WASTE GENERATION IN THE WA HOSPITALITY INDUSTRY

4/5 STAR HOTEL SECTOR

For

THE WA DEPARTMENT OF ENVIRONMENT & CONSERVATION

CONDUCTED BY
HOFSTEDE & ASSOCIATES

2008
EXECUTIVE SUMMARY

The hospitality industry is a significant waste generator and there is some evidence of low waste minimisation and recycling activities. This project initiated by Hofstede & Associates in response to a call by the Department of Environment and Conservation to investigate waste generation and diversion activities in the hospitality industry.

Hofstede & Associates proposed to investigate waste generation in the hospitality industry by focusing on several distinct sectors of the industry; including hotels; bars & clubs; sports clubs; cafés & restaurants; and events venues.

The sector investigated in the current project was the Four- and Five-star Hotel sector. Hofstede & Associates conducted an investigation and waste audit of the sector by sampling a medium sized hotel, considered representative of the sector.

Findings
The sector generates 11,749 tonnes (72,941 cubic metres) of waste annually. Of this 7,707 tonnes (49,590 cubic metres) is generated through normal daily operations and sent to landfill. An additional 3,595 tonnes (21,208 cubic metres) of recyclables are diverted from daily waste and collected for recycling. In addition to regular collections of recyclables and landfill waste, ‘bulk waste’ mainly arising from renovations or refits is sent to landfill intermittently. This amounts to 447 tonnes (2,143 cubic metres) per annum.

Maximising source separation of recyclables and introducing separate collection of recyclable waste, combined would reduce daily landfilled waste by 91.5% to 652 tonnes per year. Full source separation of recyclables requires a great deal of space.

Diversion of bulk waste from landfill is impeded by difficulty in finding recipients (such as charities) for re-usable items.

Recommendations
Promotion of on-site volume reduction of recyclable materials could increase source separation, while potentially providing cost and space benefits for hotels.

Research and promotion of commercial composting operations targeting hospitality waste.

Establishment of an information service which connects hotels with recipients for used items such as furniture.
TABLE OF CONTENTS

1 INTRODUCTION .............................................................................................................................. 4
   1.1 OBJECTIVES .......................................................................................................................... 4
   1.2 WASTE AUDIT HOSTS ........................................................................................................... 4
   1.3 4/5-STAR HOTEL SECTOR IN WESTERN AUSTRALIA ........................................................... 5
   1.4 COMPONENTS OF THE STUDY ............................................................................................... 5
       1.4.1 Daily Waste ...................................................................................................................... 1
       1.4.2 Bulk Waste ..................................................................................................................... 5
2 FINDINGS ......................................................................................................................................... 6
   2.1 OVERVIEW ............................................................................................................................. 6
   2.2 DAILY WASTE ......................................................................................................................... 7
       2.2.1 Amount of Daily waste by weight ...................................................................................... 7
       2.2.2 Volume of daily waste ...................................................................................................... 8
       2.2.3 Breakdown of Landfilled Daily Waste (tonnes) ................................................................. 9
       2.2.4 Breakdown of Landfilled Daily Waste (cubic metres) ..................................................... 10
   2.3 BULK WASTE ......................................................................................................................... 10
3 GREENHOUSE GAS EMISSIONS ...................................................................................................... 11
4 POTENTIAL TO INCREASE WASTE DIVERSION ......................................................................... 12
   4.1 DAILY WASTE ....................................................................................................................... 12
       4.1.1 Potential diversion by weight ............................................................................................ 12
       4.1.2 Potential Diversion by volume .......................................................................................... 13
   4.2 BULK WASTE ........................................................................................................................ 14
5 OPPORTUNITIES & BARRIERS ....................................................................................................... 15
   5.1 RECYCLABLES ....................................................................................................................... 15
   5.2 COMPOSTABLES ..................................................................................................................... 18
   5.3 RE-USABLE BULK WASTE ..................................................................................................... 18
6 RECOMMENDATIONS .................................................................................................................... 19
   6.1 RECYCLABLES ....................................................................................................................... 19
   6.2 COMPOSTABLES ..................................................................................................................... 19
   6.3 RE-USABLE BULK WASTE ..................................................................................................... 19
7 APPENDIX ....................................................................................................................................... 20
   7.1 WASTE CHARACTERISATION ................................................................................................. 20
8 BIBLIOGRAPHY ............................................................................................................................... 20

LIST OF TABLES

Table 2-1 BULK WASTE SENT TO LANDFILL ................................................................................... 6
Table 2-2 WEIGHT OF WASTE GENERATED BY 4/5-STAR HOTELS THROUGH DAILY OPERATIONS ......................................................... 7
Table 2-3 PERCENT WEIGHT OF WASTE PRODUCED BY 4/5-STAR HOTELS THROUGH DAILY OPERATIONS ................................. 7
Table 2-4 VOLUME OF WASTE PRODUCED BY 4/5-STAR HOTELS THROUGH DAILY OPERATIONS ........................................................ 8
Table 2-5 PERCENT VOLUME OF WASTE PRODUCED BY 4/5-STAR HOTELS THROUGH DAILY OPERATIONS ........................................... 8
Table 2-6 BULK WASTE SENT TO LANDFILL ................................................................................... 10
Table 3-1 ............................................................................................................................... 11
Table 7-1 WASTE FRACTIONS USED IN THE PHYSICAL AUDIT TO CHARACTERISE WASTE GENERATED THROUGH DAILY HOTEL OPERATIONS AND SENT TO LANDFILL ............................................................................. 20
LIST OF FIGURES

FIGURE 2-1   TOTAL WASTE GENERATED BY WEST AUSTRALIAN FOUR-STAR AND FIVE-STAR HOTELS ANNually, including daily general waste, separated recyclables and bulk general waste. ........................................... 6
FIGURE 2-2   COMPOSITION BY WEIGHT OF DAILY WASTE FROM THE 4- AND 5- STAR HOTEL SECTOR IN WESTERN AUSTRALIA WHICH IS SENT TO LANDFILL EACH YEAR. .................................................. 9
FIGURE 2-3   COMPOSITION IN CUBIC METRES OF DAILY WASTE FROM 4- AND 5- STAR HOTEL SECTOR IN WESTERN AUSTRALIA WHICH IS SENT TO LANDFILL EACH YEAR. ................................................................. 10
FIGURE 4-1   CURRENT WASTE DIVERSION VERSUS POTENTIAL DIVERSION BY WEIGHT ............................................. 12
FIGURE 4-2   CURRENT WASTE DIVERSION VERSUS POTENTIAL DIVERSION BY VOLUME ............................................. 13

LIST OF PLATES

PLATE 1   WEIGHING WASTE FRACTIONS DURING THE PHYSICAL AUDIT. .......................................................... 5
PLATE 2   FOOD WASTE SEPARATED DURING PHYSICAL AUDIT. DUE TO THE LARGE QUANTITIES OF FOOD WASTE, COMPOSTABLES ACCOUNT FOR 62% BY WEIGHT OF ALL LAND-FILLED WASTE. ................................................................. 9
PLATE 3   LOW DENSITY RECYCLABLES REMOVED FROM GENERAL WASTE STREAM DURING PHYSICAL AUDIT. ........ 10
PLATE 4   AN 80L BUCKET OF BOTTLES PRIOR TO GLASS CRUSHING. ..................................................................... 15
PLATE 5   A 20L CRATE OF GLASS CULLET (REDUCED FROM 80L OF BOTTLES) ......................................................... 15
PLATE 6   LOOSE CARDBOARD CLOGS THE WASTE MANAGEMENT AREA BECAUSE BALING WIRES FOR THE COMPACTOR HAD RUN OUT .................................................................................. 16
PLATE 7   CARDBOARD COMPACTOR .................................................................................................................. 17
PLATE 8   THE GLASS CRUSHER IS LOCATED CENTRALLY NEAR THE HOTEL BARS, ALLOWING VOLUME REDUCTION PRIOR TO REMOVAL THEREBY REDUCING TRIPS TO THE LOADING BAY ........................................................................ 17
**GLOSSARY**

<table>
<thead>
<tr>
<th>Compostables</th>
<th>Waste that is suitable for composting, including: food waste; organic garden waste; tissue paper &amp; other low-grade or wet paper.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recyclables</td>
<td>Items that can be collected separately for reprocessing into raw material for new items. Major constituents include: container glass, HDPE, PET, paper, &amp; cardboard. For a full list of constituents, see Table 7-1.</td>
</tr>
<tr>
<td>‘Non-recoverables’</td>
<td>Waste materials that are not suitable for composting or recycling collections. This category includes items which are: hazardous; consist of a material for which there is no viable recycling option; or consist of a mixture of materials which cannot reasonably be separated or cleaned.</td>
</tr>
<tr>
<td>general waste</td>
<td>Un-sorted waste that is sent to landfill.</td>
</tr>
<tr>
<td>daily general waste</td>
<td>General waste generated through normal daily operations.</td>
</tr>
<tr>
<td>Daily waste</td>
<td>Daily general waste PLUS separately collected recyclables generated through daily operations.</td>
</tr>
<tr>
<td>Bulk waste</td>
<td>Large bulk items for disposal such as beds, computers, waste materials from renovations, equipment, etc. Bulk waste may be generated in pulses, such as during major renovations, or accumulated onsite and disposed of as necessary.</td>
</tr>
<tr>
<td>Bulk general waste</td>
<td>Bulk waste that is sent to landfill, typically by ordering large waste skips as required.</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

This project is a collaboration between Hofstede & Associates and the Western Australian Department of Environment and Conservation. The project is funded by a grant from the WA DEC through the solid waste infrastructure support scheme (SWIS).

The project was instigated in order to obtain waste generation data in the hospitality industry and determine current recycling versus landfill disposal of hospitality waste. This data can form the basis to develop policy or incentives to increase the diversion of waste away from landfill and towards resource recovery.

1.1 OBJECTIVES

The ultimate objective of the project is to quantify waste generation in major sectors of the West Australian hospitality industry. In particular it is an investigation into:

- the amount waste going to landfill;
- the amount of waste that is currently diverted; and
- the maximum possible proportion of waste that can be diverted from landfill.

A number of distinct hospitality industry sectors have been identified which should be audited separately due to their different waste generation profiles:

- Hotel sector
- bars/nightclubs;
- sports clubs/ovals;
- special events venues; and
- restaurants/cafes.

1.2 WASTE AUDIT HOSTS

For each sector, the above information will be determined from an in-depth investigation of waste generation at a selected representative host enterprise. The immediate subject of the current project is the 4/5 Star Hotel sector of the Hospitality Industry. It has also been a pilot for audits of four other sectors.
1.3 4/5-STAR HOTEL SECTOR IN WESTERN AUSTRALIA

The host selected to represent all four- and five- star hotels in Western Australia is a medium to large sized hotel in Perth. It has multiple food and beverage outlets, including: a wine-bar and restaurant; a casual bar and restaurant; a sports bar; and a fully catered functions centre.

According to the Australian Bureau of Statistics and the Tourism Western Australia (the peak state government tourism body) the room capacity of all four-star and five-star establishments with five or more rooms stood at 11,271 as of December, 2007\(^1\). Based on number of rooms the host hotel represents approximately 2.5% of the market. While not all four star hotels may have the same restaurant capacity relative to the number of rooms, it is assumed that guests will generate an equivalent amount of restaurant waste in the vicinity of their accommodation by dining at nearby restaurants.

All values given in this report are on an annual basis for the whole 4/5-star sector in Western Australia.

1.4 COMPONENTS OF THE STUDY

1.4.1 DAILY WASTE

Daily waste is waste generated through normal daily operations. It has two sub-categories: daily general (landfilled) waste and source-separated recyclables. Daily waste is collected regularly and frequently – typically up to every day in the case of general waste and at least once a week for some types of separated recyclables.

Over a seven day period, Hofstede & Associates audited all daily general waste and all separated recyclables streams. Daily general waste was characterised according to a schedule of three categories (Recyclables, Compostables and Non-recoverable Waste) and 18 material types (see Appendix 7.1).

1.4.2 BULK WASTE

Bulk waste refers to large quantities of waste disposed of separately from daily general waste and recyclables. It typically arises from renovations, or renewal of commercial goods such as furniture and appliances. Bulk waste may be generated in large pulses or accumulated gradually. Bulk general waste, which is currently sent to landfill, was quantified by auditing historical waste removal invoices and furniture and IT replacement programs.

2 FINDINGS

2.1 OVERVIEW

Based on the current study, four and five-star hotels in Western Australia dispose of 11,749 tonnes or 72,941 cubic metres of waste annually to landfill or through scheduled recyclables collections. As can be seen in Figure 2-1, the largest stream is daily general waste. This is followed by source separated recycling, which comprises several categories, such as: cardboard; paper; and mixed recyclables including glass and certain plastics. Intermittent disposal of bulk waste is minor in comparison to daily operation waste.

![Figure 2-1 Total waste generated by West Australian four-star and five-star hotels annually, including daily general waste, separated recyclables and bulk general waste.](image)

<table>
<thead>
<tr>
<th></th>
<th>Tonnes per annum</th>
<th>Cubic metres per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfilled daily waste</td>
<td>7,707</td>
<td>49,590</td>
</tr>
<tr>
<td>Landfilled bulk waste</td>
<td>447</td>
<td>2,143</td>
</tr>
<tr>
<td>Recycling separated from daily waste</td>
<td>3,595</td>
<td>21,208</td>
</tr>
<tr>
<td>Total</td>
<td>11,749</td>
<td>72,941</td>
</tr>
</tbody>
</table>

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2.2 DAILY WASTE

2.2.1 AMOUNT OF DAILY WASTE BY WEIGHT

Daily waste stands at 11,302 tonnes per year including waste diverted from landfill. The total weight is broken down in Table 2-2 into waste type and current recovery. The subtotals in the right-hand column show current practice (landfill and diversion). 7,707 tonnes (68.2%) of this is sent to landfill.

The sub-totals in the bottom row show potential diversion. It is estimated that at least half of ‘Non-recoverable’ waste is suitable for energy recovery.

Table 2-2 Amount of waste generated by 4/5-Star hotels through daily operations.

<table>
<thead>
<tr>
<th>Current practice</th>
<th>Recyclables</th>
<th>Compostables</th>
<th>Non-recoverables</th>
<th>Sub-totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sent to landfill</td>
<td>1,891</td>
<td>5,163</td>
<td>652</td>
<td>7,707</td>
</tr>
<tr>
<td>Separated for recycling</td>
<td>3,595</td>
<td>-</td>
<td>0</td>
<td>3,595</td>
</tr>
<tr>
<td>Separated for composting</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sub-totals</td>
<td>5,486</td>
<td>5,163</td>
<td>652</td>
<td>Total Weight 11,302</td>
</tr>
</tbody>
</table>

Table 2-3 presents the information in Table 2-2 as percentages of all daily waste (i.e. including landfilled waste and separated recyclables).

Table 2-3 Weight in percent of waste produced by 4/5-Star hotels through daily operation.

<table>
<thead>
<tr>
<th>Current practice</th>
<th>Recyclables</th>
<th>Compostables</th>
<th>Non-recoverables</th>
<th>Sub-totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sent to landfill</td>
<td>16.7%</td>
<td>45.7%</td>
<td>5.8%</td>
<td>68.2%</td>
</tr>
<tr>
<td>Separated for recycling</td>
<td>31.8%</td>
<td>-</td>
<td>0.0%</td>
<td>31.8%</td>
</tr>
<tr>
<td>Separated for composting</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sub-totals</td>
<td>48.5%</td>
<td>45.7%</td>
<td>5.8%</td>
<td>Total Weight 100.0%</td>
</tr>
</tbody>
</table>
2.2.2 VOLUME OF DAILY WASTE

Whereas by weight the recyclables and compostables represent similar proportions of total waste, by volume recyclables make up the great majority at 51,843 cubic metres per year (73.2%). Compostables still make up a large volume at 16,779 cubic metres per year (23.7%). At 2,175 tonnes per year (3.1%), the total volume of ‘non-recoverables’ is relatively very small. It is estimated that at least 75% of this is in principle suitable for energy recovery.

One cubic metre of compostables was recorded as ‘separated for recyclables’. This refers to very minor contamination of source-separated recyclable paper with wet paper which was suitable only for composting.

Table 2-4  Volume of waste produced by 4/5-Star hotels through daily operations.

<table>
<thead>
<tr>
<th>Current practice</th>
<th>Recyclables</th>
<th>Compostables</th>
<th>Non-recoverables</th>
<th>Sub-totals ↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sent to landfill</td>
<td>30,636</td>
<td>16,779</td>
<td>2,175</td>
<td>49,590</td>
</tr>
<tr>
<td>Separated for recycling</td>
<td>21,207</td>
<td>-</td>
<td>1</td>
<td>21,208</td>
</tr>
<tr>
<td>Separated for composting</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sub-totals</td>
<td>51,843</td>
<td>16,779</td>
<td>2,175</td>
<td>Total volume 70,798</td>
</tr>
</tbody>
</table>

Table 2-5  Percent volume of waste produced by 4/5-Star hotels through daily operations.

<table>
<thead>
<tr>
<th>Current practice</th>
<th>Recyclables</th>
<th>Compostables</th>
<th>Non-recoverables</th>
<th>Sub-totals ↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sent to landfill</td>
<td>43.3%</td>
<td>23.7%</td>
<td>3.1%</td>
<td>70.0%</td>
</tr>
<tr>
<td>Separated for recycling</td>
<td>30.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>30.0%</td>
</tr>
<tr>
<td>Separated for composting</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Sub-totals</td>
<td>73.2%</td>
<td>23.7%</td>
<td>3.1%</td>
<td>Total volume 100.0%</td>
</tr>
</tbody>
</table>

2 The volume given for separated recyclables has been revised upwards to take into account volume reduction practices in place at the host hotel which are not widespread in the industry.
2.2.3 BREAKDOWN OF LANDFILLED DAILY WASTE (TONNES)

![Pie chart showing the breakdown of landfilled daily waste](image)

**Figure 2-2** Composition by weight of daily waste from the 4- and 5- Star hotel sector in Western Australia which is sent to landfill each year.

**Plate 2** Food waste separated during physical audit. Due to the large quantities of food waste, compostables account for 62% by weight of all land-filled waste.
2.2.4 BREAKDOWN OF LANDFILLED DAILY WASTE (CUBIC METRES)

By volume 49,590 cubic metres of waste is sent to landfill annually. Recyclable materials make up 62% (30,636 cubic metres), while compostable materials make up 34% (16,779 cubic metres). Of the 2,175 cubic metres of ‘non-recoverables’, an estimated three quarters would be suitable for energy recovery.

![Pie chart showing breakdown of daily waste](image)

Figure 2-3 Composition by volume of daily waste from 4- and 5- Star hotel sector in Western Australia which is sent to landfill each year.

2.3 BULK WASTE

Annually, 447 tonnes (2,143 cubic metres) of bulk waste is sent to landfill state wide by four- and five-star hotels. By comparison, this is approximately 4% of the weight of waste generated through daily operations.

<table>
<thead>
<tr>
<th>Landfilled bulk waste</th>
<th>Tonnes per annum</th>
<th>Cubic metres per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>447</td>
<td>2,143</td>
<td></td>
</tr>
</tbody>
</table>

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3 GREENHOUSE GAS EMISSIONS

The annual greenhouse gas emissions resulting from sending all waste from the 4/5-star hotel sector to landfill are calculated in Table 3-1 using the method and conversion factors outlined by the Australian Department of Climate Change (DCC) (DCC, 2008). The DCC gives conversion factors for the CO₂ equivalent (CO₂-e) of methane generated as a result of disposing of various waste types in well-managed municipal landfills. Calculations are omitted for waste fractions which do not generate greenhouse gases in landfill. It is assumed that no methane is recovered.

Table 3-1  Annual greenhouse gas (CO₂ equivalent) produced if all daily general waste from four- and five-star hotels in Western Australia is disposed of in municipal landfill.

<table>
<thead>
<tr>
<th>Waste Type</th>
<th>Tonnes of waste per year</th>
<th>CO₂-e conversion factor</th>
<th>CO₂-e per year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recyclables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High grade paper</td>
<td>222</td>
<td>2.5</td>
<td>556</td>
</tr>
<tr>
<td>Newspaper</td>
<td>171</td>
<td>2.5</td>
<td>427</td>
</tr>
<tr>
<td>Cardboard</td>
<td>44</td>
<td>2.5</td>
<td>109</td>
</tr>
<tr>
<td>Liquid paper cartons</td>
<td>48</td>
<td>2.5</td>
<td>119</td>
</tr>
<tr>
<td>Other paper &amp; card</td>
<td>143</td>
<td>2.5</td>
<td>357</td>
</tr>
<tr>
<td>Recyclable textiles</td>
<td>71</td>
<td>1.5</td>
<td>107</td>
</tr>
<tr>
<td><strong>Compostables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food waste</td>
<td>4,377</td>
<td>0.9</td>
<td>3,940</td>
</tr>
<tr>
<td>Garden waste</td>
<td>111</td>
<td>1.3</td>
<td>144</td>
</tr>
<tr>
<td>wet dirty paper</td>
<td>508</td>
<td>2.5</td>
<td>1,270</td>
</tr>
<tr>
<td>Paper hand-towels &amp; tissues</td>
<td>167</td>
<td>2.5</td>
<td>417</td>
</tr>
<tr>
<td><strong>Non-recoverables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual waste</td>
<td>651</td>
<td>0.9 *(x 0.2)</td>
<td>117</td>
</tr>
</tbody>
</table>

* (Approximately 20% of waste in this category was food which could not easily be separated from other materials)

Total Greenhouse Gas Emissions (CO₂-e): 7,563
4 POTENTIAL TO INCREASE WASTE DIVERSION

4.1 DAILY WASTE

4.1.1 POTENTIAL DIVERSION BY WEIGHT

Figure 4-1 compares current diversion (by weight) with three hypothetical scenarios for increased diversion. Implementing complete diversion of compostables would result in a 5,163 tonne per annum reduction in waste currently going to landfill. Maximising recovery of recyclables would result in a further reduction of 1891 tonnes. Full recovery of both recyclables and compostables would reduce daily waste to landfill by 92% by weight to 652 tonnes. When including intermittent bulk waste the overall reduction in waste equates to 87% to 1099 tonnes.

Figure 4-1 Current waste diversion versus potential diversion by weight.
4.1.2 POTENTIAL DIVERSION BY VOLUME

While it is traditional to quantify waste by weight, volume is the limiting factor in many stages of the disposal of waste and recyclables, including:

- Space restrictions at venues.
- Frequency and cost of transportation (economic cost and environmental cost of fuel consumption and CO$_2$ emissions).
- Viability of collecting separated recyclables for reprocessing.
- Space in landfill.

By volume, the potential increase in diversion for recyclables (Figure 4-2) is much larger than for compostables; there is potential to increase recovery of recyclables by 30,636 cubic metres per year. This would result in a 59% reduction by volume of total waste sent to landfill annually, bringing total recycling close to the current landfilled volume. Maximising recovery of compostables would result in a further reduction of 16,779 cubic metres (32%).

Full recovery of both recyclables and compostables would reduce waste to landfill by 96% by volume to 4,318 cubic metres (including daily waste and intermittent bulk waste).

Figure 4-2  Current waste diversion versus potential diversion by volume.
4.2 BULK WASTE

The amount of bulk waste sent to landfill depends on the success of hotels in finding alternative channels for the disposal of unwanted materials and items.

Waste materials from hotel maintenance activities is reduced by encouraging contractors to remove waste materials and replaced items from the site for disposal through their own company. This is particularly the case for recyclable materials such as metal. Some waste removed via informal channels – especially that removed by contractors – may still end up in landfill.

The quantity of reusable items such as furniture sent to landfill can be reduced by various means, including: giving them to staff; sale at auction; donation to second-hand dealers; and donation to charity. Typical examples of bulk waste include beds, televisions and computers. Disposing of these items can be very time consuming and depends on the hotel staff concerned finding recipients who are willing and able to take the items in question at the time they become available.

Example:

Used beds are a just one example of bulk waste. It was found that between 1996 and 2007 an average of 5.2% of all beds were replaced each year. Expanding this to the whole sector, and using typical dimensions for a queen size mattress and base, it was calculated that the sector generates 629 cubic metres of waste annually, just through regular replacement of beds – far in excess of recorded bulk waste sent to landfill by the sector. In the case of beds and many other items the rate of re-use depends on there being willing recipients of second-hand beds, and on the amount of effort that individual hotels devote to finding recipients.
5 OPPORTUNITIES & BARRIERS

There are significant opportunities for recovering large quantities of useful resources, thereby reducing waste-to-landfill and greenhouse gas emissions. In addition to direct environmental benefits, successful waste recovery programs in this sector would raise awareness for these types of programs in a number of groups, including: the hospitality industry; hospitality industry staff; corporate and individual customers; and the general public through environmental marketing by hotels.

5.1 RECYCLABLES

Opportunities

1. **Major gains possible through established recycling channels**

   As illustrated in Figure 4-1, full diversion of recyclables would decrease waste going to landfill by additional 1,891 tonnes per year (30,636 cubic metres - Figure 4-2). Most if not all of this can be disposed of through well-established collection services, such as for paper, cardboard and mixed recyclables (glass, PET, HDPE, etc).

2. **Reduction in greenhouse gas emissions**

   Maximum diversion of recyclable paper products would cut greenhouse emissions for the sector by 1,675 tonnes CO$_2$-e per annum.

3. **Volume reduction**

   Volume reduction can increase diversion from landfill by increasing the feasibility and appeal of recycling to hotels. In WA there is increasing uptake of devices which reduce the volume of container glass waste by 75% (Hofstede & Associates, unpublished data). Balers and shredders suitable for container plastics also exist. Advantages of volume reduction include:

   - Volume reduction of up to 80% is possible but can result in a high proportion of cullet which is too fine for recycling facilities’ equipment.

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• Source separation becomes more cost effective compared to landfill.
• Less space is required for waste storage
• Fewer kilometres travelled through collections from hotels and transport to recycling facilities (often inter-state). This reduces traffic congestion and vehicle emissions.
• Noise pollution normally associated with the disposal of bottles outside venues is eliminated.

Barriers
1. **Space**
   Total source separation of high-volume recyclables (food and drink containers) would require a great deal of space. Hotels would need to set the same disposal capacity for collecting recyclables as they have currently for landfill waste. This is without allowing for space for compostables, remaining landfill waste, or the fact that – in practice – there are likely to be multiple recyclables streams, each requiring their own infrastructure.

2. **Low volume of disposal containers for separated recyclables**
   Containers for collection of recyclable materials (e.g. 240L MGBs) tend to be smaller than those for general waste and thus require more floor space per cubic metre of disposal capacity.

3. **Limited awareness of volume reduction technology**
   Relatively few venues practice volume reduction of recyclables.

4. **Cost**
   By volume, it can be cheaper to send recyclables to landfill than to divert them, due to the cost of having some types of recyclables picked up.

5. **Time**
   More staff time spent on waste separation and training.

Plate 6  Loose cardboard clogs the waste management area because baling wires for the compactor had run out.
Case study: Volume reduction

Cardboard compacting

Cardboard compacting - commonplace in the hospital industry – greatly reduces the volume of waste of this major waste fraction, making for easy storage and economic collection for reprocessing. Segregating cardboard from the general waste stream and promptly baling it also makes the management of remaining waste and recyclables fractions easier and quicker. This is illustrated in Plate 6, above.

Glass crushing

The host hotel in this study has committed to increasing source separation of glass bottles but this has come at threefold cost to the company in terms of handling time, storage space and disposal fees – all arising from the high volume of these types of recyclables. In addition to these costs to individual hotels, are the impact on inner-city traffic congestion of frequent collections and the cost in fuel and greenhouse emissions associated with transporting glass bottles to reprocessing facilities in the eastern states.

At the host hotel glass waste is collected in a pool of standard 240L MGBs located near the loading bay from where they are collected by the recycling service provider. Each MGB requires one square metre of floor space each. Hotel staff report that after implementing the program up to seventy bins per week were filled – mainly due to glass bottle sales during busy weeks – equating 70 square metres of floor space, requiring a great deal of handling time. As the service provider charges per unit, it was also a very expensive proposition.

Installation of a Glass Crusher reduced the number of MGBs required on busy weeks to around 20 thereby greatly reducing the space required and the cost of disposal. As the glass crusher is located close to the sites of waste generation, handling time spent taking MGBs to and from the loading bay area is also much reduced. The much higher bulk density of glass cullet compared to un-crushed bottles meant that the MGBs could no longer be completely filled with glass waste. In agreement with the service provider, the hotel now part-fills MGBs with recyclable plastic bottles before topping them up with glass cullet. This means that the weight specifications of the MGBs are not exceeded while allowing the host to divert additional fractions of recyclables from landfill.
5.2 COMPOSTABLES

Opportunities

1. Greatly reduce volume of waste going to landfill
   Food waste is the largest single waste fraction generated by hotels, enabling source separation of usable quantities with relatively little effort. Paper towels, tissues and other low-grade paper have little if any potential for paper recycling but are a useful addition to composting.

2. Simplify separation of recyclables
   Separation of this substantial fraction from the waste stream may make source separation of recyclables easier.

3. Major reduction in greenhouse gas emissions
   Maximum diversion of recyclable paper products would cut greenhouse emissions for the sector by 5,771 tonnes CO$_2$-e per annum.

Barriers

1. Lack of established collection and processing services

5.3 RE-USABLE BULK WASTE

Opportunities

2. Increase diversion of used goods from landfill

Barriers

1. Difficulty faced by hotel staff tasked with finding recipients for re-usable bulk waste
   To avoid sending re-usable items to landfill, hotel staff must spend time finding recipients and arranging pick-up. Recipients are not always found.
6 RECOMMENDATIONS

6.1 RECYCLABLES

1. Promotion of volume reduction equipment
   - Volume reduction has the potential to greatly reduce the space requirements for source-separated recyclables, as well as the cost of disposal through reduced pick-up frequency and higher value per-volume of materials.
   - Prior research may be necessary into: (1) the requirements of the recycling industry regarding the commingling of compressed or shredded raw materials; and (2) alternative storage systems for volume-reduced recyclables awaiting pick-up from hotels. These should address optimal use of space and the greater weight of volume-reduced materials.

2. Other programs encouraging increased source separation and recovery of recyclables
   - Waste-to-landfill could be reduced via existing recyclables collection services.

6.2 COMPOSTABLES

1. Research and promotion for commercial composting geared to the hospitality industry

6.3 RE-USABLE BULK WASTE

1. Waste exchange or similar service
   - Awareness campaign for any existing services.
   - If necessary, assist in the creation of a new service.
7 APPENDIX

7.1 WASTE CHARACTERISATION

Table 7-1: Waste fractions used in the physical audit to characterise waste generated through daily hotel operations and sent to landfill.

<table>
<thead>
<tr>
<th>Recyclables</th>
<th>Compostables</th>
<th>‘Non-recoverables’</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High grade paper</td>
<td>• Food waste</td>
<td>• Hazardous waste</td>
</tr>
<tr>
<td>Newspaper</td>
<td>• Garden waste</td>
<td>• Residual waste</td>
</tr>
<tr>
<td>• Cardboard</td>
<td>• Liquid paper cartons</td>
<td></td>
</tr>
<tr>
<td>• Liquid paper cartons</td>
<td>• Other paper &amp; card</td>
<td></td>
</tr>
<tr>
<td>• HDPE</td>
<td>• PET</td>
<td></td>
</tr>
<tr>
<td>• PET</td>
<td>• Other recyclable plastics</td>
<td></td>
</tr>
<tr>
<td>• Recyclable textiles</td>
<td>• Recyclable textiles</td>
<td></td>
</tr>
<tr>
<td>• Recyclable glass</td>
<td>• Recyclable glass</td>
<td></td>
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<tr>
<td>• Recyclable ferric</td>
<td>• Recyclable ferric</td>
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<tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hazardous waste</td>
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</table>

8 BIBLIOGRAPHY
