations with funding for clean-up campaigns) and increased funding for litter enforcement are not targeted at packaging specifically, and should therefore also benefit other products.

Litter prevention campaigns are likely to impact litter behaviour more generally, resulting in reduced litter of non-packaging products.

These co-benefits, like those of Option 1, would not require additional investments.

Option 2C

Option 2C includes the same recycling initiatives as Option 2B and would be expected to generate the same co-benefits that were discussed above.

In addition, improved kerbside recycling through national uniformity of bin types and colours and information on materials accepted for recycling is not specifically targeted at packaging, and would be likely to benefit other products through increased recycling. A similar argument can be applied to national extension of kerbside recycling to SMEs on a commercial basis.

Option 3: Mandatory ADF

Option 3 includes the same recycling initiatives as Option 2C and would be expected to generate the same co-benefits that were discussed above.

The mandatory ADF could also increase the level of producer responsibility imposed on packaging companies. This may lead to additional pressure for companies that produce non-packaging items that can be recycled to engage in product stewardship activities. It may also create additional pressure for packaging companies to consider sustainability in their packaging design and reduce over-packaging.

Some of these co-benefits, if realised, would not have additional costs. However, other co-benefits, such as non-packaging companies engaging in producer responsibility and re-design of packaging, may come at additional cost to businesses.

Option 4A and 4B: CDS options

BA, who advocate a CDS, cite a range of benefits of CDS in encouraging other recycling activity such as:

- Providing a base level of economic activity for collection centres or depots to be established which can then be expanded to collect other materials like used oil, tyres, paint containers etc
- Increasing the awareness of the importance of recycling leading to greater recycling of other goods, and
- Increasing the recycling of all recyclable materials in remote areas where there is limited or no kerbside recycling.[97]

The depot infrastructure constructed as part of the CDS options could be used for the recycling of non-packaging items, though this would be at additional cost. Many depots in SA currently accept a range of non-packaging items such as newspapers and car batteries (see table in **Appendix J**), which could lead to additional benefits of the recycling of other items. Although, it should be noted that the proposed CDS Options rely to a far greater degree on RVMs and smaller 'shop front' collection centres, which are likely to be less suited to accepting other products

All these benefits, which may be realised to different extents, are not without cost. For the depots used in CDS to collect other items would require more handling, storage and transportation of items. Unlike some of the co-benefits of other options, these co-benefits are not spill-over effects in that they require additional investments. For example, expanding CDS depot collection to oil, types and paint containers would come at a cost.

[97] Boomerang Alliance 2007, *Container Deposits: The Common Sense Approach V2.1,* p 48.

Additionally, there are already existing opportunities for consumers to recycle these goods. For example, most tyre retailers have contracts with recyclers. Recycling of other goods, such as mobile phones, is already conducted through well-established schemes where items are returned to convenient locations such as MobileMuster where mobiles are returned to retail outlets. Furthermore, existing depots in non-CDS states, such as the approximately 400 depots in NSW, already accept many of these non-packaging items.

Additionally, this CRIS has assessed the need for government intervention to address the impacts of packaging waste. It has not sought to identify if intervention is necessary to address the impacts of non-packaging items such as tyres, oils or paints.

Perhaps most importantly, the TV and Computers recycling scheme will be introduced prior to the possible establishment of a CDS. In the design of the TV and Computers scheme, the possible recycling of other items is being considered. This may mean that these co-benefits will be realised when the TV and Computers scheme is introduced.

The depots in SA also accept deposits of non-CDL items that may be packaging items. Estimates provided by the SA EPA indicate that 1.23% of aluminium, 38.94% of HDPE, 5.51% of LPB and 1.30% of PETE handled by one of the super collectors are non-CDL items. An additional 689 tonnes of mixed plastics was also handled during 2010. It should be noted that the majority on non-CDL material collected by depots is sold directly by the depot and not passed on to super collectors. This data is therefore not a full representation of non-CDL items collected by depots. Based on a sample of 9 depots in SA, each depot was estimated to collection over 100 tonnes of non-packaging material per year.[98]

The data below shows that the recycling centres in SA also have a range of non-deposit packaging and non-packaging items returned to them.

Table 74 – Deposit and non-deposit items returns to recycling centres in SA

Commodity	Recycling centre (tonnes)	Proportion of materials recovered (%)
Deposit Cans	3,061.8	4.28%
Deposit Glass	33,172.2	46.4%
Deposit PET	2,789.9	3.9%
Deposit Refill Glass S/Drink	7,970.2	11.15%
Wine Refillable	766.4	1.07%
Non Deposit Glass	7,401.3	10.35%
Brass, Copper, Batteries	5,125	7.17%
PVC	63	0.09%
HDPE	130	0.18%
LPB	333	0.47%
Paper and Cardboard	8,061	11.28%
Non Deposit PET	19.2	0.03%
Steel	3,600	5.04%
Total	**71,493**	

Source: Recycle SA 1997, Recycling Centres Established Under South Australian CDL Play a Major Role n Recycling both Deposit and Kerbside Recycled Commodities. Available at: http://www.recyclesa.com.au/tonnages.htm

[98] Provided in correspondence with the Working Group.

B. Society's willingness to pay for reduced packaging litter

In 2010 the EPHC (now the SCEW) commissioned a study to quantitatively estimate households' willingness to pay for improvements to packaging and beverage container waste management. Based on a national sample of 3,432 households from 15 regions within Australia (including eight capital cities and seven regional areas) it was estimated that households are willing to pay, on average $4.15 per 1% reduction in litter based on a 10% ('noticeable') or a 20% ('significant') improvement.[99]

The table below presents the projected litter reductions relative to 2010 used to estimate willingness to pay for reduced litter. It should be noted that the willingness to pay study recommends that the unit value estimate is only applied to litter reduction in the range between and including 10% to 20%.[100] For example, a litter reduction of 20% is multiplied by a willingness to pay parameter of $4.15 for every 1% decrease in recycling (i.e. 20.0), an 80% aggregation factor to account for drop-outs and people in remote areas that were not sampled as part of the study[101] and a total of 8.5 million households in Australia to derive a total willingness to pay estimate of $5.7 million.

Caution should be exercised when interpreting the litter willingness to pay results given that the estimates from the willingness to pay study were not able to be calibrated to determine what respondents actually envisioned by a 'noticeable' or 'significant' improvement given that the unit of this reduction was not clear. As a result, estimates of the willingness to pay for reduced litter were excluded from the CBA.

Table 75 – Projected litter reductions relative to 2010 (%)

	2010	2015	2020	2025	2030	2035
Base Case	0.0%	14.5%	25.0%	39.0%	42.2%	40.7%
Option 1	0.0%	18.0%	32.8%	47.1%	50.9%	49.6%
Option 2A	0.0%	14.5%	36.4%	48.1%	49.6%	48.2%
Option 2B	0.0%	14.5%	42.1%	54.6%	52.2%	51.9%
Option 2C	0.0%	14.5%	48.9%	57.8%	63.1%	63.8%
Option 3	0.0%	14.5%	48.9%	57.8%	63.1%	63.8%
Option 4A	0.0%	14.5%	41.1%	51.8%	54.0%	52.7%
Option 4B	0.0%	14.5%	41.1%	51.8%	54.0%	52.7%

Source: WCS (2011)

Table 76 – Capped litter reduction relative to 2010 used to estimate willingness to pay for reduced litter (%)

	2010	2015	2020	2025	2030	2035
Base Case	0.0%	14.5%	20.0%	20.0%	20.0%	20.0%
Option 1	0.0%	18.0%	20.0%	20.0%	20.0%	20.0%
Option 2A	0.0%	14.5%	20.0%	20.0%	20.0%	20.0%
Option 2B	0.0%	14.5%	20.0%	20.0%	20.0%	20.0%
Option 2C	0.0%	14.5%	20.0%	20.0%	20.0%	20.0%
Option 3	0.0%	14.5%	20.0%	20.0%	20.0%	20.0%
Option 4A	0.0%	14.5%	20.0%	20.0%	20.0%	20.0%
Option 4B	0.0%	14.5%	20.0%	20.0%	20.0%	20.0%

[99] PwC (2010) *Estimating consumers' willingness to pay for improvements to packaging and beverage container waste management*, p iii

[100] PwC (2010) *Estimating consumers' willingness to pay for improvements to packaging and beverage container waste management*, p iv

[101] PwC (2010) *Estimating consumers' willingness to pay for improvements to packaging and beverage container waste management*, p 40

Table 77 – Annual litter willingness to pay estimates by option ($M, undiscounted)

	2010	2015	2020	2025	2030	2035
Base Case	0.0	3.9	5.7	5.7	5.7	5.7
Option 1	0.0	4.9	5.7	5.7	5.7	5.7
Option 2A	0.0	3.9	5.7	5.7	5.7	5.7
Option 2B	0.0	3.9	5.7	5.7	5.7	5.7
Option 2C	0.0	3.9	5.7	5.7	5.7	5.7
Option 3	0.0	3.9	5.7	5.7	5.7	5.7
Option 4A	0.0	3.9	5.7	5.7	5.7	5.7
Option 4B	0.0	3.9	5.7	5.7	5.7	5.7

C. Avoided resource costs

Currently some 62.5% of all packaging generated in Australia is captured for recycling, leaving 37.5%, or 1.66 million tonnes in 2009-10, to be discarded to landfill or littered. Of the predominant materials used in packaging:

- Paper and cardboard represent the only renewable resource in 2009-10, and in excess of 75% of the paper and cardboard packaging was recycled
- Steel, aluminium and glass are non-renewable resources that are manufactured from natural resources that are relatively plentiful. However, they are manufactured using energy sources that are predominantly non-renewable. For steel, aluminium and glass 30%, 67% and 47% respectively were recycled in 2010[102], and
- Plastics represent a non-renewable resource manufactured from scarce natural resources. In 2010, 34% of plastic packaging was recycled.

The table below presents estimates of the net environmental benefits (in terms of greenhouse gas emission, energy and water savings) resulting from recycling a tonne of packaging material instead of producing it from virgin materials.

These net benefits are not included quantitatively in the CBA due to the uncertainty in accurately quantifying them.

Table 78 - Net benefit of recycling 1 tonne of packaging material

Material	Resource	Greenhouse gases (tonnes CO2e)	Cumulative energy demand (GJ LHV)	Water use (kl)
Paper / cardboard[1]	Wood	0.6	9.3-10.8	25.4-28.3
Glass	Sand	0.6	6.1-6.9	2.3-2.4
Plastics[2]	Oil	0.8 – 2.0	38.8-63.0	(22.6) – 71.3
Steel Cans	Iron ore	0.4	8.0	(2.4)
Aluminium cans[1]	Bauxite	15.9 – 17.7	171.1 – 191.4	181.8 - 202.0

Source: NSW Department of Environment, Climate Change and Water (2010) Environmental Benefits of Recycling, p 14.
Notes:
1. The range of estimates represents the location of recycling (i.e. kerbside versus C&I)
2. The range of estimates represents the location of recycling and the type of plastic.

[102] Australian Packaging Covenant (2011) *The National Packaging Covenant – 2010 Annual Report*, p 11

These benefits could be quantified by applying long term average costs of greenhouse gas emissions ($/tonne), water usage charges ($/kl) and electricity charges ($/kWh), for example based on Treasury modelling of the carbon tax or regulatory price determinations of utility companies. However, this assumes that additional recycling (and use of recycled materials) crowds out upstream production of virgin material. In addition, it is not robust to include the net environmental benefits without offsetting this with the lost profit of virgin producers.

As a result, this benefit will not be quantified as part of the CBA given that the scale of impact that an Australian packaging recycling scheme could have on world quantities is not likely be so significant as to change the quantities of virgin materials produced globally each year.

D. Avoided costs of mixed waste contamination

Processing of mixed waste in alternative waste technology (AWT) facilities is progressively being introduced as an alternative to landfill disposal. AWT are particularly being used to process a suite of organic soil conditioning resources that can be used to enhance agricultural production and reduce dependence on imported synthetic fertilisers.

In 2009/10, 0.5 million tonnes of mixed waste was processed in AWTs and this is forecast to grow to around 2.0 million tonnes within five years.

Recent regulatory changes for compost-like products in NSW have specified the glass, rigid plastics and film plastics content of these products so they are acceptable for land application. These packaging fragments form part of the in-feed waste stream and are challenging to remove from the product lines.

WCS estimated that if all mixed waste AWTs operating in 2009/10 were fitted with suitable equipment and operated to remove these contaminants (so that the NSW standards are met) this would cost $32 million. For all future mixed waste AWTs to meet the guidelines, the cost impost is estimated to be $90 million per annum within five years.

These additional costs are estimated to amount to around $25/tonne of residual feedstock waste. It should be noted that there is a relatively large degree of uncertainty regarding the future of mixed waste processing and therefore, this avoided cost is not included in the CBA.

In addition, this benefit only applies if it is actually possible to avoid the need for the contaminant equipment altogether at an AWT. No packaging option is projected to completely avoid the discarding of glass and plastic packaging from the residual waste bin and people are likely to continue to discard other non-packaging contaminants in the residual waste. As such, it is unlikely that a firm would decline to invest in the extra equipment to remove contaminants.

Therefore, this benefit will be excluded from the core CBA, but could be included as a sensitivity assuming that this benefit is not realised until non-beverage recycling reaches 50% and beverage recycling reaches 75%.

Cost benefit analysis

6. Cost benefit analysis

This section summarise the results of modelling of the benefits and costs of different options to address packaging impacts in Australia.

Costs

The table below summarises the incremental present value of costs (relative to the Base Case) for each major category over the analysis period in millions of dollars. For each cost category, CBA model outputs (undiscounted) are presented in the first year of operation of the scheme ('Year 1'), the year 2020 and the final year of the appraisal (2035). It should be noted that the first year of operation differs by Option, ranging from 2014 for Option 1 to 2016 for Options 4A and 4B.

The table also presents the present value (PV) of costs (discounted to $2010/11 using a 7% discount rate) over the entire appraisal period (2011 to 2035). As table 78 shows, Options 4A and 4B, have the highest total costs. This is due to the significant infrastructure investment required in these schemes and the relatively high costs of operating the infrastructure. It should be noted that the infrastructure investment costs of Options 4A and 4B are based on estimated container handling fees which are designed to cover costs associated with:

- Up front capital costs of CDS infrastructure
- Ongoing operating costs of CDS infrastructure
- Coordination across the system
- Bailing and transport.

These costs are offset to a certain extent, however, by avoided cost of collection, transport and recycling as a result of beverage containers being diverted away from kerbside, C&I collection and recycling systems (and consequently MRFs). As a result, collection, transport and recycling costs for Options 4A and 4B are negative as the cost of kerbside recycling, away-from-home recycling and processing at MRFs is lower than in the base case (representing cost savings). Option 1 has the lowest costs of all the options because there are no scheme compliance costs, as well as relatively low scheme design and implementation costs given that it is a voluntary option that does not require any additional regulation. It also has relatively low collection, transport and recycling costs in line with lower projected recycling levels relative to other options.

All the co-regulatory options (ie. Options 2A, 2B and 2C) have similar scheme design and implementation costs and scheme compliance costs. The difference in total costs of Options 2A, 2B and 2C is driven by differences in the scheme operation costs and collection, transport and recycling costs. Each of the co-regulatory options has a different range of initiatives; Option 2C has the largest number of initiatives and therefore, is the highest cost co-regulatory option.

Option 3 has similar costs to Option 2C given that it has the same initiatives and projected outcomes with different administrative arrangements.

Table 79 - Incremental costs, annual and present values over the analysis period ($ millions)

		Option 1 National Waste Strategy	Option 2a Co-reg Stewardship	Option 2b Industry Scheme	Option 2c Extended Stewardship	Option 3 Mandatory ADF	Option 4a Boomerang CDS	Option 4b Hybrid CDS
Scheme design and implementation	Year 1	$0	$0	$0	$0	$1	$0	$0
	2020	$0	$0	$0	$0	$0	$1	$1
	2035	$0	$0	$0	$0	$0	$1	$1
	PV	$4	$3	$4	$4	$4	$11	$11
Regulation design and implementation	Year 1	$0	$0	$0	$0	$1	$0	$0
	2020	$0	$0	$0	$0	$0	$0	$0
	2035	$0	$0	$0	$0	$0	$0	$0
	PV	$0	$1	$1	$1	$1	$1	$1
Communications	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$0	$0	$0	$0	$0	$1	$1
	2035	$0	$0	$0	$0	$0	$1	$1
	PV	$3	$3	$4	$4	$4	$10	$10
Collection, transport and recycling	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$17	$32	$49	$78	$78	-$272	-$271
	2035	$38	$38	$48	$123	$123	-$293	-$292
	PV	$219	$239	$365	$630	$630	-$2,269	-$2,260
Household participation costs	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$5	$11	$18	$27	$27	$55	$56
	2035	$14	$12	$20	$50	$50	$76	$77
	PV	$83	$83	$152	$250	$250	$447	$457
Business participation costs	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$1	$3	$4	$7	$7	$1	$1
	2035	$3	$3	$5	$12	$12	$1	$1
	PV	$20	$20	$37	$61	$61	$7	$7
Collection and transport costs	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$5	$7	$8	$14	$14	-$88	-$88
	2035	$12	$16	$10	$28	$28	-$107	-$107
	PV	$53	$70	$58	$125	$125	-$759	-$759
Processing at MRFs	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$6	$12	$19	$30	$30	-$240	-$240
	2035	$9	$7	$13	$32	$32	-$263	-$263
	PV	$63	$66	$118	$194	$194	-$1,964	-$1,964

		Option 1 National Waste Strategy	Option 2a Co-reg Stewardship	Option 2b Industry Scheme	Option 2c Extended Stewardship	Option 3 Mandatory ADF	Option 4a Boomerang CDS	Option 4b Hybrid CDS
Scheme operation	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$9	$0	$20	$38	$38	$542	$584
	2035	$9	$2	$20	$43	$42	$626	$674
	PV	$87	$14	$181	$346	$343	$4,383	$4,720
Government admin of regs	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$0	$0	$0	$0	$0	$0	$0
	2035	$0	$0	$0	$0	$0	$0	$0
	PV	$0	$1	$1	$1	$1	$1	$1
Scheme administration	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$0	$0	$0	$0	$0	$0	$0
	2035	$0	$0	$0	$0	$0	$0	$0
	PV	$0	$3	$3	$3	$0	$3	$3
Scheme initiatives and infrastructure	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$9	$0	$20	$38	$38	$541	$583
	2035	$9	$2	$20	$42	$42	$626	$674
	PV	$87	$10	$177	$342	$342	$4,379	$4,716
Scheme compliance	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$0	$0	$0	$0	$0	$0	$0
	2035	$0	$0	$0	$0	$0	$0	$0
	PV	$0	$2	$2	$2	$2	$0	$0
Businesses	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$0	$0	$0	$0	$0	$0	$0
	2035	$0	$0	$0	$0	$0	$0	$0
	PV	$0	$2	$2	$2	$2	$0	$0
Total Costs	Year 1	$0	$0	$0	$0	$1	$0	$0
	2020	$26	$33	$69	$116	$116	$270	$313
	2035	$47	$41	$69	$166	$166	$333	$383
	PV	$311	$258	$552	$982	$979	$2,125	$2,471

Benefits

Willingness to pay benefits have been presented separately from other benefits in the CBA given that the extent of double counting is indeterminate. In arriving at their willingness' to pay for increased recycling, it is assumed that they consider both the embedded resources of recycled goods as well as a range of 'non-use' values such as environmental benefits and a feeling of civic duty. The existing willingness to pay estimates do not allow for the use and non-use values placed on recycling by households to be separated. Therefore, including both the willingness' to pay estimates as well as the market value of resources recovered may lead to double counting of benefits.

The following section reports the results of the CBA using the market value of recycled material and table 79 details the results of the CBA using the willingness to pay values.

For each benefit category, CBA model outputs (undiscounted) are presented in the first year of operation of the scheme ('Year 1'), the year 2020 and the final year of the appraisal (2034). It should be noted that the first year of operation differs by Option, ranging from 20114 for Option 1 to 2016 for Options 4A and 4B. The table also presents the PV of benefits (discounted to $2011 using a 7% discount rate) over the entire appraisal period (2011 to 2035).

Market value of recycled materials

Options 2C and 3 have the highest benefits. This is because these options result in the highest level of recycling and therefore, also have significant benefits which are driven by the embedded value of resources recovered. As shown below, Options 4A and 4B also have relatively high benefits. This is because under the CDS options the value of glass and plastic recovered is higher than under the other options due to reduced contamination.

Table 80 –Incremental benefits using market values of recycled materials, annual and present values over the analysis period ($ millions)

		Option 1 National Waste Strategy	Option 2a Co-reg Stewardship	Option 2b Industry Scheme	Option 2c Extended Stewardship	Option 3 Mandatory ADF	Option 4a Boomerang CDS	Option 4b Hybrid CDS
Financial Benefits	Year 1	$0	$4	$4	$4	$4	$4	$4
	2020	$14	$27	$45	$70	$70	$69	$69
	2035	$21	$17	$30	$73	$73	$67	$67
	PV	$148	$153	$275	$449	$449	$463	$463
Market value of resources	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$14	$27	$45	$70	$70	$69	$69
	2035	$21	$17	$30	$73	$73	$67	$67
	PV	$148	$153	$275	$449	$449	$463	$463
Avoided costs	Year 1	$0	$4	$4	$4	$4	$4	$4
	2020	$11	$22	$33	$49	$49	$38	$38
	2035	$17	$18	$26	$54	$54	$32	$32
	PV	$114	$152	$227	$337	$337	$247	$247
Regulatory costs	Year 1	$0	$4	$4	$4	$4	$4	$4
	2020	$0	$4	$4	$4	$4	$4	$4
	2035	$0	$4	$4	$4	$4	$4	$4
	PV	$0	$35	$35	$35	$35	$35	$35
Resource costs	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$0	$0	$0	$0	$0	$0	$0
	2035	$0	$0	$0	$0	$0	$0	$0
	PV	$0	$0	$0	$0	$0	$0	$0
Landfill externalities	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$3	$3	$4	$5	$5	$4	$4
	2035	$5	$5	$5	$7	$7	$6	$6
	PV	$31	$30	$36	$43	$43	$36	$36
Landfill operating costs	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$3	$5	$9	$14	$14	$10	$10
	2035	$4	$3	$6	$15	$15	$8	$8
	PV	$29	$31	$55	$91	$91	$62	$62
Mixed waste processing	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$0	$0	$0	$0	$0	$0	$0
	2035	$0	$0	$0	$0	$0	$0	$0

Table 80 –Incremental benefits using market values of recycled materials, annual and present values over the analysis period ($ millions)

		Option 1 National Waste Strategy	Option 2a Co-reg Stewardship	Option 2b Industry Scheme	Option 2c Extended Stewardship	Option 3 Mandatory ADF	Option 4a Boomerang CDS	Option 4b Hybrid CDS
	PV	$0	$0	$0	$0	$0	$0	$0
Litter clean up	Year 1	$0	$0	$0	$0	$0	$0	$0
	2020	$5	$10	$17	$26	$26	$19	$19
	2035	$8	$6	$11	$28	$28	$15	
	PV	$54	$56	$102	$168	$168	$114	$114
Total Benefits	Year 1	$0	$4	$4	$4	$4	$4	$4
	2020	$25	$49	$78	$119	$119	$107	$107
	2035	$38	$35	$55	$127	$127	$99	$99
	PV	$262	$304	$503	$786	$786	$710	$710

Willingness to pay for recycled materials

An alternative measure of the increased value of recycling as a result of the options is the willingness to pay for recycling. Households place a value on increasing recycling that, to an unknown extent, includes the value of the embedded resources in recycled goods and a range of other 'non-use' components. These non-use components that lead households to value recycling could include the environmental benefits or a feeling of civic duty.

In 2010 PwC was commissioned by the EPHC to undertake a study of households' willingness to pay (WTP) for recycling. In the study it was found that households were willing to pay on average $2.77 per year for every 1% increase above current levels of tonnes of packaging recycled.[103]

The below table presents the present value of the willingness to pay benefits estimated using the 95% confidence interval lower bound of $2.19 and upper bound of $3.77, in addition to the core estimate of $2.77. This analysis indicates that the present value of the willingness to pay benefits ranges from $233 million for the lower bound estimate of Option 2A to $1.2 billion for the upper bound estimate of Options 2C and 3.

Table 81 - Summary of willingness to pay benefits (incremental to base case, $millions, PV)

		Option 1 National Waste Strategy	Option 2A Co-reg Stewardship	Option 2B Industry Scheme	Option 2C Extended Stewardship	Option 3 Mandatory ADF	Option 4A Boomerang CDS	Option 4B Hybrid CDS
Lower confidence interval	PV	$234	$233	$422	$689	$689	$465	$465
Point estimate	PV	$296	$295	$534	$871	$871	$588	$588
Upper confidence interval	PV	$403	$402	$727	$1,186	$1,186	$801	$801

It is potentially misleading to include both estimates of the willingness to pay for increased recycling and the market value of materials given the possibility of double counting (i.e. if it was true that households considered market values associated with packaging when responding to the questionnaire that was employed to estimate willingness to pay). It is not possible to disaggregate this WTP value into the use (i.e. the market value of resources) and non-use values of recycling, so the extent of this potential double counting is indeterminate.

As well as placing a value on increasing recycling, society places a value on reducing litter. The 2010 PwC study conducted analysis of the extent to which households value decreases in litter. However, it was not possible to reliably include these WTP for reductions in litter in the CBA. This is because households were asked about their willingness to pay for a 'visual' reduction in litter and were not given units of measurement, meaning that the results require calibration against the quantity or tonnes of litter expected to be reduced.

Results

The COAG guidelines favour highest NPV, as this assists in selection of the option that generates the greatest net benefit for the community.[104] A BCR is usually useful when there are budget constraints and the most 'effective' spend for each dollar spent.

Option 2A is the only option with a positive NPVs and BCRs of greater than 1 meaning that the benefits of this options are greater than the costs when non-use values are excluded. All other options have negative NPVs and BCRs meaning that the costs are greater than the benefits when non-use values are excluded. Options 2B has the second highest BCR and NPV, with a BCR of 0.91. Options 2C and 3 have the highest benefits, however also entail the greater costs than Options 1, 2A or 2B. Options 4A and B have relatively high benefits, however also have the greatest costs resulting in the lowest NPV and BCR of the options.

[103] PwC, 2010. *Estimating consumes' willingness to pay for improvements to packaging and beverage container waste management.*

[104] COAG 2007, *Best Practice Regulation: A Guide for Ministerial Councils and Standard Setting Bodies.*

Table 82 - Results of CBA based excluding non-use values ($2011 millions, discounted)

		Option 1 National Waste Strategy	Option 2A Co-reg Stewardship	Option 2B Industry Scheme	Option 2C Extended Stewardship	Option 3 Mandatory ADF	Option 4A Boomerang CDS	Option 4B Hybrid CDS
Costs	$millions	$311	$258	$554	$984	$981	$2,125	$2,471
Benefits	$ millions	$262	$304	$503	$786	$786	$710	$710
NPV	$ millions	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
BCR	Number	0.84	1.18	0.91	0.80	0.80	0.33	0.29

Note: Real discount rate of 7% and evaluation period of 20 years (see table ES.1 for summary of general assumptions.

The table below summarises the key factors driving the results of the CBA, which include:

- Option 1 and 2A are relatively low-cost options, while Options 4A and 4B are relatively high cost options. This is driven by higher household participation costs and scheme initiatives/infrastructure costs of Options 4A and 4B relative to other options. A CDS moves from a well understood and utilised, centralised kerbside recycling system offering substantial coverage to a decentralised system requiring significant behavioural change

- All options involve an overall increase in recycling by 2035, with Options 2C and 3 having the highest overall recycling rate in 2035 (4,371,421 tonnes per annum) and Options 4A and 4B having the highest beverage container recycling rates in 2035 (85%).

Table 83 – Summary of key factors driving the results of the CBA

Option	Costs ($2011, PV, millions)	Benefits ($2011, PV, millions)	2035 packaging recycling quantity (million tonnes)	2035 litter quantity (tonnes)	2035 landfill quantity (tonnes)
Option 1	$311	$262	4,22	30,300	956,000
Option 2A	$258	$304	4.20	31,000	977,000
Option 2B	$554	$503	4.26	28,900	915,000
Option 2C	$984	$786	4.50	21,700	689,000
Option 3	$981	$786	4.50	21,700	689,000
Option 4A	$2,125	$710	4.31	28,400	867,000
Option 4B	$2,471	$710	4.31	28,400	867,000

Distribution of costs and benefits

The table below qualitatively identifies the primary parties to which costs and benefits quantified as part of this CBA are likely to accrue.

Table 84 - Distribution of CBA costs and benefits

	Option 1	Options 2A, 2B and 2C	Option 3	Options 4A and 4B
Market value of resources	Recyclers	Recyclers	Recyclers	Recyclers
WTP for increased packaging recycling	Households	Households	Households	Households
WTP for reduced packing litter	Households	Households	Households	Households
Avoided regulatory costs	State Government	State Government	State Government	State Government
Landfill externalities	Households	Households	Households	Households
Landfill operating costs	Local Government	Local Government	Local Government	Local Government
Litter clean up	Local Government	Local Government	Local Government	Local Government
Regulation design and implementation	N/A	Cth Government	Cth Government	Cth Government
Government participation costs	Cth Government	N/A	N/A	N/A
Communications	Cth Government / Industry	Cth Government / Industry	Cth Government / Industry	Cth Government / Industry
Household participation costs	Households	Households	Households	Households
Business participation costs	Employees / businesses	Employees / businesses	Employees / businesses	Employees / businesses
Collection and transport costs	Local Government / Recyclers	Local Government / Recyclers	Local Government / Recyclers	Local Government / Recyclers
Processing at MRFs	Local Government / Recyclers	Local Government / Recyclers	Local Government / Recyclers	Local Government / Recyclers
Government administration of regulations	N/A	Cth Government	Cth Government	Cth Government
Scheme administration	Industry PSO(s)	Industry PSO(s)	Cth Government	Industry PSO(s)
Scheme initiatives and infrastructure	Industry PSO(s)	Industry PSO(s)	Cth Government	Industry PSO(s)
Industry compliance	Packaging industry	Packaging industry	Packaging industry	Packaging industry

Sensitivity analysis

In order to test the sensitivity of results to changes in costs, benefits and discount rates a range of sensitivity tests were undertaken. The results of the sensitivity test can be summarised as follows:

- Given that costs and benefits continue throughout the entire appraisal period, they are not particularly sensitive to changes in discount rates
- Results are very sensitive to changes in the cost estimates. If costs decrease by 30%, all options except the CDS (Options 4A and 4B) become viable without including the willingness to pay estimates
- Results are also sensitive to changes in benefits. If benefits are underestimated by 30%, all options except the CDS (Options 4A and 4B) become viable without including the willingness to pay estimates
- The CDS (Options 4A and 4B) are not estimated to be viable under any sensitivity testing scenario

- Option 1 is only economically viable when the benefits are increased by 30%, the costs reduced by 30% and the proportion of litter that is packaging is increased
- Option 2A remains economically viable except when costs are increased by 30%, benefits decreased by 30% and in the worst case scenario where costs are increased and benefits decreased,
- Option 2B is economically viable when the benefits are increased by 30%, the costs reduced by 30% and the proportion of litter that is packaging is increased.
- Option 2C and 3 are only economically viable when benefits overall are increased, overall costs are decreased and the proportion of packaging litter is increased. However, it should be noted that Option 2C and 3 have BCRs of above 0.8 under a number of sensitivity tests meaning they are nearing being economically viable.

General sensitivity analysis

Adjusting the discount rates, costs and benefits does not change the relativities of the options.

Options 4A and 4B have negative NPVs and BCRs of below 1 when the costs are decreased or benefits increased.

Table 85 - Summary of general sensitivity testing based on market values, NPV ($ millions)

		Option 1 National Waste Strategy	Option 2a Co-reg Stewardship	Option 2b Industry Scheme	Option 2c Extended Stewardship	Option 3 Mandatory ADF	Option 4a Boomerang CDS	Option 4b Hybrid CDS
Discount rate- 3%	NPV	-$81	$59	-$87	-$341	-$336	-$2,458	-$3,040
Discount rate- 10%	NPV	-$35	$38	-$37	-$138	-$136	-$971	-$1,216
Discount rate- 1.85%	NPV	-$95	$62	-$103	-$404	-$399	-$2,915	-$3,600
Costs- 70%	NPV	$45	$124	$115	$98	$100	-$777	-$1,020
Costs- 130%	NPV	-$142	-$31	-$217	-$493	-$489	-$2,052	-$2,502
Benefits- 70%	NPV	-$127	-$45	-$202	-$433	-$430	-$1,627	-$1,974
Benefits- 130%	NPV	-$142	-$31	-$217	-$493	-$489	-$2,052	-$2,502
Benefits 70%; Costs 130%	NPV	-$127	-$45	-$202	-$433	-$430	-$1,627	-$1,974
Benefits 130%; Costs 70%	NPV	$30	$138	$100	$38	$41	-$1,201	-$1,548

Table 86 - Summary of general sensitivity testing based on market values, BCR

		Option 1 National Waste Strategy	Option 2a Co-reg Stewardship	Option 2b Industry Scheme	Option 2c Extended Stewardship	Option 3 Mandatory ADF	Option 4a Boomerang CDS	Option 4b Hybrid CDS
Discount rate- 3%	BCR	0.84	1.13	0.91	0.80	0.80	0.33	0.28
Discount rate- 10%	BCR	0.84	1.21	0.91	0.80	0.80	0.34	0.29
Discount rate- 1.85%	BCR	0.84	1.12	0.90	0.80	0.80	0.32	0.28
Costs- 70%	BCR	1.20	1.69	1.30	1.14	1.15	0.48	0.41
Costs- 130%	BCR	0.65	0.91	0.70	0.61	0.62	0.26	0.22
Benefits- 70%	BCR	0.59	0.83	0.64	0.56	0.56	0.23	0.20
Benefits- 130%	BCR	1.10	1.53	1.18	1.04	1.04	0.43	0.37
Benefits 70%; Costs 130%	BCR	0.45	0.64	0.49	0.43	0.43	0.18	0.15
Benefits 130%; Costs 70%	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29

Household and business participation costs

Household participation costs

When the household participation costs are reduced by 50%, Option 2A remain economically viable and Option 2B becomes economically viable. Decreasing the household participation costs does not make any of the other options economically viable.

Increasing the household participation costs has a significant effect on the NPVs and BCRs of each option, making all, except Option 2A, significantly more unviable. Option 2A is the only option that remains economically viable when the household participation costs are increased by 25% and 50%.

Business participation costs

Reducing the business participation costs by 25% or 50% does not change the economic viability of any option, with Option 2A remaining economically viable and the other options remaining unviable. Increasing the business participation costs exacerbates the economic non-viability of all the options except Option 2A. Option 2A is the only option that is economically viable when the business participation costs are increased by 25% and 50%.

Table 87 - Summary of household participation costs sensitivity testing (excluding non-use values), NPV ($ millions) and BCR

		Option 1 National Waste Strategy	Option 2a Co-reg Stewardship	Option 2b Industry Scheme	Option 2c Extended Stewardship	Option 3 Mandatory ADF	Option 4a Boomerang CDS	Option 4b Hybrid CDS
Core results	NPV	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Reduced costs- 50%	NPV	-$7	$88	$25	-$72	-$69	-$1,191	-$1,533
	BCR	0.97	1.41	1.05	0.92	0.92	0.37	0.32
Reduced costs- 75%	NPV	-$28	$67	-$13	-$135	-$132	-$1,303	-$1,647
	BCR	0.90	1.28	0.97	0.85	0.86	0.35	0.30
Increased costs- 125%	NPV	-$69	$26	-$89	-$260	-$257	-$1,526	-$1,875
	BCR	0.79	1.09	0.85	0.75	0.75	0.32	0.27
Increased costs- 150%	NPV	-$90	$5	-$127	-$323	-$320	-$1,638	-$1,990
	BCR	0.74	1.02	0.80	0.71	0.71	0.30	0.26

Table 88 - Summary of business participation costs sensitivity testing (excluding non-use values), NPV ($ millions) and BCR

		Option 1 National Waste Strategy	Option 2a Co-reg Stewardship	Option 2b Industry Scheme	Option 2c Extended Stewardship	Option 3 Mandatory ADF	Option 4a Boomerang CDS	Option 4b Hybrid CDS
Core results	NPV	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Reduced costs- 50%	NPV	-$39	$57	-$33	-$167	-$164	-$1,411	-$1,758
	BCR	0.87	1.23	0.94	0.82	0.83	0.33	0.29
Reduced costs- 75%	NPV	-$44	$52	-$42	-$182	-$179	-$1,413	-$1,759
	BCR	0.86	1.20	0.92	0.81	0.81	0.33	0.29
Increased costs- 125%	NPV	-$54	$41	-$60	-$213	-$210	-$1,416	-$1,763
	BCR	0.83	1.16	0.89	0.79	0.79	0.33	0.29
Increased costs- 150%	NPV	-$58	$36	-$70	-$228	-$225	$1,418	-$1764
	BCR	0.82	1.14	0.88	0.78	0.78	0.33	0.29

Scheme design and implementation costs

Communication costs

Testing was conducted on reducing the communication costs to $2.2 million in the first year of operation and $0.125 million in subsequent years. This represents an increase in the communication costs of Option 1 and 2A, meaning that Option 1 remains economically unviable, whilst Option 2A remains economically viable. Reducing the communication costs of Options 2C, 3, 4A and 4B has a negligible impact on the results of these options, with all remaining economically unviable.

Increasing the communication costs of all options to $8.8 million in the first year and $0.5 million in subsequent years exacerbated the economical unviability of Options 1, 2B, 2C, 3, 4A and 4B. Increasing the communication costs does not make Options 2A economically unviable.

Table 89 - Summary of communication cost sensitivity testing (excluding non-use values), NPV ($ millions) and BCR

		Option 1	Option 2A	Option 2B	Option 2C	Option 3	Option 4A	Option 4B
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Lower bound- $2.2 million up front and $0.125 million ongoing	NPV	-$49	$46	-$49	-$195	-$192	-$1,407	-$1,754
	BCR	0.84	1.18	0.91	0.80	0.80	0.34	0.29
Upper bound- $8.8 million up front and $0.5 million ongoing	NPV	-$57	$38	-$57	-$203	-$200	-$1,414	-$1,761
	BCR	0.82	1.14	0.90	0.79	0.80	0.33	0.29

Scheme administration costs

Reducing or increasing the scheme administration costs does not change the economic viability of any of the options. Options 1, 2B, 2C, 3, 4A and 4B remain economically unviable when costs are increased or decreased. Whilst Option 2A remain economically viable.

Table 90 - Summary of scheme administration costs sensitivity testing (excluding non-use values), NPV ($ millions) and BCR

		Option 1	Option 2A	Option 2B	Option 2C	Option 3	Option 4A	Option 4B
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Reduced cost- 50%	NPV	-$49	$48	-$50	-$196	-$195	-$1,413	-$1,760
	BCR	0.84	1.19	0.91	0.80	0.80	0.33	0.29
Increased costs- 150%	NPV	-$49	$45	-$53	-$199	-$195	-$1,416	-$1,763
	BCR	0.84	1.17	0.90	0.80	0.80	0.33	0.29

Collection, transport and recycling costs

Vehicle Operating Costs (VOC)

An alternative method for estimating the VOC would be to use the NSW Road and Traffic Authority's *Economic Analysis Manual* VOC estimate of 23 cents/km. As shown on the below table, Options 4A and 4B remain economically unviable when the RTA VOC is used. However, the costs of the schemes have marginally decreased.

Table 91 - Summary of VOC sensitivity testing using RTA VOC (excluding non-use values)

		Option 4a Boomerang CDS	Option 4b Hybrid CDS
Costs	$ millions	$2,122	$2,469
Benefits	$ millions	$710	$710
NPV	$ millions	-$1,412	-$1,759
BCR	Number	0.33	0.29

Collection and transport costs

Reducing the collection and transport costs by 50% makes Option 2B economically viable, however reducing the costs by 50% or 25% does not impact the economic viability of any of the other options. Option 2A remains economically viable, whilst Options 1, 2C, 3, 4A and 4B remain economically unviable.

Table 92 - Summary of collection and transport costs sensitivity testing (excluding non-use values) - NPV ($ millions) and BCR

		Option 1 National Waste Strategy	Option 2A Co-reg Stewardship	Option 2B Industry Scheme	Option 2C Extended Stewardship	Option 3 Mandatory ADF	Option 4A Boomerang CDS	Option 4B Hybrid CDS
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
50% of costs	NPV	-$22	$81	-$22	-$135	-$132	-$1,794	-$2,141
	BCR	0.92	1.36	0.96	0.85	0.86	0.28	0.25
75% of costs	NPV	-$35	$64	-$37	-$166	-$163	-$1,604	-$1,951
	BCR	0.88	1.27	0.93	0.83	0.83	0.31	0.27

Alternative estimates of kerbside transport and collection costs

Sensitivity analysis was conducted of using the BA's estimate and Sustainability Victoria's estimate of kerbside transport and collection costs. When Sustainability Victoria's estimate of kerbside costs are used, Option 2A remains viable. The remaining options are still unviable.

When BA's estimates of kerbside costs are used, the BCRs and NPVs of all options decrease and Option 2A is the only option that is viable.

Table 93 – Summary of kerbside transport and collection costs sensitivity testing (excluding non-use values) - NPV ($ millions) and BCR

		Option 1	Option 2A	Option 2B	Option 2C	Option 3	Option 4A	Option 4B
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Sustainability Victoria ($99.60 (metro), $172.61 (non-metro))	NPV	-$35	$66	-$42	-$171	-$168	-$1,669	-$2,015
	BCR	0.88	1.28	0.92	0.82	0.82	0.30	0.26
Boomerang Alliance- $248.47	NPV	-$62	$28	-$60	-$223	-$219	-$1,172	-$1,519
	BCR	0.81	1.10	0.89	0.78	0.78	0.38	0.32

Distance to infrastructure

Reducing the distance to infrastructure from 10m to 5m does not change the economic viability of any of the options.

Table 94 – Summary of distance to infrastructure sensitivity testing (excluding non-use values) - NPV ($ millions) and BCR

		Option 1 National Waste Strategy	Option 2A Co-reg Stewardship	Option 2B Industry Scheme	Option 2C Extended Stewardship	Option 3 Mandatory ADF	Option 4A Boomerang CDS	Option 4B Hybrid CDS
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Reduced distance-50%	NPV	-$39	$57	-$33	-$167	-$164	-$1,380	-$1,726
	BCR	0.87	1.23	0.94	0.82	0.83	0.34	0.29
Increased distance-150%	NPV	-$59	$36	-$70	-$228	-$225	-$1,449	-$1,796
	BCR	0.82	1.14	0.88	0.78	0.78	0.33	0.28

Scheme operation costs

CDS infrastructure costs

Testing was conducted of reducing the CDS infrastructure costs by 30%. This reduction in costs exceeds the difference in the cost estimates proposed by BA on a commercial basis, taking into account that these costs would need to be inflated to June 2011 dollars to be consistent with other costs estimated in the CBA. As discussed earlier in the report, WCS formed the view that the costs associated with Option 4A as proposed by BA were lower than contemporary costs and were lower than the most recent published CDS study. Therefore, the results of this sensitivity analysis should be treated with some caution given that they are not considered to reflect real resource costs of CDS infrastructure.

The NPV of Option 4A significantly improves when infrastructure costs are reduced, however it remains economically unviable with a BCR of 0.94. Option 4B has a significantly negative NPV when costs are reduced and also remains economically unviable.

Table 95 – Summary of CDS infrastructure costs sensitivity testing (excluding non-use values) - NPV ($ millions) and BCR

		Option 4a Boomerang CDS	Option 4b Hybrid CDS
Costs	$ millions	$811	$1,056
Benefits	$ millions	$710	$710
NPV	$ millions	-$101	-$346
BCR	Number	0.88	0.67

NEPM follow-up and enforcement

Testing was conducted of increasing and decreasing the compliance with NEPM. This had a negligible impact on the results, with all Options having the same BCRs when the number of companies was increased or decreased. When the number of companies is decreased the NPVs of Options 4A and 4B worsen very slightly.

Table 96 – Summary of NEPM follow-up and enforcement sensitivity testing (excluding non-use values), NPV ($ millions) and BCR

		Option 1	Option 2A	Option 2B	Option 2C	Option 3	Option 4A	Option 4B
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Government administration of regulations - Companies + 50%	NPV	-$49	$48	-$48	-$194	-$193	-$1,413	-$1,760
	BCR	0.84	1.19	0.91	0.80	0.80	0.33	0.29
Government administration of regulations - Companies - 50%	NPV	-$49	$45	-$51	-$197	-$193	-$1,416	-$1,763
	BCR	0.84	1.17	0.91	0.80	0.80	0.33	0.29

Benefits- Use values

Avoided kerbside collection costs

An alternative method of estimating kerbside collection costs was used to estimate potential avoided kerbside collection costs of up to $2.7 million per year. Sensitivity analysis was conducted of including this avoided cost.

Table 97 – Summary of avoided kerbside collection costs sensitivity testing (excluding non-use values) - NPV ($ millions) and BCR

		Option 1	Option 2A	Option 2B	Option 2C	Option 3	Option 4A	Option 4B
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Avoided kerbside costs relatively fixed	NPV	-$49	$45	-$51	-$197	-$193	-$2,145	-$2,492
	BCR	0.84	1.17	0.91	0.80	0.80	0.25	0.22

Reducing market value of glass for stockpiling

As described, approximately 40% of glass that goes to MRFs for reprocessing is stockpiled and not recycled. To account for the stockpiling of glass that occurs, the market value of glass was reduced by 40%. This has a negligible impact on the results and did not change the BCRs, NPVs or economic viability of any of the options.

Table 98 – Summary of stockpiling of glass sensitivity testing (excluding non-use values) - NPV ($ millions) and BCR

		Option 1 National Waste Strategy	Option 2A Co-reg Stewardship	Option 2B Industry Scheme	Option 2C Extended Stewardship	Option 3 Mandatory ADF	Option 4A Boomerang CDS	Option 4B Hybrid CDS
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Reduced value of glass	NPV	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29

Litter projections

Increasing the proportion of litter that is packaging items

It was assumed that 37% of litter quantities are packaging items. To test the sensitivity of results to this assumption, the proportion of litter that is packaging was increased to 87% (in line with the proportion of packaging items of total litter items). This has a significant impact on the results making Options1, 2B, 2C and 3 economically viable and significantly improving their NPVs and BCRs. Options 4A and 4B remained economically unviable.

Table 99 – Summary of proportion of litter that is packaging sensitivity testing (excluding non-use values), NPV ($ millions) and BCR

		Option 1	Option 2A	Option 2B	Option 2C	Option 3	Option 4A	Option 4B
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Increased % of packaging litter- 87%	NPV	$24	$122	$86	$29	$33	-$1,260	-$1,607
	BCR	1.08	1.47	1.16	1.03	1.03	0.41	0.35

Litter reduction projections

Increasing or decreasing the litter projections does not change the economic viability of the options, with Option 2A remaining economically viable and the other options remaining unviable.

Table 100 – Summary of litter reduction projections sensitivity testing (excluding non-use values) - NPV ($ millions) and BCR

		Option 1 National Waste Strategy	Option 2A Co-reg Stewardship	Option 2B Industry Scheme	Option 2C Extended Stewardship	Option 3 Mandatory ADF	Option 4A Boomerang CDS	Option 4B Hybrid CDS
Core results	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
Litter projections- 75%	NPV	-$62	$32	-$77	-$240	-$237	-$1,443	-$1,790
	BCR	0.80	1.13	0.86	0.76	0.76	0.32	0.28
Litter projections- 125%	NPV	-$35	$61	-$26	-$156	-$153	-$1,386	-$1,733
	BCR	0.89	1.23	0.95	0.84	0.84	0.35	0.30

Packaging litter quantities

Increasing the packaging litter quantities in the base year from 60,000 tonnes to 100,000 tonnes has no impact on the results of the analysis. This is because the percentage reductions in litter and the relativities between the options remain the same.

Table 101 – Summary of packaging litter quantity sensitivity testing (excluding non-use values) - NPV ($ millions) and BCR

		Option 1 National Waste Strategy	Option 2A Co-reg Stewardship	Option 2B Industry Scheme	Option 2C Extended Stewardship	Option 3 Mandatory ADF	Option 4A Boomerang CDS	Option 4B Hybrid CDS
Core	**NPV**	-$49	$46	-$51	-$198	-$195	-$1,414	-$1,761
	BCR	0.84	1.18	0.91	0.80	0.80	0.33	0.29
100,000 tonnes of packaging litter	NPV	-$48	$48	-$49	-$194	-$191	-$1,412	-$1,759
	BCR	0.85	1.18	0.91	0.80	0.80	0.34	0.29

Appendices

Appendix A The recycling supply chain

Recycling is a multi-step activity in which post-consumer packaging or products are recovered and sorted to material type then sold to manufacturers of specific materials as feedstock for new product production. The recycling value chains for three types of resource recovery and recycling activities are described below. Descriptions A.1 and A.2 apply to routine arrangements in wide current use; description A.3 applies to CDS.

A.1 Household Kerbside Collection of Used Packaging and Other Recyclable Materials

The main steps in the recycling of household kerbside are as follows:

1. Used packaging or products are discarded to a bin designated for capture of a variety of used materials to be recycled.
2. Recycling bins are collected and transported to a MRF.
3. Packaging or products are sorted to material type at the MRF and recovered to stockpiles of collated materials for sale to downstream markets, usually to be used in manufacture of new materials.
4. Residue materials are usually sent to landfill.
5. Specific recovered materials are transported to a specialist processor or manufacturer of specific materials or products (e.g. paper and cardboard, glass, steel, plastics, aluminum cans.
6. The specialist processor or manufacturer combines recovered packaging or product with virgin feedstock to manufacture new products, some of which may be the same packaging or product.
7. Faulty products are used as feedstock to the production process; residues are either used as feedstock or sent to landfill.
8. The new product can be designated as “containing recycled materials”.

A.2 C&I Sector Collection of Recyclable Used Packaging and other Materials

The main steps in C&I recycling are as follows:

1. Used packaging or products are discarded to a bin or location often designated for capture of specific materials to be recycled (e.g. glass, cardboard, plastics).
2. Recycling bins are collected and transported to a holding point, often at a recycling facility or MRF.
3. Packaging or products placed in stockpiles of collated materials for sale to downstream markets, usually to be used in manufacture of new materials.
4. Residue materials are usually sent to landfill.
5. Specific recovered materials are transported to a specialist processor or manufacturer of specific materials or products (e.g., paper and cardboard, glass, steel, plastics, aluminum cans.
6. The specialist processor or manufacturer combines recovered packaging or product with virgin feedstock to manufacture new products, some of which may be the same packaging or product.
7. Faulty products are used as feedstock to the production process; residues are either used as feedstock or sent to landfill.

A.3 The CDS Value Chain for Used Packaging Materials (Household and C&I)

The main steps in the recycling value chain as applied to CDS are (generally) as follows:

1. Used beverage containers are discarded at household (or business) to a bin designated by the householder (or business) for capture of beverage containers to be recycled[105].
2. Recycling bins are transported by the householder (or business) to a CDS collection depot.
3. Collection depot operators receive and sort containers to material type and (sometimes) by brand.
4. Specific recovered container materials are transported to a super-collector storage point for aggregation prior to sale to downstream markets, usually to be used in manufacture of new materials.
5. Specific recovered container materials are transported to a specialist processor or manufacturer of specific materials or products (e.g. paper and cardboard, glass, steel, plastics, aluminum cans).
6. The specialist processor or manufacturer combines recovered packaging or product with virgin feedstock to manufacture new products, some of which may be the same packaging or product.
7. Faulty products are used as feedstock to the production process; residues are either used as feedstock or sent to landfill.
8. The new product can be designated as "containing recycled materials".

Option 4A: Boomerang Alliance CDS

Additional detail is also provided on the system operation, collection facility design and incidence of transport costs for Option 4A, as follows:

- **System operation:**

1. Containers redeemed at collection centres are manually crushed or broken (for product security reasons), baled or loaded to skips, and transported to the nearest hub for any further material-type collation, and transported to a material reprocessor
2. Containers redeemed at RVMs are transferred to material reprocessors direct or via a hub depending on location and container flow
3. Containers redeemed at rural and remote collection points are transferred to a hub then collated, baled, and transported to material reprocessor

- **Collection facility design**

1. Hubs are a mix of shop-fronts and depots established at existing waste facilities.
2. Collection depots are a mix of small shop-fronts and depots established at existing waste facilities.
3. RVMs are predominantly located at shopping centres.
4. Rural and remote collection points will make use of existing retail outlets including outback stores.

- **Incidence of transport costs**

1. The costs of transport from collection centres / RVMs to hubs is incurred by the collection centre / RVM operator
2. The costs of transport from hubs to reprocessors is largely incurred by the reprocessor other than for Darwin, Perth, Hobart and Adelaide

[105] Note that where the householder (or business) discards used containers to the kerbside recycling bin in lieu of redeeming the containers at a CDS collection centre, the contents of the kerbside bin are collected, taken to a MRF and recovered for presentation by the MRF operator to a CDS collection centre.

Option 4B: Hybrid CDS

Additional detail is also provided on the system operation, collection facility design and incidence of transport costs for Option 4B as follows:

- **System operation:**

  1. Containers redeemed at collection depots are manually crushed or broken (for product security reasons), baled or loaded to skips, and transported to the nearest consolidation depot for any further material-type collation, and transported to material reprocessor
  2. Containers redeemed at RVMs are transferred to material reprocessors direct or via a collection depot or consolidation Depot depending on location and container flow
  3. Containers redeemed at a rural and remote collection point are transferred to a consolidation depot then collated, baled, and transported to a material reprocessor.

- **Collection facility design**

  1. Consolidation depots are assumed to be shop-front style and operate as both a hub for consolidation and collation and a redemption point for local returns
  2. Collection depots are a mix of small shop-fronts and depots established at existing waste facilities
  3. RVMs are mainly at shopping centres
  4. Rural and remote collection points will make use of existing retail outlets including outback stores

- **Incidence of transport costs**

  1. The costs of transport from collection depots / RVMs to consolidation depots is incurred by the collection centre / RVM operator
  2. The costs of transport from collection depots to reprocessors is largely incurred by the reprocessor other than for Darwin, Perth, Hobart and Adelaide

Appendix B Household participation costs

Appendix B presents alternative VOC parameters, and alternative estimates of the distance to CDS infrastructure.

B.1 - Vehicle operating cost parameters

The table below presents alternative estimates that may be used to calculate the VOC parameter for the purposes of sensitivity testing.

VOC estimates by the Australian Taxation Office (ATO) and motoring bodies such as the RACQ are not suitable for the purposes of an economic CBA given the inclusion of:

- Financial costs such as depreciation and interest. These are transfers between parties and do not represent a net economic cost to society
- Taxes such as the fuel excise which are not economic costs
- Sunk costs such as registration and insurance, which should not be attributed to incremental trips to CDS collection infrastructure.

As such, the NSW RTA estimate of 23 cents/km could potentially be included as a sensitivity test. This estimate was developed specifically for the purposes of economic analysis.

Table B.1: Vehicle operating cost sensitivities

Source	Value (cents/km)	Note
Austroads *Guide to Project Evaluation*	10.3	Applied in the core CBA
NSW Roads and Traffic Authority *Economic Analysis Manual*	23.0	Relative to the core scenario, fuel consumption is reduced to 9.0 cents / 100 km and vehicle operating costs are increased to 14.8 cents / km ($2011 June))
Australian Taxation Office	70.7	Average deduction (across 3 engine capacity classes) allowable by the ATO for business related car expenses
RACQ	76.8	Average vehicle operating cost estimate (across more than 80 vehicles) based on the costs of depreciation, registration, insurance, license, RACQ membership, interest on loan, fuel, tyres and service/repairs
RACV	19.2	Average vehicle operating cost estimate (across 55 vehicles) based on running costs including fuel, tyres and maintenance. If additional financial costs such as depreciation, interest, registration and insurance are included the estimate increases to 74.4 cents per km.

Source: NSW Roads and Traffic Authority (2009) *RTA Economic Analysis Manual, Version 2,* Appendix B, Economic Parameters for 2009, p 2; Australian Taxation Office, *Claiming a deduction for car expenses using the centres per kilometre method*, available at: http://www.ato.gov.au/individuals/content.aspx?doc=/content/33874.htm; RACQ, *Private vehicle running costs 2011*, available at : http://www.racq.com.au/motoring/cars/car_economy/vehicle_running_costs;

B.2 Distance to container deposit infrastructure

The section below presents alternative estimates that may be used to calculate the distance from households to CDS infrastructure based on the urban intensive and rural residential land area in Australia, the average distance to a shopping centre and the average distance to landfill.

Urban intensive and rural residential land area

As outlined in the *Problem Statement for Packaging*, the total area of land in Australia is approximately 7.7 million square kilometres, of which 14,000 square kilometres are for urban intensive uses and 9,400 are for rural residential uses.[106]

The tables below estimates the land area (km2) per unit of container deposit assuming that they are equally distributed over rural residential land (rural and remote collection centre points) or urban intensive land (other infrastructure types). The maximum distance to a unit of infrastructure is calculated as the radius of a circle with the estimated area per unit.

Table B.2: Average distance to CDS infrastructure by land area – Options 4A and 4B

Infrastructure type	Number	Area per unit (km2/unit)	Distance (km)
Urban collection centres	1,200	11.7	1.9
Rural/remote centre collection points	700	13.4	2.1

Population density

As outlined in the Options Report, it is assumed collection centres are geographically distributed to ensure coverage and consumer convenience. Preliminary infrastructure requirements have been estimated, but these are subject to verification based on a population/geographical analysis.

ABS data on population density by Statistical Local Area was used to estimate the catchment area of each unit of infrastructure noting that the *Packaging Option Report* assumed that there would be 1 collection centre per 200,000 homes in metropolitan areas and 1 per 50,000 homes in regional areas.[107] The average distance to each unit of collection infrastructure was estimated as half the radius of a circle with the same area as the catchment area.

Table B.3: Estimates of average distance to infrastructure based on population density

Assumption	Value	Source	Note
Population density – urban (persons/km2)	401.8	ABS (2011) *3218.0 Regional Population Growth, Australia*, Tables 1-10	Population density of all LGAs in capital city Statistical Divisions
Population density – rural (persons/km2)	3.85		Median population density of LGAs outside capital city Statistical Divisions
Catchment households– urban (households/unit of infrastructure)	200,000	Packaging option report	Catchment is based on the number of households, not population
Catchment households – regional (households per unit of infrastructure)	50,000		
Average household size (population per household)	2.6	ABS (2011) *3218.0 Regional Population Growth, Australia*, Tables 1-10/ABS (2010)	=(22,328,847/8,527072)

[106] Bureau of Rural Sciences (2001/02) *Land Use of Australia*, Version 3. *NOTE: Numbers have been rounded.*

[107] PwC (2011) Packaging option report – Draft version 2, 19 August, p 40

Assumption	Value	Source	Note
		Household and Family Projections, Australia, 2006 to 2031, Table 1.2	
Catchment area – urban (km)	1,304	PwC calculation	=(200,000/(401.8/2.6))
Catchment area – regional (km)	34,007	PwC calculation	=(50,000/(3.85/26))
Catchment radius – urban	20.4	PwC calculation assuming catchment area is circular	=((1,304)/π)^(1/2)
Catchment radius - regional	104.0		=((34,007)/π)^(1/2)
Average distance to infrastructure – urban	10.2	Population assumed to be equally distributed within the catchment area, so radius divided by 2	=20.4/2
Average distance to infrastructure - regional	52.02		=64.3/2

Average distance to shopping centres

It is assumed that RVMs are located at convenient locations such as shopping centres. The table below presents a number of estimates of the average distance to supermarkets.

Table B.4: Estimates of the average distance to shopping centres

Estimate	Source
Almost 90% of supermarkets have another supermarket within 3 km and almost 95% of supermarkets have a competitor within 5 km	ACCC Grocery Inquiry
The majority of residents of Melbourne have a supermarket within 1.5km	VIC Department of Planning and Community Development (2001)
In WA, the average distance of households from their closest supermarket is 7 km	WA Department of Planning and Infrastructure (2004)

Source: Australian Competition and Consumer Commission (2008) *Report of the ACCC Inquiry into the Competitiveness of Retail Prices for Standard Groceries;* Department of Planning and Community Development 2001, *Proximity to Shopping and Services*; WA Department of Planning and Infrastructure (2004) *The Perth and Regional Travel Survey*.

Average distance to landfill

The majority of CDS infrastructure is assumed to be located at existing waste facilities. The table below presents a number of estimates of the average distance to landfill in Australia.

Table B.4: Estimates of the average distance to landfill in Australia

Estimate	Source
The average distance from the point of waste generation to reprocessing station is 20 km on average, based on mapping of landfill locations	NSW Department of Environment, Climate Change and Water
Average distance to landfill assumed to be 30km	Grant and James (2005)
Weighted average distance to landfill calculated to be 17 km	Grant et. al (2001)

Source: NSW Department of Environment, Climate Change and Water (2010) *Environmental Benefits of Recycling;* Grant and James (2005) *Life Cycle Impact Data for Resource Recovery for Commercial and Industrial and Construction and Demolition Waste in Australia*; Grant, James, Lunfie, Sonneveld and Beavis (2001) *Report for Life Cycle Assessments for Paper and Packaging Waste Management Scenarios in New South Wales*

Appendix C Collection and transport costs

Appendix C provides additional information on the methodology used by WCS to estimate the packaging materials collection and transport costs for at-home (domestic kerbside) collection and away-from-home collection. Alternative estimates that may potentially be included in sensitivity testing have also been provided for kerbside collection costs and the impact of CDS on kerbside recycling.

C.1 At home (domestic kerbside) collection

Derivation of the WCS estimate of kerbside transport and collection costs

The cost of collecting packaging materials in the conventional dry recycling kerbside system has been estimated on the basis of the cost per tonne of material collected at kerbside i.e. the cost of providing a collection service divided by the number of tonnes collected.

In the majority of instances, local government data on kerbside collections are costed on a per lift basis. In other words, the cost to a council for each 240 L Mobile Garbage Bin (MGB) that is lifted, unloaded into the collection vehicle and hauled to the destination for the material to be processed. The rates commonly quoted are fully inclusive of both the collection and the disposal or processing. For this analysis, the cost of collecting in the kerbside system has been estimated using:

- the cost per lift and transport only has been used[108],
- the weight-based average yield of all dry recyclables per household measured across all of NSW in 2009[109], and
- the weight-based haul of packaging recyclables across all jurisdictions reporting to NEPC in 2009/10[110].

Based on the cost to collect at kerbside and the average yield in kerbside bins, the cost per tonne to collect recyclables and deliver to a local drop-off point, either a MRF or a transfer facility is estimated to be **$187 per tonne of recyclables**. On a material-by-material basis, this is assumed to be the cost per tonne for each and every tonne of the materials collected with the current mix of recyclables seen at kerbside and the current approach to pricing kerbside collections.

For this estimate, the collection cost has been based on a situation where kerbside collection vehicles deliver directly to a drop-off point for MRF processing. This situation should pertain for the vast majority of kerbside recyclables collected across the metropolitan and outer-metropolitan regions of Australia, but it may not be the case in regional and rural areas. In the more remote areas, recyclables destined for MRF processing are expected to be aggregated at transfer facilities and hauled in long-haul vehicles to metropolitan MRF facilities, adding an extra layer of cost for collection of these recyclables, with the additional cost directly related to the distance between source and destination.

In testing options where kerbside recycling is to be extended to more households, the cost per tonne to roll out those additional services can be calculated via two mechanisms, depending on the basis of the estimate for additional service:

a) if an additional tonnage haul is assumed, then the extra cost will be $187 per tonne of additional material collected
b) if on the other hand the number of additional services (households) to which the kerbside collection services are extended is the basis for the estimate, then the cost per service is estimated to be $56 per household per annum and the additional yield will be assumed at 300 kg per household per annum.

In testing options where the haul of recyclables is to be increased from premises that already receive a kerbside collection service, then there is assumed to be no additional cost for this extra haul of recyclables. This situation of no additional cost for extra haul of recyclables is a function of the basis for pricing kerbside collection services – a unit cost per bin lift, which within existing contracts will not change even if the haul of recyclables increases. This situation is arguably reasonable to assume for existing services given that the

[108] C. Horsey, personal communication

[109] Kerbside Waste Audit Data Analysis, 2009, DECCW Presentation

[110] NEPC Jurisdiction Reports 2009-10

quantum of recyclables remaining in the mixed waste bin is generally less than 15% and hence the marginal extra demand on the collection contractor if two thirds of this were diverted to the recycling bin is not assumed to result in a change to the unit cost per bin lift.

Alternative estimates of kerbside transport and collection costs

The table below provides alternative investments that may be included in sensitivity testing.

Table C.1 – Alternative estimates of kerbside transport and collection costs

Source	Estimate ($/tonne)	Note
WCS (2011)	$185	Applied in the core analysis
Sustainability Victoria (2010)	$99.60 (metro), $172.61 (non-metro)	Average kerbside collection costs for recyclables in Victorian Councils in 2008-09
Boomerang Alliance (2008)	$248.47	Based on the NEPC 2005/06 Annual Report: Used Packaging NEPM

Source: Sustainability Victoria (2010) Annual Local Government Survey, p 5; Boomerang Alliance (2008) Financial Analysis of Costs and Benefits of a National Container Deposit Scheme, Table 6, p 11

Impact of CDS on kerbside recycling

A CDS provides an alternative method of recycling and therefore diverts material away from existing kerbside collection systems. The table below provides alternative estimates of the impact of CDS on kerbside collection quantities (tonnes).

Table C.2 – Alternative estimates of the impact of CDS on kerbside recycling

Source	Estimate	Note
BDA (2010)	85% reduction in quantity of beverage containers collected through kerbside (tonnes)	Reduction in beverage container recycling only
Boomerang Alliance (2008)	78% reduction in quantity of beverage containers collected through kerbside (tonnes)	• Current recycling rate through kerbside: 22.4% • Projected recycling rate through kerbside: 4.9%
Perchards (2008)	57%-78% reduction in quantity of beverage containers collected through kerbside (tonnes)	• Current recycling rate through kerbside: 22.2%-24.6% • Projected recycling rate through kerbside: 4.9%-10.5%
Nelson et al (2010)	Kerbside programs throughout California collect 9% of the deposit eligible containers state-wide.	In California, over 65% of the population have access to kerbside recycling run by local government.

Source: BDA and Wright Corporate Strategy (2010) *Beverage Container Investigation – Revised*, p 92; Boomerang Alliance (2008) *Financial Analysis of Costs and Benefits of a National Container Deposit Scheme*, Appendix 1, p 26; Perchards (2008) *Boomerang Alliance Paper, Financial Analysis of Costs and Benefits of a National Container Deposit Scheme: A Feasibility Review*, Table 32, p 40; Nelson, Carol and Gonzalez (2010) *Improving California's Beverage Container Recycling Rates*

C.2 Away from home collection

Derivation of the WCS estimate of away from home transport and collection costs

In the away-from-home sector, the costs for collection of packaging wastes will be a function of the mix of material collected – paper and cardboard, mixed plastics, or fully comingled plastics and paper and cardboard – which are the common mix of packaging commodities collected in the C&I, or away from home, sector.

Businesses generating relatively large quantities of specific streams of packaging materials for recycling will generally implement material-specific recycling services to maximize the value in the recyclables and minimize the cost of the collection service.

However, for the vast majority of small to medium sized businesses, where significant quantities of single-stream recyclables are generally not available, the cost of infrequent services for streamed recyclables can be greater than the cost of a general waste service. Therefore, those service providers in the waste industry that are keen to obtain recyclables generally offer fully comingled recycling services. Here the embodied value in the recyclable haul is lower than for streamed materials, due to the additional sorting required, but the overall value

and the frequency of collection can make the cost of the service equivalent to or cheaper than a general waste service.

As with the municipal sector, most away-from-home collection services are priced on a full-service basis – that is collection and disposal or beneficial processing. For a general waste service the cost is therefore the cost to collect plus the cost to dispose to landfill. While for a recycling service, the cost to the generator is the cost to collect less the benefit from material recovery that the contractor is prepared to pass on to the generator. Where the value of the commodities recovered is high, then the cost of the service is expected to be well below that of a general waste service, making recycling attractive to the generator. But in instances where the value of the commodities is low, as is the case with fully comingled services, the benefit passed back to the generator is low and the marginal difference between the comingled recycling service and a general waste service is marginal.

To estimate the cost per tonne for collection only – i.e. no contribution from the value of the recovered materials – a first principles approach has been adopted based on industry-sourced and tested costs to own and operate commercial collection vehicles and the typical levels of productivity expected in the market. This approach gave rise to a cost to collect away-from-home recyclables at **$26 per tonne** collected and delivered to a facility for sorting.

This first principles based estimate was then compared with market prices obtained on a confidential basis from a number of service providers in a major metropolitan market and found to be consistent with current market costs, unencumbered by any element for disposal or beneficial processing and sale of materials.

Appendix D Landfill disposal fees

Appendix D presents WCS estimates of landfill disposal fees.

Derivation of WCS estimate of landfill disposal fees

Packaging that is collected but is unsuitable for recycling must be disposed at landfill. Landfill disposal prices differ between metropolitan, regional and rural areas. The following table shows the tonnages disposed at small/rural, medium/regional and large/metro landfills.

Table D.1: Tonnes of waste disposed of at Australian landfills

	Number of Landfills	Tonnes to small/rural landfill	Tonnes to medium/regional landfill	Tonnes to large/metro landfill	Total
NSW	85	136,182	1,404,539	4,905,000	6,445,721
QLD	97	142,472	898,998	2,972,000	4,013,470
SA	71	110,475	249,300	920,000	1,279,775
Tas	11	9,650	291,400	120,000	421,050
VIC	56	28,000	1,370,100	3,591,713	4,989,813
WA	6	172,460	759,750	2,697,306	3,629,516
NT	2		50,000	230,000	280,000
ACT	1			205,000	205,000
Total	329	599,329	5,024,087	15,641,019	21,264,345

Source: WMAA National Landfill Survey (WMAA 2007)

The table below shows landfill disposal costs for rural/regional (small), major regional (medium) and metropolitan (large) landfills in each state, based on average gate fees at between one and five representative facilities of each type in each state.

Table D.2: Estimated landfill disposal costs

		Major metro (large) $/tonne	Major regional (medium) $/tonne	Rural/regional (small) $/tonne
NSW	Gate fee	192.58	152.10	127.7
	GST	19.08	15.07	12.65
	Waste levy	70.30	65.30	20.40
	Net disposal fee	**103.19**	**71.73**	**94.65**
QLD	Gate fee	81.15	158.08	30.17
	GST	8.04	15.67	2.99
	Waste levy	0	0	0
	Net disposal fee	**73.11**	**142.41**	**27.18**
SA	Gate fee	120.00	80.00	5.00
	GST	11.89	7.93	0.00
	Waste levy	35.00	17.50	17.50
	Net disposal fee	**73.11**	**54.57**	**4.50**
Tas	Gate fee	39.25	61.50	99.00
	GST	3.89	6.09	9.81
	Waste levy	2.00	2.00	2.00
	Net disposal fee	**33.36**	**53.41**	**87.19**

		Major metro (large) $/tonne	Major regional (medium) $/tonne	Rural/regional (small) $/tonne
VIC	Gate fee	103.00	98.86	68.80
	GST	10.21	9.80	6.82
	Waste levy	30.00	20.00	20.00
	Net disposal fee	**62.79**	**69.06**	**41.98**
WA	Gate fee	97.17	89.50	58.25
	GST	9.63	8.87	5.77
	Waste levy	28.00	28.00	28.00
	Net disposal fee	**59.54**	**52.63**	**24.48**
NT	Gate fee	47.00	75.00	n/a
	GST	4.66	7.43	n/a
	Waste levy	0	0	n/a
	Net disposal fee	**42.34**	**67.57**	**n/a**
ACT	Gate fee	121.90	121.90	121.90
	GST	12.08	12.08	12.08
	Waste levy	44.00	44.00	44.00
	Net disposal fee	**65.82**	**65.82**	**65.82**

Source: Compiled by WCS from public information

The above two tables have been used to produce the following average disposal fees for small, medium and large landfills in each state, as well as weighted averages.

Table D.3: Estimated average disposal fee

Disposal fee net of GST and waste levy	Large/metro landfill $/tonne	Medium/regional landfill $/tonne	Small/rural landfill $/tonne	Weighted average $/tonne
NSW	103.19	71.73	97.65	96.15
QLD	73.11	142.41	27.18	87.00
SA	73.11	54.57	4.50	63.58
Tas	83.14	89.57	36.28	86.51
VIC	62.79	69.06	41.98	64.40
WA	83.14	89.57	36.28	82.26
NT	42.34	67.57	n/a	46.85
ACT	65.82	65.82	65.82	65.82
AUSTRALIA	**81.43**	**86.49**	**42.46**	**81.51**

Appendix E Thresholds of business size in the Australian Packaging Covenant

Appendix E discusses the justification for inclusion of a threshold, the current threshold applied in the APC and an estimate of the distributions of companies by size.

E.1 Justification for a threshold

It should be noted that, as a general statement, the implementation of new or amended regulations has the potential to impact consumers, businesses and government. Some regulatory impacts may be positive, such as reduction in environmental externalities from disposal of waste to landfills. However, some impacts may be negative such as industry costs to comply with new regulation. Furthermore, the impacts may affect one party more than another – for example regulatory compliance costs may affect importers and/or customers. This may be despite net benefits being generated for the broader community.

Providing an exemption to regulatory requirements is usually designed or intended to reduce the administrative cost on businesses (or individuals) for which activity may be small or peripheral and the cost of compliance is disproportionately high. It also reduces costs to government since it reduces the scope of enforcement of the regulation.[111]

Setting a threshold for inclusion (or exclusion) in a regulatory scheme is one method for minimising the financial burden of regulation. Such thresholds are often granted on the basis that the burden of regulation falls disproportionately on small business, defined as having less than 20 employees[112] or $2 million in revenue.[113]

E.2 Current APC threshold

The APC is underpinned by the statutory NEPM to provide protection for brand owner Covenant signatories against 'free riders'. Under the NEPM firms over a $5 million threshold who are not signatories of the Covenant are subject to the NEPM enforcement provisions. In other words, there is a threshold of $5 million turnover, under which, companies are excluded from the obligations of the APC. This threshold was established by the NEPC and is consistent with Clause 12 of the NEPM that 'it is not the intention of Council that enforceable obligations will be placed on brand owners that do not significantly contribute to the waste stream'.

E.3 Distributions of companies by size

The table below presents the distribution of signatories to the APC by company size based on analysis undertaken in 2008 for the mid-term review.

Table E.1 – Covenant (2005-2010) signatory firms (as at October 2008)

Company size ($ turnover per annum)	Number of firms	Mid-point value ($ millions)	Estimated turnover	% total
> $10bn	2	10,000*	20,000	15.0
$5bn - $10 bn	1	7,500	7,500	5.6
$3 bn - $5 bn	2	4,000	8,000	6.0
$1 bn - $3 bn	20	1,500	30,000	22.5
$0.75 bn - $1 bn	14	875	12,250	9.2
$500 m - $750 m	18	625	11,250	8.4
$250 m – 500 m	52	375	19,500	14.6

[111] PwC (2011) *Threshold for the proposed television and computer recycling scheme: Including analysis of indicative funding model scenarios*, prepared for the Department of the Environment, Water, Heritage and the Arts, p 24

[112] ABS (2002) *Small Business in Australia, 2001*, Catalogue No. 1321.0

[113] ATO website, *Am I eligible for the small business entity concessions*, available at <http://www.ato.gov.au/businesses/content.asp?doc=/content/00103072.htm&pc=001/003/084/004/001&mnu=45054&mfp=001/003&st=&cy=1>, accessed 20 July 2010

Company size ($ turnover per annum)	Number of firms	Mid-point value ($ millions)	Estimated turnover	% total
$100 m - $250 m	79	175	13,825	10.4
$75m - $100 m	32	87.5	2,800	2.1
$50 m -$75 m	41	62.5	2,562.5	1.9
$25 m - $50 m	84	37.5	3,150	2.4
$10 m – $25 m	120	17.5	2,100	1.6
$5 m - $10 m	66	7.5	495	0.4
< $5 m	36	2.5	90	0.1

Source: Environment Protection and Heritage Council, Decision Regulatory Impact Statement: Used Packaging Materials, p 21
Note: The size distribution of data as at 2008 was used to estimate actual revenues for firms (based on midpoint estimates), and relative shares of firms contributing to the Covenant. They are derived from an estimate of the 'representative' or average turnover of a company in a particular turnover band (assumed to be the midpoint value in the band), and the number of firms in each turnover band. * A lower bound estimate has been used for these 'over $10 billion pa turnover' firms. This is a conservative approach to estimating the market share (and dominance) of Covenant signatories.

Appendix F Market value of materials

Appendix F presents additional information on the WCS methodology and assumptions to estimate the market value of resources, discusses the price premium for CDS and presents alternative estimates for potential inclusion in sensitivity testing.

F.1 WCS estimate of the market value of resources

Prices received by MRF operators for the materials sorted in recycling facilities are confidential to the individual businesses and significantly influenced to the degree of vertical integration from the MRF through to further reprocessing and value adding.

However, there are public information sites where trend data for various commodities typically found in the kerbside recycling packaging haul can be obtained. Using a combination of such trend data and information provided on a confidential basis from recycling industry sources, the following data is considered to be broadly representative of the process that might be obtained for packaging materials recovered from MRFs in capital cities across Australia.

Table F.1 – Market value of resources

Material	Material Value ($/tonne)
Paper/Cardboard	$181[1]
Glass	$30[2]
Aluminium Cans	$1,560[3]
Plastics (40:20:20:20)	$560[4]
Plastics – mostly sorted	$530
Plastics – fully mixed (30:30:40)	$372[5]
Steel Cans	$280[6]
Liquid Paperboard	$150[7]
Weighted Average (basket)	**$162[8]**

Sources:

1. PPI Asia for OCC and Mixed Grade (Visy) and Paper Fibre Network
2. Owens Illinois and BDA/MMA (2007)
3. LME and Metals Price Archive (Letsrecycle.com)
4. Streamed plastics (assuming 40% PET, 20% HDPE, 20% LDPE, 20% mixed) –Recycling industry sources
5. Fully mixed plastics (assuming 30% HDPE, 30% PET, 40% mixed) – Recycling industry sources
6. Recycling industry sources
7. Recycling industry sources
8. Weighted average basket price for recyclables based on national NEPC recyclate mix.

Cardboard and Paper

The two major recyclers of packaging-sourced cardboard and paper in Australia are VISY and AMCOR, and both organisations source recycled paper and cardboard for in-put feed to their paper mills (i.e. they are vertically integrated and source recycled product as an alternative to virgin feed stock for manufacture of new packaging products). Notwithstanding that the internal transfer prices for recovered materials within these business is confidential, there is a reasonable probability that those prices (if available) might also not be fully reflective of the open market dynamics that shape commodity prices.

Therefore, to develop an understanding of the likely market price for packaging paper and cardboard recovered from MRFs reference was made to:

- the Waste Paper Composite index which tracks the changing market prices in the paper recycling and recovered paper fibre markets (the Index consists of a weighted basket of specific benchmark grades of scrap/recovered paper)
- PPI price data for Old Corrugated Cardboard (OCC) sold in Australia for export to China.

The medium-term trend data gave an indication of price trends, while the PPI price index data provided information on OCC prices paid in Australia up to December 2011. With the price trend very stable over the last six months, the December 2010 data was projected forward to June 2011 for this analysis.

Premium for CDS

Anecdotal evidence suggests that there is an increase in the value of paper/cardboard recovered through kerbside when a CDS is in place. This is because there is reduced glass contamination in kerbside, which can lead to a higher market value for other items.

A premium for the price of plastic under CDS has been included in the CBA, however there was not sufficient evidence or data available to include a premium for paper/cardboard. However, further investigation of this issue would be warranted in the Decision RIS.

Glass

Compared to other recovered packaging materials, glass is heavy, low in value and subject to a stringent quality specification for reuse. This means it is generally not viable to export recovered glass. Most recovered glass in Australia is directed to Owens Illinois (or Amcor in SA) for re-smelting - or is processed for alternative uses such as aggregate substitute, glass-sand or filtration material.
Recovered glass which conforms to specification (98% colour separation and less than 25ppm CSP (ceramics/stones/pyroceramics)) is purchased by Owens Illinois at $72 per tonne. This base rate for relatively high quality sorted glass has not changed in the past decade. A more conservative price of $30 per tonne was applied in the core CBA based on advice from WCS.

Kerbside or commingled glass (mixed glass) is collected mixed with other recyclable materials and requires separation from those materials, sorting into the three-colour streams and decontamination from CSP. Owens Illinois charges a processing fee (in addition to the purchase price) to processors who deliver this material.

Premium for CDS

The core CBA applied an assumed value for glass of $30 per tonne. However, there is evidence that Owens Illnois purchases glass for as much as $72 per tonne and advice from South Australia that recyclers receive as much as $100 per tonne for glass collected by the CDS. The core CBA applies a 'price premium' of $100 per tonne for glass collected through the CDS.

Aluminium

Whilst Aluminium, commonly used in the manufacture of many drink cans, is traded on the LME (London Metal Exchange). The prices commonly seen are those for virgin metal, which is not representative of the market value placed on recycled aluminium containers in the typical kerbside recycling haul. For example, in June 2011, data from the LME and the Metal Prices Archive of Letsrecycle.com reveal the following variation in prices for virgin aluminium metal compared with recycled aluminium cans of various quality.

Table F.2 – Comparison of prices for virgin aluminium metal compared with recycled aluminium cans

Grade of Material	Price /tonne
LME 100% Al metal	£1,615
LME 70% (clean Al cans)	£1,180
Baled and compacted cans	£1,040
Loose & flattened cans	£980
Loose whole cans	£980

For this analysis the June 2011 price paid in UK to recyclers for used aluminium beverage containers that are baled and compacted was selected as the benchmark price.

Plastics

As with most commodities, plastics are sold both by sorted polymer type and in mixed lots, with higher prices being attained with higher degrees of sorting. In May-June 2011 recycling industry sources indicated that the following prices were being offered to Australian recyclers for recycled plastic packaging materials.

Table F.3 – Prices offered to Australian recyclers for recycled plastic packaging materials

Plastic Type	USD $/tonne	Comments
PET	$750 - $780	
PET Coloured	$535 - $545	
HDPE	$660 - $670	
HDPE Coloured	$640 - $650	
LDPE 90/10	$500 - $510	90% clean film, 10% stickers or labels
LDPE 95/5	$550 - $570	95% clean film, 5% stickers or labels
LDPE Colour	$290 - $310	
Mixed Plastic 442	$370 - $400	40% HDPE, 40% PET mixed colours, 20% other plastics
Mixed Plastic 226	$340-$380	20% HDPE, 20% PET mixed colours, 60% other plastics

Note: These prices primarily include the cost of transporting to reprocesses.

Recycling MRF operators attempt to sort the mixed in-feed plastics to polymer type, but commonly have a residual amount of plastics that are aggregated into a mixed plastics class. Therefore a number of options are available for pricing the basket of plastics that might be recovered in MRFs as follows:

(a) Assuming a sort to polymer type that yields a 40:20:20:20 sort (40% PET, 20% HDPE, 20% LDPE, and 20% mixed), indicates a price for the basket of $560 per tonne;
(b) An alternative approach is to
  - Select the main polymer types that comprise the recycled plastics stream in the domestic recyclables (PET 61% and HDPE 25%) from recycling activity reports in South Australia
  - assume they achieve the market price for the coloured class of those polymer and the remainder (14% mixed), and
  - assume that yields the lowest quality price for mixed plastics.
  - This indicates a price for the basket of $530 per tonne;
(c) Using the same selection, but assuming that only 75% of each of the two main polymer types is recovered to type and the balance is in the mixed class, indicates a price for the basket of $501 per tonne;
(d) Assuming all plastics remain mixed and are baled and sold mixed, indicates a price for the basket of $372 per tonne.

In all probability, the majority of capital city MRFs will sort the plastics stream to type to some degree or another, given the pricing differentials between mixed plastics and sorted plastics. Therefore, the fully mixed scenario is unlikely, and one could expect a price for the basket of plastics to be in the range $500 to $560 per tonne, depending on the degree of sort – say $530 per tonne.

Premium for CDS

Plastic beverage containers recovered through the SA CDS are invariably cleaner and presented more accurately to polymer type than most shipments received via the kerbside/MRF system. The general industry view is that this results in a preference by plastics reprocessors for SA CDS post-consumer PET and HDPE. Does this translate to a premium price? This is commercial information not formally available outside the companies involved in transactions. The key factors are the material supply/demand position and the scope for economies in the reprocessing production line with clean, well sorted containers. Granting both an excess of supply over demand and the fact that production economies can be achieved with CDS materials, a price premium is entirely feasible, and it is likely continue in a national CDS as current and future production systems could be organised to take advantage of CDS output quality.

Based on discussions with industry it is estimated that $100/tonne premium for PET and HDPE is available, bringing the **total price for the basket of plastics to $660/tonne.**

Liquid Paperboard

Liquid paperboard ceased to be recycled in Australia following the closure of the paper recycling mill at Shoalhaven in NSW. Therefore, if recovered in the MRF sorting process, these materials are exported to either China or Korea.

There are two common grades of LPB in use in Australia – Standard LPB and Aeseptic LPB.

- Standard LPB is high grade cardboard with a liquid-proof polyethylene coating on both sides, and
- Aseptic LPB has a thin layer of aluminium foil on one side (the inside of the container).

If included in the paper/cardboard stream of recyclables, LPB containers tend to be flattened in the collection process and may end up in one of three output streams –

i. the aluminium stream for some Aseptic LPB which is removed via the eddy current sorting device,
ii. the cardboard stream for many of the LPB containers where much of the material is lost in the hydro pulping mill at the paper recycling mills, or
iii. the waste stream and destined for landfill.

If included in the containers stream, some of the LPB containers retain their shape and can be recovered as part of the manual picking process, then bales and sent for export.

Exported LPB typically achieves a price of $US250 per tonne CIF in China or Korea.

Steel Cans

Tin-plated steel cans are very effectively recovered from all Australian MRFs using electro-magnetic separation. They are also recovered from mixed waste at various AWT facilities, however these cans typically contain a higher level of residual food contamination compared with the MRF-sourced material. This makes storage, shipping and acceptance of the AWT-sourced material by reprocessors problematic.

Since the closure of Blue Scope's Port Kembla de-tinning plant in 2006, there is no de-tinning capability in Australia and steel cans are officially banned as a contaminant in steel feedstock at all Australian steel mills. This means that currently all tin-plated steel cans are exported from Australia.

Clean tin-plated steel cans are currently selling for around USD$380 per tonne CIF delivered in Pakistan.

F.2 Recycling by material

In order to estimate the value of the material recycled under each option, the projections for recycling reflect a change in the split of material types. Some options target certain material types or recycling locations, and could therefore have differing impacts on the split of recycling by material type.

Base case

In the base case recycling in tonnes increases for each material type. However, some material types have faster growth rates (such as Glass). This means that as a proportion of total recycling, paper/cardboard decreases whereas the other materials increase or are stable.

Some material types, such as aluminium cans and paper/cardboard, already have very high recycling rates and it is assumed that recycling rates cannot exceed 90%. Therefore, there is 'less room' for growth in the recycling of these materials. Whereas other materials, with low recycling rates, have more room for growth and consequently increase as a proportion of total recycling.

Table F.4 - Base case recycling by proportion of materials

Material	*2015*	*2025*	*2035*
	%	*%*	*%*
Paper/cardboard	73%	72%	66%
Glass	18%	19%	23%
Plastics: PET beverage	2%	3%	3%
Plastics: HDPE beverage	1%	1%	1%
Plastics: non-beverage (mixed)	1%	1%	1%
Film plastic	2%	2%	2%
Steel cans	2%	2%	2%
Aluminium Cans	1%	1%	1%
Total	100%	100%	100%

Source: WCS (2011) based on products/materials targeted by each option
Note: Due to rounding the tables may not add to 100.

Option 1

The split of recycling by material type is broadly similar in option 1 to the base case, though total recycling under Option 1 increases faster than in the base case.

It is assumed that beverage container recycling increases slightly more rapidly than in the base case. This is because of the coordinated, national initiatives which are assumed to target beverage containers. Therefore, PET beverage containers increase a proportion of total recycling.

Table F.5 - Option 1 recycling by proportion of materials

Material	*2015*	*2025*	*2035*
	%	*%*	*%*
Paper/cardboard	73%	70%	66%
Glass	18%	20%	23%
Plastics: PET beverage	2%	3%	3%
Plastics: HDPE beverage	1%	1%	1%
Plastics: non-beverage (mixed)	1%	1%	1%
Film plastic	2%	2%	2%
Steel cans	2%	2%	2%
Aluminium Cans	1%	1%	1%
Total	100%	100%	100%

Source: WCS (2011) based on products/materials targeted by each option
Note: Due to rounding the tables may not add to 100.

Option 2A

Under option 2A. beverage containers recycling increases at a more rapid rate than in the base case, resulting in beverage containers making up a greater proportion of total recycling. This is reflected in the beverage container categories (such as plastics and glass) making up an increasing proportion of recycling compared to the base case.

Table F.6 - Option 2A recycling by proportion of materials

Material	*2015*	*2025*	*2035*
	%	*%*	*%*
Paper/cardboard	73%	69%	66%
Glass	18%	21%	23%
Plastics: PET beverage	2%	3%	3%
Plastics: HDPE beverage	1%	1%	1%
Plastics: non-beverage (mixed)	1%	1%	1%
Film plastic	2%	2%	2%
Steel cans	2%	2%	2%
Aluminium Cans	1%	1%	1%
Total	100%	100%	100%

Source: WCS (2011) based on products/materials targeted by each option
Note: Due to rounding the tables may not add to 100.

Option 2B

Option 2B, as proposed by industry, is assumed to particularly target problem areas such as beverage container recycling. A range of initiatives such as the provision of recycling bins in public spaces, lead to an increase in the recycling rates of beverage containers. Consequently, plastics and glass recycling increase at a faster rate than paper/cardboard, which is the reason for the decrease in the proportion of paper/cardboard and the increase in glass and PET.

Table F.7 - Option 2B recycling by proportion of materials[1]

Material	*2015*	*2025*	*2035*
	%	*%*	*%*
Paper/cardboard	71%	67%	65%
Glass	19%	22%	24%
Plastics: PET beverage	3%	3%	4%
Plastics: HDPE beverage	1%	1%	2%
Plastics: non-beverage (mixed)	1%	1%	1%
Film plastic	2%	2%	2%
Steel cans	2%	2%	2%
Aluminium Cans	1%	1%	1%
Total	100%	100%	100%

Source: WCS (2011) based on products/materials targeted by each option
Note: Due to rounding the tables may not add to 100.

Option 2C

Like Option 2B, Option 2C targets identified problem areas such as beverage container recycling. However, Option 2C involves significantly greater funding and a greater number of initiatives to target phoenix activity. Therefore, there is a greater increase in overall recycling and a particularly significant increase in glass and PET recycling. This results in glass and PET making up a greater proportion of total recycling.

Table F.8- Option 2c recycling by proportion of materials

Material	*2015*	*2025*	*2035*
	%	*%*	*%*
Paper/cardboard	71%	66%	63%
Glass	19%	23%	25%
Plastics: PET beverage	3%	3%	4%
Plastics: HDPE beverage	1%	1%	2%
Plastics: non-beverage (mixed)	1%	1%	1%
Film plastic	2%	2%	2%
Steel cans	2%	2%	2%
Aluminium Cans	1%	1%	1%
Total	100%	100%	100%

Source: WCS (2011) based on products/materials targeted by each option
Note: Due to rounding the tables may not add to 100.

Option 3

Option 3 involves the same level of funding and initiatives as Option 2C. Therefore, the projections by material type and the split of material types is the same as under Option 2C.

Table F.9 - Option 3 recycling by proportion of materials[1]

Material	*2015*	*2025*	*2035*
	%	*%*	*%*
Paper/cardboard	71%	66%	63%
Glass	19%	23%	25%
Plastics: PET beverage	3%	3%	4%

Plastics: HDPE beverage	1%	1%	2%
Plastics: non-beverage (mixed)	1%	1%	1%
Film plastic	2%	2%	2%
Steel cans	2%	2%	2%
Aluminium Cans	1%	1%	1%
Total	100%	100%	100%

Source: WCS (2011) based on products/materials targeted by each option
Note: Due to rounding the tables may not add to 100.

Options 4A and 4B

Both Option 4A and 4B have the same projected recycling rates. As the CDS options target beverage containers, recycling of glass and PET increase a rate greater than the other material types. This results in glass and PET making up an increased proportion of total recycling. Aluminium cans do not increase as a proportion of total recycling despite being targeted by the CDS. This is because recycling of aluminium cans is already very high and as it is assumed that the recycling rate of any material type cannot exceed 90%, there is minimal additional recycling of aluminium cans that can occur.

Table F.10 - Option 4 recycling by proportion of materials[1]

Material	***2015***	***2025***	***2035***
	%	***%***	***%***
Paper/cardboard	73%	67%	64%
Glass	18%	22%	24%
Plastics: PET beverage	2%	3%	4%
Plastics: HDPE beverage	1%	1%	2%
Plastics: non-beverage (mixed)	1%	1%	1%
Film plastic	2%	2%	2%
Steel cans	2%	2%	2%
Aluminium Cans	1%	1%	1%
Total	100%	100%	100%

Sources: Provided by WCS
Note: Due to rounding the tables may not add to 100.

F.3 Other potential sources for sensitivity testing

The table below presents alternative estimates of the market value of materials for potential inclusion in sensitivity testing.

Table F.11 – Alternative estimates of the market value of materials

Material	*Material value ($/tonne) WCS*[1]	*Material value ($/tonne) Hyder*[2]	*Material value ($/tonne) MMA*[3]	*Material value ($/tonne) Boomerang*[4]
Paper/cardboard	$181	$120	$120	
Glass	$30	$70	$30	$30-90
Aluminium Cans	$1,560	$2,000	$2,100	$2,000-$2,500
PET		$700		$600-750
Plastics (40:20:20:20)	$560		$700 (For 'plastics' as a generic category)	
Plastics-mostly sorted	$530			
Plastic- fully mixed	$372			$350-500
Steel cans	$280	$75	$150	
Liquid paperboard	$150	$150		

Sources:

1. Provided by WCS
2. Hyder 2008 National Packaging Covenant mid-term review and BDA/WCS estimate' cited in BDA Group and Wright Corporate Strategy (2010) Beverage Container Investigation, p 91
3. MMA and BDA Report, 2007. National Packaging Covenant Complementary Economic Mechanisms Investigation: Report for National Packaging Covenant Jurisdictional Working Group, Table H-2, p 125.
4. Boomerang Alliance, 2008. Financial Analysis of Costs and Benefits of a National Container Deposit Scheme.

Appendix G Landfill externalities

The table below presents alternative estimates of the costs of landfill externalities in Australia:

Table G.1 – Alternative estimates of the costs of landfill externalities in Australia

Source	Estimate	Note
BDA and WCS (2010)	$0-$24	BDA cited the Productivity Commission 2006 study which reviewed a number of studies and concluded that the external disamenity costs of Australian landfills could range from $0 to $24/tonne of waste. They noted that the Productivity Commission concluded that the average cost for a properly located, engineering and well managed site would be less than $1.00/tonne
BDA (2009)	$41-$102	The BDA Group quantified the following key non-market costs of landfill: • Greenhouse emissions, using the National Greenhouse Accounts (NGA) Factors published by the Department of Climate Change in November 2008. • Other emissions to air, using the National Pollutant Inventory Emission Estimation Technique Manual for Municipal Solid Waste Landfills published by the Department of Environment and Heritage in May 2005 • Emissions to water (leachate) • Disamenity using the Productivity Commission's estimate of around $1 per tonne of waste for disamenity associated with a best practice landfill. The BDA Report concluded that total costs for urban and rural landfills are similar - ranging between $42 and $102 per tonne of waste in urban areas and between $41 and $101 per tonne in rural areas, depending on the level of management controls and prevailing climate. External costs are significant for landfills with the poorest controls and in wet climates, making up 25%-45% of total costs for landfills in urban areas and 20%-40% of total costs for landfills in rural areas. The contribution of external costs to total costs is much lower for landfills with best practice controls at less than 4% in urban areas and less than 1% in rural areas.
European Commission (2000)	€11-20	• The report estimated environmental impacts based on both a modern landfill with modern leachate collection and treatment and with landfill gas collected to generate electricity and heat. Old landfills were assumed not to have a liner and leachate collection or gas collection. • The total external impact of landfills in Europe is estimated to range between 11 and 20 Euros per tonne of waste delivered to modern and old landfills respectively. Because of the larger populations and closer settlement in Europe, a greater number of households could be expected to be directly impacted by each landfill, and this is borne out in the large environmental cost attributed to disamenity impacts on local communities arising from noise, dust, litter, odour and vermin.
Porter (2002)	US$3-15	In 2002 Porter estimated the external costs of landfilling in the US at between $US3 and $US15 per ton[114]. This estimate covers methane emissions, leachate and amenity impacts and draws on earlier work[115]. It ignores land costs and assumes no landfill gas is recovered.
Enviros Consulting (2004)	£1.5-2.2	In 2003 the UK Department for Environment Food and Rural Affairs commissioned Cambridge Econometrics to identify and estimate the disamenity costs of landfill in Great Britain. Disamenity costs were defined as those local nuisance costs experienced by households living close to a landfill such as odour, dust, litter, noise, vermin, and visual intrusion. The study used hedonic pricing[116] to estimate disamenity costs. The disamenity cost in the UK was estimated at between £1.5 and £2.2 per tonne of waste disposed to landfill.
Davies and Doble (2004)	£4.6-6	In 2004 the external costs of landfilling in the UK were explored as part of a study on a landfill tax for the UK. Davies and Doble 2004[117] estimated external costs at around £4.6 - £6 per tonne of waste landfilled. The estimates cover global pollutants such as greenhouse gases, local (urban) air pollution, transport impacts[118], leachate, disamenity and pollution displacement. The disamenity values were derived by transferring results from US studies of property pricing to the UK context.

[114] Porter 2002

[115] Miranda and Hale 1997

[116] Hedonic pricing is an economic valuation method based on assessing the indirect impact on a market price – in this case housing prices – when an externality occurs. Landfill sites were categorised, and variation in the level of prices of adjacent houses that are solely attributable to disamenity impacts were identified.

[117] Davies and Doble 2004

[118] The estimates shown in this section include many components of the costs of disposal (and these are specified). In later sections of the report our assessment of external costs ignores collection and transport impacts as these will be similar whether sent to landfill or for recycling.

Source	Estimate	Note
Covec (2007)	NS$10-60	In 2007 the New Zealand Ministry for the Environment commissioned a cost-benefit analysis of recycling[119]. The study by Covec estimates the external costs of landfilling at around NZ$10-$60 per tonne of waste landfilled. The estimates cover avoided disamenity impacts, greenhouse gases and leachate.
Productivity Commission (2006)	$0-24	In 2006 the Productivity Commission examined the external costs of landfill as part of its Inquiry into Waste Generation and Resource Efficiency in Australia. The Productivity Commission examined a range of estimates including the value of avoided air and water emission benefits at landfills inferred using 'eco-dollars'. 'Eco-dollars' is a proprietary tool for the monetary valuation of environmental impacts associated with changes in waste management. The initial estimates were developed by Nolan-ITU as part of an *Independent Assessment of Kerbside Recycling in Australia* (Nolan-ITU/SKM) in 2001. The Productivity Commission reviewed the basis of the Nolan-ITU eco-dollar values and concluded they were 'implausibly high'[120]. This was attributed to • the inclusion of estimates based on the *potential* impacts of pollution without any risk adjustment for the *expected* impact; and • valuing all pollution as if it occurred in a large metropolitan area where human health costs of pollution are relatively high. The Productivity Commission identified the value of avoided air and water emission benefits at landfills inferred using the 'eco-dollar' approach was between $89 and $182 per tonne. When correcting for the factors identified above, the Productivity Commission estimated that the environmental benefits were more likely in the order of $0 to $5 per tonne.

Source: BDA and WCS (2010) *Beverage Container Investigation;* BDA (2009) *The full cost of landfill disposal in Australia*; European Commission (2000) *A study on the economic valuation of environmental externalities from landfill disposal and incineration of waste*, undertaken by COWI Consulting Engineers and Planners AS; Porter (2001) *The Economics of Waste, Resource for the Future*; Enviros Consulting (2004) *Valuation of the external costs and benefits to health and environment of waste management options*, Final Report for DEFRA; Davies and Doble (2004) *The Development and implementation of a landfill tax in the UK, in Addressing the Economics of Waste*, OECD; Covec (2007) *Recycling: Cost Benefit Analysis*, prepared for the New Zealand Ministry for the Environment; Productivity Commission (2006) *Waste Management Report*, Report no 38, Canberra

Note: Overseas estimates have been left in their original currency

[119] Covec 2007

[120] Productivity Commission 2006, page 425

Appendix H Landfill operating costs

The table below presents alternative estimates of landfill operating costs in Australia:

Table H.1 – Alternative estimates of the landfill operating costs in Australia

Source	Estimate ($/tonne)	Note
Boomerang Alliance (2008)	N/A	Boomerang estimates that the current cost of land filling containers is $37,960,132
BDA and WCS (2010)	40	BDA based avoided landfill costs on an average $40 per tonne gate fee (excluding government levies). "Landfill costs are estimated at an average $40 per tonne based on the average distance to landfill, landfill gate fee, truck costs and wages costs. Landfill costs do not include the landfill levy, which is a transfer cost between parties, not an economic cost." (Appendix 7)
National Waste Policy	42-102	• The National Waste Policy used a midpoint of BDA's 2009 estimate for calculating the cost per tonne for putrescibles waste ($42 per tonne). They also conducted sensitivity testing using the high estimate of $102 per tonne
Waste Management Association of Australia	25	The Waste Management Association of Australia (WMAA) have estimated some of the direct costs of landfills, relating chiefly to the operating and capital costs required to operate a landfill. These are listed below (excluding levies, management costs, profit margin and GST): • $2 per tonne for land purchase including airspace; • $2 per tonne for approvals and site development; • $6.50 per tonne for cell development; • $10 per tonne for operation including monitoring and fees; • $2.50 per tonne for capping and rehabilitation; and • $2 per tonne for aftercare."

Source: Boomerang Alliance (2008) *Financial Analysis of Costs and Benefits of a National Container Deposit Scheme*; BDA and WCS (2010) *Beverage Container Investigation*, Australian Government (2010) *National Waste Policy*, p 160

Appendix I Litter clean up costs

The table below presents alternative estimates of litter cleanup costs in Australia:

Table I.1 – Alternative estimates of litter clean up costs in Australia

Source	Estimate	Note
Sustainability Victoria (2010)	$74 million $13.92 per person	• Overall cost of litter and street sweeping maintenance for local governments was over $74mill or $13.92 per person in Victoria o Maintenance of litter bins, traps and litter clean up cost just $25 million o Street sweeping services cost nearly $50 million a year (74% of this cost was metropolitan local governments) ($49,561,215) o Roadside litter and illegally dumped rubbish cost local governments in Victoria nearly $6 million annually to collect
Boomerang Alliance (2008)	$48 million	• Boomerang estimates that the CDS could result in a saving of $48mill p.a in litter clean up costs. • They estimated that containers make up 28.38% of litter volume and therefore, the cost of litter abatement of containers is $58,760,000
Water WA (2006)	$66 per kerb km	• Used an upper bound estimate that street sweeping in Western Australia cost $66 per kerb km (based on monthly clean up) • Indicative costs were reported from the Town of Victoria Park in Perth (population 27,500 people and approximately 17.6km^2), it cost $130,000 for one street sweeper to collect 720-1080 tonnes of waste (main roads swept fortnightly, residential streets monthly)
BDA and WCS (2010)	$100,000 per council	• The average annual expenditure was calculated at just under $100,000 per year per Council, with the amount spent annually increasing in proportion to population size (this was calculated from the Nolan-ITU report and the McGregor marketing report)
Nolan-ITU (2002)	$16.5 million	• Nolan-ITU[121] in 2002 undertook an investigation of the costs borne by key players in WA litter abatement, including Local Government, State Government and non-government organisations (NGOs) with a litter-related mandate. • Nolan-ITU caution that the estimate of direct costs to managing litter in WA is conservative as '*it does not take into account many other direct costs associated with litter management such as those incurred by special event organisers, shopping centres, transport authorities and National Parks to name a few*'. • This results in a Nolan ITU estimate of $99,994 per council for litter abatement
McGregor Marketing (1994)	$105,061 per council	• The McGregor (1994) CPI adjusted (into 2010 $) Australian council average of $105,061 • Cited in Nolan-ITU (2002)
Brisbane City Council	$6 million	• BCC reports that they spend more than $6 million per year on litter clean up

Source: Sustainability Victoria (2010) *Annual Local Government Survey*, p 5; Boomerang Alliance (2008) *Financial Analysis of Costs and Benefits of a National Container Deposit Scheme*: Water WA (2006) *Stormwater Management Manual for Western Australia*; Nolan-ITU (2002) *Western Australian Local Government Association Litter Management Options in Western Australia*; Brisbane City Council (2010) *Litter costs*

[121] Nolan-ITU (2002), Western Australian Local Government Association Litter Management Options in Western Australia

Appendix J CDS co-benefits

Appendix J provides additional detail on the non-packaging items currently accepted at CDS infrastructure in South Australia.

Table J.1 – Depots and commodities handled at CDS depots in South Australia

Depot ● = Buy ● = Drop off	Deposit Containers	Wine Bottles	Newspaper	Cardboard	Car Batteries	Non-Deposit Plastic Bottles	HDPE Milk Non-Deposit	Non Ferrous Metals	Steel	Mixed Clean Plastics	Non Deposit Steel cans
Metropolitan											
Daws Road Edwardstown	●	●	●	●	●	●	●	●	●	●	●
Daws Road Oaklands Pk	●	●	●	●	●	●	●	●	●	●	●
North Plympton	●	●	●	●	●	●	●	●	●	●	●
Blackwood	●	●		Beer boxes only		●	●				
Brighton	● No glass										
Burton	●	●			●	●	●	●	●	●	●
Scouts Elizabeth West	●	●	●	●	●	●	●	●	●	●	●
Glen Osmond	●	●	●	●	●	●	●	●	●	●	●
Golden Grove	●	●	●	●	●	●	●	●	●	●	●
Hackham	●	●	●	●	●	●	●	●	●		●
Holden Hill	●	●	●	●	●	●	●	●	●		●
Lonsdale	●	●	●	●	●			●	● small quantities		●
Magill	●	●	●	●	●	●	●	●	●	●	●
Modbury North	●	●	●	●	●	●	●	●			●
Marlston	●	●	●	●		●	●	●			●
Newton	●	●	●	●	●	●	●	●		●	●
Scouts Greenfields	●	●	●	●	●	●	●	●	●	●	●
Welland	●	●	●	●	●	●	●	●	●		●
Scouts Payneham	●	●	●	●	●	●	●	●	●	●	●
Pooraka	●	●			●	●	●	●	●		●
Scouts Port Adelaide	●	●	●	●	●	●	●	●	●	●	●
Prospect	●	●				●	●				●
Royal Park	●	●			●	●	●				
Reynella	●	●			●	●	●	●			●
Scouts Salisbury	●	●	●	●	●	●	●	●	●	●	●
Seaford	●	●	●	●	●	●	●	●	●	●	●
Sheidow Park	●	●		Beer boxes only		●	●				
Scouts Munno Para	●	●	●	●	●	●	●	●	●	●	●
Thebarton	●	●				●	●				●
Welland	●	●	●	●	●	●	●	●	●		●
Scouts Willaston	●	●	●	●	●	●	●	●	●	●	●

Depot ● = Buy ● = Drop off	Deposit Containers	Wine Bottles	Newspaper	Cardboard	Car Batteries	Non-Deposit Plastic Bottles	HDPE Milk Non-Deposit	Non Ferrous Metals	Steel	Mixed Clean Plastics	Non Deposit Steel cans
Wingfield	●	●				●	●				●
Woodville South	●	●									
Riverland											
Angaston	●	●	●	●	●	●	●		●		●
Barmera	●	●	●	●		●	●			●	●
Berri	●	●	●	●		●	●				●
Blanchetown	●	●			●	●	●	●	●	●	●
Bowhill	●	●									
Eudunda	●	●				●	●				
Loxton	●	●	●	●	●	●	●	●	●	●	●
Mannum	●	●			●						
Murray Bridge	●	●	●	●	●	●	●				●
Wally's	●	●	●	●	●	●	●	●	●	●	●
Nildottie	●	●									
Renmark	●	●	●	●		●	●			●	●
Waikerie	●	●	●	●		●	●			●	●
South East											
Bordertown	●	●			●			●	●		
Kingston	●	●									
Lucindale	●	●									
Millicent	●	●	●	●		●	●			●	●
Naracoorte	●	●	●	●	●	●	●	●		●	●
Penola	●	●			●	●	●	●			●
Pinnaroo	●	●									
Robe	●	●		●		●	●				●
Keith	●	●			●			●	●		
Adelaide Hills											
Balhannah	●	●	●	●	●	●	●	●	●	●	●
Scouts Hahndorf	●	●	●	●	●	●	●	●	●	●	●
Mount Barker	●	●	● tied	Beer boxes only		●	●	●		●	●
Far North											
Broken Hill	●	●				●	●				●
Marree	●	●									
Oodnadatta	●	●			●						
Coober Pedy	●	●			●			●	●		
Quorn	●	●									
Roxby Downs	●	●	●	●	●			●	●		●
Fluerieu Peninsula											
Aldinga	●	●	●	●	●	●	●	●	●	●	●
Cape Jervis	●	●				●	●				●
Kingscote	●	●			●			●			
McLaren Vale	●	●	●		●	●	●				●
Miningee	●	●	●	●	●	●	●				●
Strathalbyn	●	●	●	●	●	●	●				●
Victor Harbor	●	●	●	●	●	●	●	●	●	●	●
Yankalilla	●	●	●	●	●	●	●	●	●	●	●
Goolwa	●	●	●	●	●	●	●	●	●	●	●
Mid North											
Burra	●	●									
Blinman	●	●									
Carrieton	●	●				●	●				
Clare	●	●			●			●	●		●
Hawker	●	●									
Jamestown	●	●									●
Leigh Creek	●	●				●	●				●
Murraytown	●										

Depot ● = Buy ● = Drop off	Deposit Containers	Wine Bottles	Newspaper	Cardboard	Car Batteries	Non-Deposit Plastic Bottles	HDPE Milk Non-Deposit	Non Ferrous Metals	Steel	Mixed Clean Plastics	Non Deposit Steel cans
Orroroo	●	●									
Peterborough	●	●									
Eyre Peninsula											
Cleve	●	●				●	●			●	●
Ceduna	●	●			●	●	●	●		●	●
Cowell	●	●									
Cummins	●	●									
Darke Peak	●										
Elliston	●	●									
Kimba	●	●									
Port Augusta	●	●									
Port Lincoln	●	●									
Port Neill	●	●									
Hamilton	●	●		Beer	●	●	●	●	●		●
Aldinga				boxes							
Streaky Bay	●	●									
Tumby Bay	●	●		●							
Whyalla	●	●	●	●		●	●			●	●
Wudinna	●	●			●	●	●	●		●	●
Lock	●	●					●				
Yorke Peninsula											
Minlaton	●	●									
Owen	●	●									
Port Broughton	●	●			●			●	●		●
Stansbury	●	●			●			●	●		●
Warooka	●	●									
Scotty's Warooka	● no glass										

Source: Recyclers of South Australia, *Depots and Commodities Handled*, available at: http://www.recyclesa.com.au/

pwc.com.au
wrightstrategy.com

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