



## **Burnside Bio-Organics Trial: Diverting Food Waste From Landfill**



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## **EXECUTIVE SUMMARY**

In light of South Australia's municipal waste diversion target of 75% of waste from landfill by 2010, the Burnside Bio-Organics Trial, involving 1,775 households was undertaken to assess the suitability of new technologies and changes in residents' behaviours to divert food waste from landfill.

By utilising a ventilated kitchen bench-top bin and compostable (and porous) bin-liner-bag which enabled aeration, residents diverted food waste from their 'normal' waste bin into the Burnside Bio-basket with "little or no odour" being generated. The food scraps enclosed within the bin-liner-bag were then placed into the green organics stream, which was collected and successfully processed into compost.

The trial results show that an additional 8.6% of waste was diverted from landfill.

Reflection on the trial components such as the communication strategies and green organics bin ownership rates suggests that diversion rates could be increased through rejuvenation of the 'household recycling culture' to incorporate food waste.

## **INTRODUCTION**

In 2004 the State of South Australia developed a strategic plan to reduce waste to landfill. The 'Zero Waste' plan set a waste diversion from landfill target of 75%, to be achieved by municipalities by 2010.

Whilst the City of Burnside leads South Australia in diverting 56% of its total waste stream from landfill, the 75% target will be difficult to meet.

### **How Could Local Government Achieve This Very Ambitious Target?**

The Burnside Bio-Organics Trial was formulated by the City of Burnside in conjunction with project partners East Waste, Jeffries Group and Zero Waste South Australia (ZWSA), to assess the viability of diverting kitchen food waste from landfill, where it contributes to the generation of toxic landfill gases and leachates, to the more environmentally sustainable application of compost production and final use as topdressing and soil conditioner.

The trial utilised new technologies in bin and compostable bin-liner-bag manufacture and linked these technologies to existing waste infrastructure such as household wheelie bins (mobile garbage bins), waste collection trucks and 'green-waste' (garden clippings and prunings) processing, in order to determine the suitability of diverting kitchen food waste to achieve the 75% total waste diversion target by 2010.

Overlying the technology and infrastructure factors was the 'human factor'. The trial also assessed the behaviour of participants and their propensity to utilise the system and its associated infrastructure.

The trial was undertaken as if it were being implemented as a full scale initiative across the entire City of Burnside, so as to assess its suitability for broad scale application. More specifically, the trial outcomes enable better definition of the barriers to achieving the State Government target and highlight in greater detail what would be required in order to realise 75% diversion from landfill by 2010.

## **MATERIALS AND METHODS**

The Burnside Bio-Organics Trial was undertaken within the City of Burnside and comprised 1,775 households (or approximately 4,000 residents/10% of the City population) located across six suburbs.

The trial required residents to divert kitchen food scraps from the 'normal' rubbish bin by placing the food scraps in a kitchen bench-top bin coined a 'Burnside Bio-basket'<sup>i</sup>. The Burnside Bio-basket was lined with a compostable/biodegradable liner-bag, which was provided to residents with advice to remove it every two to three days and place it in the 'green-organics' bin for kerbside collection on a fortnightly basis.

East Waste undertook the fortnightly collection of the bio-organic material (green organics and food organics) and then transported it to the Jeffries Group for processing into compost.

### **The City of Burnside**

With a residential population of approximately 42,500 people, the City of Burnside is nestled between the foothills of the Mt Lofty ranges and the City of Adelaide in South Australia. It is renowned for its green and leafy streetscapes, quiet residential neighbourhoods, historical areas and natural environments.

Compared to the South Australian average, Burnside has a higher percentage of people aged 50 to 59 and 70 to 84; and a lower percentage of people aged 25 to 34 and infants 0 to 5, highlighting the relative 'older' population. Approximately 47% of Burnside's residents have a university of technical qualification, compared with 34% across the Adelaide metropolitan area.

### **Trial Area**

The trial area comprised the entire suburb of Erindale and parts of Kensington Gardens, Burnside, Kensington Park, Rosslyn Park and Hazelwood Park in South Australia.

The trial area selection was primarily based on its general representativeness of the broader community housing types and comprised 39% units and flats and 61% houses on traditional allotments.

By ensuring that the full spectrum of dwelling types were represented, the trial took into account potential variances of use of the system and green organics bin ownership (higher density dwelling types were less likely to own a green organics bin, as they would have less need for one, and less room to store it than a traditional dwelling).

Other secondary factors considered in the selection of the trial area included:

- Age of residents and their representativeness of the broader City population
- Ease of delineation of the collection areas
- Volume of vegetation (collection volumes provided by contractor)
- Timing of normal green organics collections (day & date)
- Existing collection regimes of East Waste

### **Burnside Bio-Basket**

The kitchen bench-top bin was coined as the 'Burnside Bio-basket' reflecting its basket-like ventilated construction (Figure 1). With a volume of approximately 6.6 litres this bin proved to be of an appropriate size to leave on the kitchen bench to maximise the recovery of food scraps and was adequate for most household needs.



**Figure 1: The Burnside Bio-basket**

Burnside Bio-baskets (along with printed information, bin stickers and liner-bags) were delivered to each household within the trial area 14 days prior to trial commencement. Each basket had a sticker on its lid, as a prompt for residents of acceptable items and contaminants.

### **Compostable Liner-Bags**

The compostable liner-bags were sourced from Norway<sup>ii</sup>. They are manufactured from biodegradable material based on cornstarch, vegetable oil and compostable polymers. When commercially composted with other organic materials, these bags have been shown to completely break down in approximately 30 days under European conditions.

The liner-bags are porous (16 micron in size) allowing for a transpiration rate of 1750 grams per m<sup>2</sup> per 24 hours, enabling aeration of food scraps and aerobic microbial activity, whilst maintaining waterproofness.

A roll of 100 liner-bags was delivered to residents (along with the Burnside Bio-basket) that provided for seven months use (at a rate of use of up to one liner-bag for every two days).

At the time of delivery the first bag of every roll was placed in the basket to demonstrate how the system worked.



**Figure 2: The Compostable Liner-bag**

### **Green Organics Bin**

Compostable liner-bags containing food scraps were placed in the green organics bin by residents for collection on a fortnightly basis.

Burnside residents purchase their own green organics bins – the Council does not provide them. Green organics bins, therefore, were made available free of charge for the duration of the trial for residents who did not own a green organics bin.

A sticker for green organics bins was included with the information packs. Residents were encouraged to place the sticker on the lid of their green organics bin in order to:

- Act as a reminder to residents and garden contractors regarding contamination
- Raise awareness in the local community of the trial and encourage participation amongst neighbours.

### **Kerbside Collection**

Burnside has a monthly green organics collection service. Residents can opt to purchase a second 'user pays' service that occurs two weeks after the standard service.

For the purposes of the trial a fortnightly collection service was provided in the trial area to address concerns associated with perishable food items remaining in bins for up to one month.

To enable synergy of trial collection with the broader City collection regimes, half of the trial area was collected on a Tuesday with the remainder of the trial area collected on the alternate (and following) Tuesday.

### **Residual Waste Stream Composition**

Based on a 2004 audit of the Burnside waste and recycling streams, it was identified that 54% of the material presented for collection in the residual waste stream was organic in nature and could potentially be composted rather than disposed of to landfill.

A breakdown of the total tonnages of waste shows that 7,500 tonnes is disposed of to landfill whilst 4,800 tonnes is recycled and a further 4,400 tonnes is diverted into the green organics stream.

### **Waste Stream Auditing**

Six organics audits were undertaken as part of the trial: September 2005 (pre-trial), October, November, December, January 2006, February and March to determine:

- Household participation rates in the trial
- Organic diversion rates
- Remaining organic material in residual waste
- Contamination rates within liner-bags
- Contamination rates within green organics bins

The trial was conducted over the warmer months of spring and summer to test the system under Australian summer conditions, this period included the festive season which also allowed assessment of the system's capacity (Adelaide typically experiences peak green organics volumes from October through to February).

The trial audits involved sampling of the waste and green organics stream over a seven-month period. The audits involved detailed assessment of both organic and residual material presented by 245 dwellings (13.8% of the trial area). The entire auditing process included 219 green organic bins and 246 residual waste bins.

Discrete samples (households) were randomly selected, however, it was ensured that the total number of samples collected was proportionately representative of the housing types in the trial area (i.e. 39% units and flats and 61% houses on traditional allotments).

The audit process completed by Council involved manual collection and sorting. Whilst the sampling frequency was developed specifically for the trial, the waste measurement (by weight) and recording methodologies were based on the Zero Waste SA (ZWSA) "Guide to Kerbside Performance Reporting" 2005.

### **A. Participation Rates**

Participation rates were recorded as part of the audits.

Households were deemed as participants in the trial if they placed food waste in the green organics bin.

Households were deemed as non-participants in the trial if they placed food waste in the residual waste bin, AND did not place food waste in the green organics bin for collection.

### **B. Diversion Of Food Organics**

Food organics present in both the green organics bin and the residual waste bin were measured by weight as part of the audit. This provided a percentage of how much of the food waste stream was being diverted into the green organics stream.

The audit process was unable to capture the amount of food waste diverted from landfill by those residents composting their food waste at home (because the samples were collected at kerbside only).

### **C. Contamination**

Contamination (or the presence of non-organic material) of the bio-organics stream was assessed both in the green organics bin and also in the bin liner-bag. Non-organic material was measured by weight.

Project partners the Jeffries Group, upon receipt of each truckload of bio-organics, also assessed contamination rates on a visual basis.

### **D. Odour**

A Nasal Ranger Field Olfactometer was utilised to assess odour generation at both the residual waste bin and the green organics bin for comparison purposes<sup>iii</sup>. This relatively simple device utilises carbon filters to allow the user to record qualitative measurements by 'sniffing' odour levels.

15 green organics bins comprising food waste and 28 residual waste bins (of non-participants) were sampled for comparison purposes.

## **Communications Strategy**

A communications strategy was developed and assessed as part of the trial. It was implemented as if it was for broad scale application across the City.

The communication strategy aimed to:

- Inform residents of the purpose and objectives of the trial
- Inform residents of the application of the technology
- Encourage residents to change their disposal habits and utilise the Burnside Bio-basket
- Encourage residents to place the liner-bags in the green organics bin
- Inform residents about the change in green organics bin collection frequency from the existing monthly service to a fortnightly basis

- Inform and remind residents of what should be placed in the liner-bags and what shouldn't

The strategy comprised:

- A media release (including television news)
- Personally addressed letters sent to all households within the trial area introducing the project and outlining its objectives in August 2005
- An information pack, which was included inside the Burnside Bio-baskets upon their delivery to all households within the trial area. The pack contained:
  - A sticker each for the green organics bin (Figure 3) and the Burnside Bio-basket (outlining what should and shouldn't be placed in the organics stream)
  - A letter outlining the details of the changed collection frequencies
  - A brochure that pictorially demonstrated how to use the system which included a section for 'common questions and answers'
  - Invitations to information sessions, and
  - A 'hotline' phone number for residents to call if they had any further questions
- Four information sessions conducted at the Civic Centre and in a venue located within the trial area. These sessions were designed to demonstrate the use of the system and provide an opportunity for residents to gain more detail from the project partners
- A hotline number for any enquiries
- A letter sent prior to Christmas, reminding residents to utilise the system and minimize contamination.



Figure 3: The Green Organics Bin Lid Sticker

### Participant Behaviour Surveys

An independent and statistically representative telephone survey was conducted of residents within the trial area during March 2006 to gain greater insight into their opinions and behaviors associated with using the system. This was complemented by face-to-face interviews that were undertaken to ensure that a representative number of rental premises were included.

Additionally two focus groups were held to gain even more detailed understanding of attitudes and behaviours of traditional homeowners and unit/flat owners.

Three hundred and seventeen (317) residents were interviewed as part of the telephone and face-to-face survey, approximately 18% of the trial population (based on number of households).

The survey assessed:

- Awareness and understanding of the system
- Patterns of use
- Predicted future of use
- Barriers to using the system and experiences of users
- Other aspects of behaviour relating to household waste disposal

### **Processing of Bio-Organic Material**

The bio-organic material collected from the trial area was processed by project partner the Jeffries Group in accordance with Australian Standard AS4454-2003<sup>iv</sup>.

Special licenses were obtained to allow composting of putrescible material in uncontained windrows at the Jeffries facility located at Buckland Park, South Australia.

Upon receipt of the bio-organic material, it was immediately weighed and unloaded into an isolated area where it was assessed visually for contamination and composition. Identified contamination was removed by hand prior to it being shredded and tested for C:N ratio, moisture content, porosity and subject to a bio-security check.

The shredded material was stockpiled into windrows (at 1/3 windrow height) before being capped (2/3 windrow height) by pure green organics material sourced from outside of the trial area, which acted as a bio-security and odour control measure. The capped windrow was then left for approximately one week to enable intensive full heat destruction and stabilisation of the food content and liner-bags, achieved by maintaining the internal temperature of the windrow (measured at 500 – 600mm depth) at 55 degrees Celsius for at least 72 consecutive hours before further processing.

Subsequent turning of the windrow was undertaken using a 'Topturn X53', a machine that straddles the windrow and inverts the material as it passes down the length of the windrow ensuring even temperature, moisture and aeration. The Topturn added water directly into the mixing zone, which achieved the generation of optimum aerobic microbial activity in order to break-down the organic material and destroy weed seeds and pathogenic organisms.

The moisture content of the windrow was maintained in the range of 40% to 50%.

## **RESULTS AND DISCUSSION**

### **Participation Rates**

Kerbside audit results show that 75% of households present a green organics bin at kerbside for collection. Of those presenting a green organics bin at kerbside, 80% placed food waste in the green organics bin (i.e. used the system). This suggests, that for the audited trial area, 60% (80% of 75%) of households used the system.

What this figure does not show is the number of households that compost 100% of their food waste. Based on the audit results 11 of 245 households placed no food waste at kerbside (in either the green organics or residual waste bin).

### **Diversion Of Food Organics**

Overall (including non-participants) the kerbside audit results show that 36.3% of organic food waste material was diverted to the green organics stream.

Council's existing kerbside services divert 56% of material from landfill (i.e. 44% of total household waste goes to landfill). Based on previous audits 54% of Council's residual



waste material is organic, which represents 23.7% (3,970 tonnes) of the total waste stream (i.e. 54% of 44%).

Therefore, the system was successful in achieving an overall additional diversion of 8.6% (i.e. 36.3% diversion of the residual food waste 23.7%) of the total waste stream, raising it from 56% to 64.6%.

The average food waste presented in the green organics stream was 2.47kg per household per fortnight.

Those households using the system, however, used it very diligently as can be seen in the following graph (Figure 4), which shows that 38% of participating households (132) diverted more than 90% of the food waste from their residual waste bin into the green organics bin.

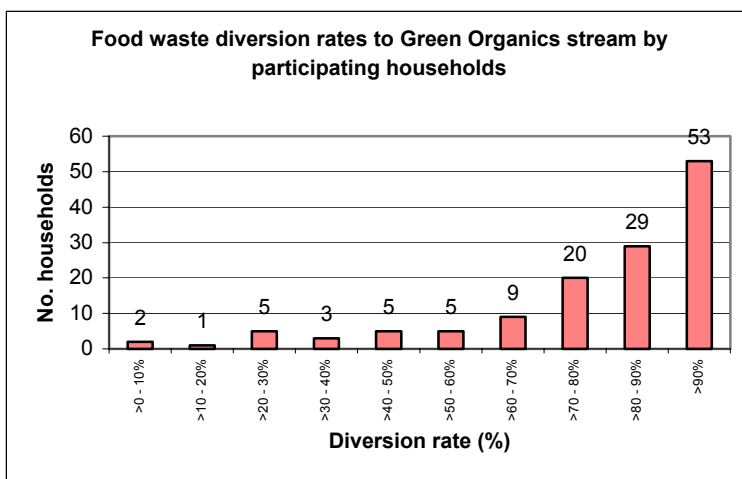


Figure 4: Diversion Rates

### Contamination Rates Present In The Green Organics Bin And Liner-Bags

Contamination rates of green organic bins was 2.79% by weight, this resulted from a contamination incident rate of 23%.

A contamination rate within the liner-bags was negligible by weight and where it was found to be present, predominantly comprised incidental wrappers (e.g. cling film).

Whilst contamination (non-organic material) is not a significant problem with green organics material derived from the City of Burnside collections, foreign material in loads of green organics represents a problem for processors, end users, with the cost and effort associated with its removal having been identified by industry in South Australia as an impediment to the long term viability of the product.

### Odour

Results of the qualitative assessment using the Nasal Ranger clearly indicated that the 'organic' odours were less noticeable within participants green organics bins (which had been presented on a fortnightly basis) when compared with non-participants waste bins (which had been presented on a weekly basis).

From an anecdotal point of view, only one complaint was reported during the trial period regarding odour.

Residents involved in the focus groups also reported that there was "little or no odour" associated with the Burnside Bio-basket system.

These results suggest that a fortnightly collection of the bio-organics material is suitable, which would provide Local Governments with significant benefits in terms of collection costs.

### **Communications Strategy**

Results of the survey showed that knowledge of the Bio-basket was almost universal at 98%, indicating that the communications strategy was successful in raising awareness within the trial area.

Further to this, the great majority of survey respondents (93%) felt that the information supplied was at least “adequate”, and most of these (71%) were of the opinion that the information supplied was “well presented”.

### **Survey Results**

The independent survey results showed:

#### **A. Awareness And Understanding:**

- Awareness of the Bio-basket was almost universal at 98%
- 89% of respondents were correct in saying that the bags from the Burnside Bio-basket should go in the green organics bin

#### **B. Patterns Of Use:**

- 84% of respondents indicated that they had used the Burnside Bio-basket system
- 77% of respondents were still using the system at the time of the survey interview
- The mean number of liner-bags used per week (by the respondents still using the system at the time of the interview) was 3.2 bags
- Over half of the current users claimed to use the system for everything possible (56%). A further 23% used it for most things. No current user said that they hardly used the system
- In half of the participating households where the Burnside Bio-basket system was used, it was used by everyone. About one third of households had only one user
- Where other users were present, 88% of current users felt that other household members understood how to use the system.

#### **C. Predicted Future Use:**

- The proportion of those who had already used the Burnside Bio-basket system and indicated they were likely to continue to do so was high (93%), with only 6% saying they would be unlikely to continue
- Amongst non-users, the response was quite different. 21% of this subgroup were likely to continue using the system, while 74% said they would be unlikely to continue
- 38% of respondents stated that it was likely they would buy compost produced from the Burnside Bio-basket system, including 15% who felt it would be very likely.

#### **D. Barriers To Using The System And Difficulties Encountered By Users:**

- 75% of current and former users felt there were no problems with the Burnside Bio-basket system. Of the 25% who indicated specific problems, responses were fragmented, with no major negative perceptions emerging
- 81% of current users and 48% of former users found the system very easy to use. Most of the remainder indicated that it was quite easy. Only one current user and one former user found using the system difficult (quite difficult)

- When those respondents who have never used the Burnside Bio-basket system were asked why they had not, the only major response was that they already compost (36%). No major negative perceptions of the system were apparent
- Among the small group of people (22) who had stopped using the system, reasons cited included:
  - Didn't want rotting food in the kitchen (23%)
  - Haven't been at home (23%)
  - Green organics bin is smelly (18%)
  - Use own compost bin (14%).

#### E. Other Aspects Of Behaviour Relating To Household Waste:

- 95% of respondents have a green organics bin
- 87% of respondents who have a green organics bin put this bin out for collection on a fortnightly basis, 9% do so monthly and 4% less than monthly
- 77% of current users of the Burnside Bio-basket system and 57% of former users indicated that this experience had made them more aware of what can be put in the green organics bin
- 82% of all respondents regularly dispose of lawn clippings or garden prunings in their green organics bin. Other relatively popular responses were: spread on garden (26%); compost bin (20%); and garden contractor takes away (17%).

#### Bio-Basket And Bin Liner-Bags

As indicated in the survey results, 81% of current participants and 48% of former participants found the system very easy to use. Most of the remainder indicated that it was quite easy.

The system performed very well during the Australian summer months, highlighting the technology's suitability to Australian conditions. As indicated above, odour issues were negligible during the trial period. Mean temperatures for the duration of the trial are presented in the graph below (Figure 5).

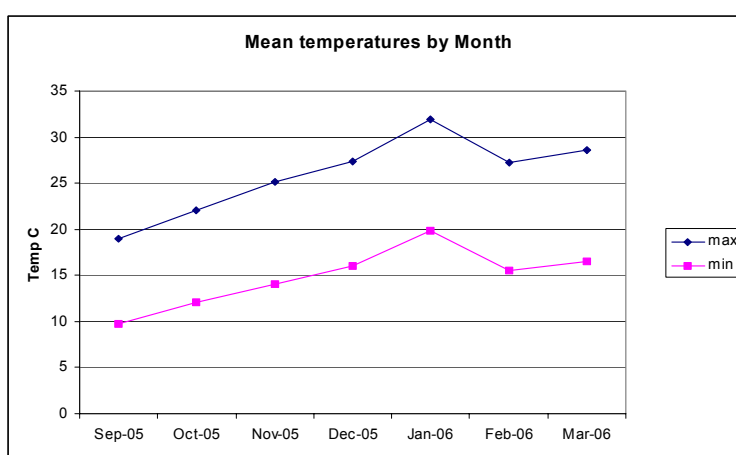


Figure 5: Temperatures During Trial

#### Green Organics Collection Frequency

Based on the qualitative odour assessment that indicated levels of 'organic' odours were less in the participating green organics bins than the residual waste bins of non-participants, the fortnightly collection regime was adequate in frequency.

Bio-security checks undertaken by Jeffries also indicated that a fortnightly collection frequency did not give rise to any concerns.

## Processing

Project partners the Jeffries Group have reported that full compliance was achieved for windrow temperature, moisture and oxygen content, odour levels, surface water and that decomposition of food waste and liner-bags occurred within seven days of stockpiling.

## Costs

One of the largest barriers for Local Government in implementing this system broadly are the costs associated with the Burnside Bio-baskets, compostable bin liner-bags and additionally, the increase in volume and rates for processing of the bio-organic material.

The following Table 1 outlines the costs associated with implementation of a trial across the City of Burnside. The rates listed are for this trial only and may differ from commercial rates, where economies of scale may apply.

Bio-basket (each)	\$10.00	
City wide @ 18,340 households		\$183,400
Liner-bags (each)	\$0.06	
City wide @ 4 bags per household per week		\$228,883
Additional costs for bio-organics processing (\$/tonne)	\$8.62	
Tonnes for processing (4,400t <sup>v</sup> green organics + 1,178t food waste)	5,578t	
Additional processing costs per year		\$48,082
Bio-organics diverted from landfill		
Disposal to landfill (\$/tonne)	\$50	
Tonnes of food waste diverted City wide	1,178t	
Savings arising from reduced disposal		(\$58,900)
<b>Total Cost Start-up in the City of Burnside</b>		<b>\$401,465</b>
<b>Total Subsequent Annual Cost in the City of Burnside</b>		<b>\$218,065</b>

NB: These costs do not include distribution of Bio-baskets and liner-bags, communication or project management costs.

## CONCLUSION

How could Local Government achieve the very ambitious target set by the South Australian Government of diverting 75% of waste from landfill?

The Burnside Bio-basket trial assessed the suitability of new technologies in bin and compostable bin-liner bag manufacture to capture household food waste traditionally disposed of in the residual waste stream. It also assessed the suitability of the green organics waste stream to receive the diverted food waste and technologies for its processing as a bio-organic material. Resident behaviour was also assessed to gain an understanding of the ease-of-use of the system and the propensity to change traditional disposal habits.

The trial area was selected based on its general representativeness of the housing types across the City of Burnside (61% traditional house allotments and 39% units and flats).

Waste audits undertaken as part of the trial showed that 60% of households used the system resulting in an increase in the total waste diversion rate from 56% to 64.6%, an overall increase of 8.6%.

When considering just those households that used the system, the audit results suggest that they did so effectively (38% of those participating households diverted more than 90% of their food waste). Encouraging households to use the system, therefore, is integral to increasing the diversion rate.

Independent surveys of residents within the trial area showed that the awareness of the system was almost universal (98%) and that a large majority knew that the food waste should ultimately be disposed of in the green organics bin (89%). Further, 81% of current users of the system and 48% of former users found that the system was “very easy to use”; with most of the remainder indicating that the system was “quite easy to use”.

The surveys also showed that 77% of residents were using the system, which interestingly, is 17% higher than that determined through the waste auditing process (60%).

Anecdotal evidence and focus group outcomes suggested that there was “little to no odour” associated with using the system.

The processing of the Bio-organic material in windrows by project partner the Jeffries Group was shown to be fully compliant with AS4454-2003 and that complete breakdown of food material and bin-liners occurred within seven days of treatment.

An assessment of the costs associated with implementing the system on a City-wide basis within Burnside showed that whilst there was additional processing costs, this was accounted for by the reduction in weight of residual waste to landfill. After implementation, the ongoing provision of compostable bin liner-bags per year for Burnside would be \$230,000. This is a significant barrier, but one that could be overcome by implementation of “no plastic bag” legislation and resultant widespread use of compostable bags (e.g. for shopping).

## **SUMMARY**

The project was successful in demonstrating that an additional 8.6% (2.47kg per household per fortnight) of waste was diverted from landfill for a small capital outlay (purchase of Burnside Bio-baskets), use of the existing green organics waste stream infrastructure (bins) and limited investment in communication strategies. Economic barriers exist in relation to the compostable bin-liner bags, which call for further State and/or legislative support.

Some of the other key successes of the trial also demonstrated:

- That the technology worked well under Australian conditions
- A fortnightly collection regime would be appropriate
- That the system can work effectively through partnerships with other agencies
- That household participation overall was 60%

Stronger encouragement, saturated green organics bin ownership rates and the rejuvenation of the ‘household recycling culture’ to include food waste, would likely see the overall participation rate and subsequently, diversion rate increase significantly to approximate the South Australian Municipal target of 75% diversion from landfill by 2010.

## **ACKNOWLEDGEMENTS**

The City of Burnside acknowledges the substantial contribution of all project partners. Without their funding and in-kind contributions and commitment, this trial would not have been feasible.

**Lead Agent: City of Burnside**

**Processing Partner: Jeffries Group**

**Funding Partner: Zero Waste SA**

**Collection Partner: East Waste**

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<sup>i</sup> Manufactured by PolarGruppen of Norway

<sup>ii</sup> Bio-Film bags imported by AusAsia Link Pty Ltd

<sup>iii</sup> Thanks to the South Australian Environment Protection Agency (Air Quality Division) for the use of their equipment

<sup>iv</sup> AS4454 – Composts, soil conditioners and mulches. Standards Australia.

<sup>v</sup> Burnside currently processes 4,400 tonnes of green organics material per year