SOUTHERN **METROPOLITAN REGIONAL** COUNCIL

# Strategic Waste Management Plan

## Southern Metropolitan Regional Council

11th February 2016

**Document History**

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**Disclaimer**

# 1. Executive summary

## 1.1 Background

The Southern Metropolitan Regional Council's (SMRC) Strategic Waste Management Plan (Plan) sets the program and policies for waste management in southern Perth encompassing the member councils of:

- City of Cockburn;
- Town of East Fremantle;
- City of Fremantle;
- City of Kwinana; and
- City of Melville.

SMRC owns and operates the Regional Resource Recovery Centre (RRRC) on behalf of its member councils. The RRRC encompasses a Materials Recovery Facility (MRF), Green Waste Facility (GWF) and a Waste Composting Facility (WCF). The latter is a composting, drum-based, Mechanical Biological Treatment (MBT) Advanced Waste Technology (AWT) facility and the centrepiece of the RRRC. Fully commissioned in 2003, it represented the cutting edge of waste management technology and a pioneering facility for Australia.

Since the project's inception, the waste industry has changed in ways unforeseeable at the time. Landfill gate fees did not increase at the rate projected, while various Energy from Waste (EfW) technologies have developed, promising the same or higher diversion rates at lower gate fees.

As a result, SMRC is considering the possibility of decommissioning the drum technology in the short (2018/2020) or long term (2020/2023), coinciding with loan repayment completion. Although the facility still achieves its diversion target at the promised cost, given newly available alternatives, SMRC can investigate transitioning to other system options to provide the same or better performance at lower cost.

This Plan is the first step in a process, which aims to rationalise costs, provide the foundation for improving the sustainability, and performance of SMRC waste service practices and procedures and assist in achieving the state's waste diversion from landfill targets.

The Plan's development and delivery methodology involved:

- Characterising the existing waste management landscape for SMRC;
- Forecasting future trends;
- Establishing the Strategic Vision, Themes and Targets;
- Forecasting future waste management needs;
- Analysing two recycling collection options;
- Analysing ten bin system collection and processing options (plus additional garden organic options);
- Undertaking Multi-Criteria Analysis to prioritise options; and
- Investigating alternative modes of governance for regional action (collaboration with other groups or councils) as a means of optimising services and cutting costs.

The Waste Avoidance and Resource Recovery Act (WARR) Act is the primary Act governing resource recovery in Western Australia and outlines specific powers requiring Local Governments, to produce waste plans. Specifically, the following sections are of note for this Plan:

- Division 1, Section 34 Power to request report on waste strategy compliance;
- Division 3, Section 40 Waste Plans;
- Division 3, Section 41 CEO's powers in relation to waste plan;
- Division 3, Section 42 CEO may prepare or modify a waste plan; and
- Division 3, Section 44 Report on waste plan.

SMRC has made progress on a number of the previous 2008 SWMP actions, primarily through strategic planning of waste infrastructure and regional education programs. Individually, councils have also progressed 2008 SWMP actions by undertaking waste audits and innovative trials of new collection services. This document was also reviewed in 2014 in order to ensure results against the targets set were evaluated and reviewed.

A continued coordinated approach to waste management from all councils, in compliance with the WARR Act 2007, would provide the most effective progress on waste management actions.

## 1.2 Recycling and diversion from landfill

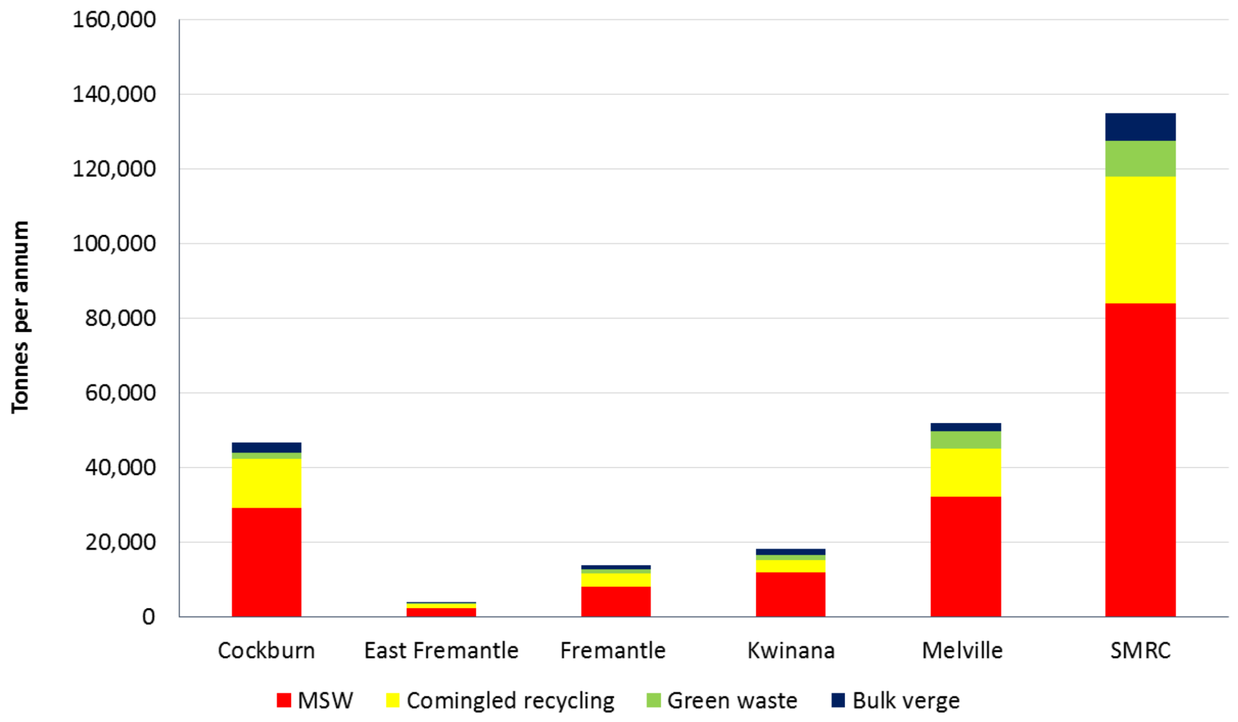
Western Australia is aiming to significantly increase resource recovery and waste diversion from landfill (Table 1-1). The diversion target applies to the sum of the municipal solid waste collected by each council.

**Table 1-1 Western Australian Waste Strategy diversion targets**

| Waste Stream | State diversion target (30 June 2015) | SMRC Actual (30 June 2015) | State diversion target (30 June 2020) |
|---|---|---|---|
| Municipal Solid Waste (Metropolitan Region) | 50% | 70% | 65% |

As illustrated in Figure 1-1, SMRC councils generate different quantities of waste, largely in accordance to their population size. Moreover, the relevant contribution of each waste type to total generation is similar for all councils.

**Figure 1-1 Total waste generation by member council per waste stream 2013/14**




The cities of East Fremantle, Fremantle, Melville and Cockburn have already achieved WA's 2020 diversion target due to the processing of their MSW (depicted in red in Figure 1-1) through the WCF at SMRC's RRRC, which helps each Council achieve an overall diversion of 70% and over.

Kwinana is landfilling its MSW and therefore has a much lower diversion rate. The region's average performance is however, still 70%, which exceeds the 65% 2020 target.

## 1.3 SWMP vision

SMRC and its Members will be leaders in delivering innovative and sustainable waste management solutions for the benefit of our communities and the environment. The delivery of the vision is achieved by undertaking actions across three Key Focus Areas:

- Business Sustainability;
- Resource Recovery; and
- Stakeholder Relationships.

This will be achieved by:

- Placing waste minimisation to landfill at the core of the business;
- Delivering waste management solutions that are effective and efficient;
- Identifying partnership opportunities to deliver waste management solutions;
- Working towards solutions that add value to residual products;
- Attracting new customers and partners to optimise processing capacity;
- Delivering sustainable waste management solutions in an efficient and effective manner;
- Reflecting the current commercial environment, and developing the flexibility to continually evolve as conditions change;

- Understanding and integrating the expectations of member councils into a governance structure that is equitable and representative;
- Providing the community with the right level of knowledge and education so that positive waste separation behaviour change happens in the household; and
- Placing education as a foundation for addressing all areas of the waste hierarchy paramount in the reduction of waste to landfill and a significant role in delivering an efficient operation.

## 1.4 Waste management options assessment

A key component of the Plan was the comparison of ten waste management options (Table 1-2) encompassing collection and processing/disposal of SMRC waste. Quantitative assessment of the options included:

1. Total cost (economics);
2. Recovery rate (%);
3. Greenhouse gas emissions ($CO_2$-e); and
4. Vehicle kilometres travelled (km).

Qualitative assessment included:

1. Political acceptability and compliance with state policy; and
2. Community engagement and participation.

The quantitative and qualitative findings were weighted by their importance (to SMRC) via a multi criteria analysis (MCA) process.

### 1.4.1 Full bin system and processing options results

Table 1-2 summarises the results of the analysis whose key findings include:

- Option 2E 3 bin FOGO (with EfW) receives the highest MCA rank across all competing criteria;
- Option 1A BAU is the least performing option;
- Option 1E EfW performs highly and ranks second; and
- Option 2A 3 bin FOGO (with landfill) can be implemented immediately and is not dependent on EfW proving its viability.

**Table 1-2 Full systems' options results summary**

| Scenario | | | System Options | System NPV ($m) | Recovery rate | MCA result | MCA rank |
|---|---|---|---|---|---|---|---|
| 1 | 2 Bin | Option 1A BAU | - MSW to WCF<br>- WCF residual to landfill<br>- WK/FN recycling | $715.49 | 70% | 49% | 10 |
| | | Option 1B | - MSW to WCF<br>- AWT residual to landfill<br>- FN recycling | $676.98 | 70% | 58% | 8 |
| | | Option 1C | - MSW to WCF<br>- AWT residual to EfW<br>- FN recycling | $668.09 | 90% | 65% | 5 |
| | | Option 1D | - MSW to landfill<br>- FN recycling | $469.92 | 33% | 54% | 9 |
| | | Option 1E | - MSW to EfW<br>- FN recycling | $462.26 | 85% | 83% | 2 |
| 2 | 3 Bin | Option 2A | - Residual waste bin (red lid) to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to landfill<br>- FN recycling | $573.13 | 57% | 66% | 4 |
| | | Option 2B | - Residual waste bin (red lid) to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to EfW<br>- FN recycling | $572.49 | 59% | 66% | 3 |
| | | Option 2C | - Residual waste bin (red lid) to landfill<br>- FOGO to MAF<br>- FOGO residual to landfill<br>- FN recycling | $520.77 | 57% | 64% | 7 |
| | | Option 2D | - Residual waste bin (red lid) to landfill<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | $519.76 | 59% | 64% | 6 |
| | | Option 2E | - Residual waste bin (red lid) to EfW<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | $519.33 | 89% | 86% | 1 |

**Key**

Poorest performing option (red): Option 1A System NPV $715.49, MCA result 49%, MCA rank 10; Option 1D Recovery rate 33%

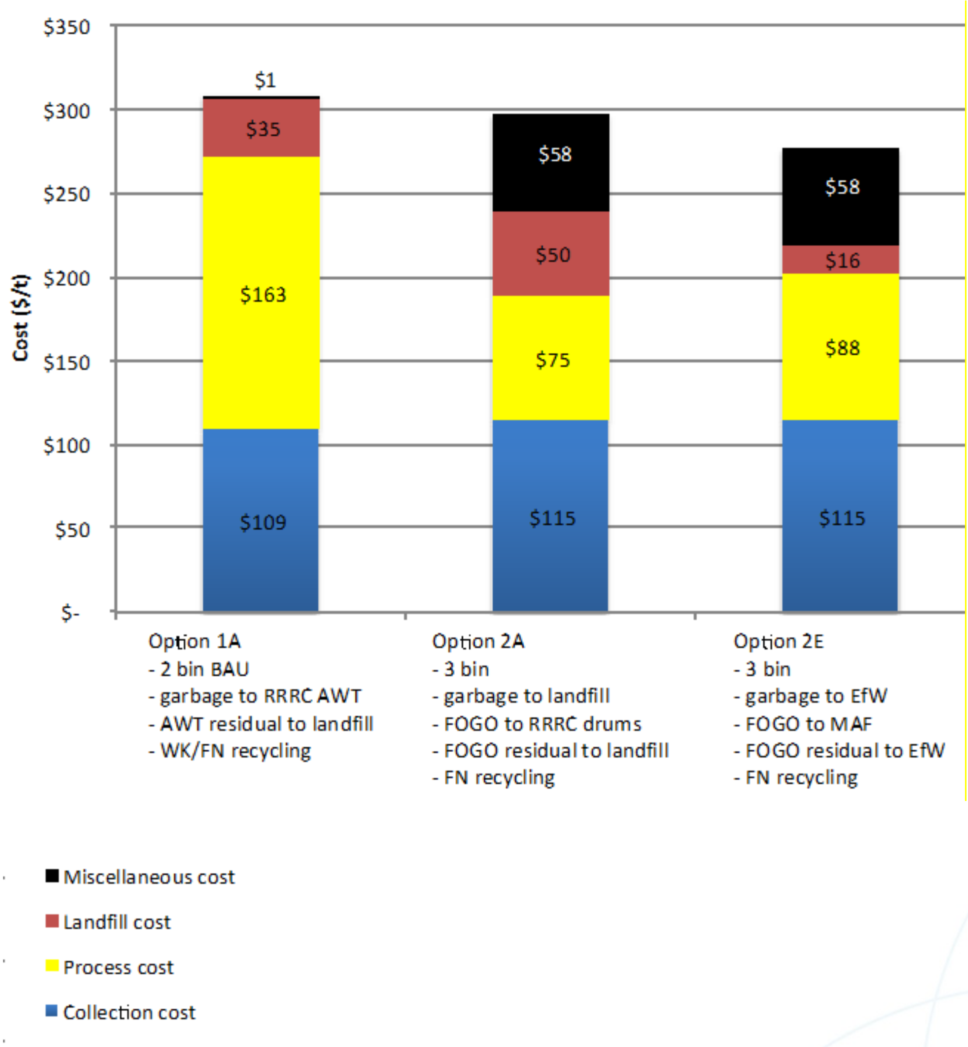
Best performing option (green): Option 1C Recovery rate 90%; Option 1E System NPV $462.26; Option 2E MCA result 86%, MCA rank 1

While EfW is the cheapest option with the highest diversion potential, there are considerable risks for councils associated with EfW in the current Australian context. The gate fee quoted by EfW developers while competitive with landfill, (and much cheaper than the RRRC WCF gate fee), cannot be validated yet as a result of:

- Approval uncertainty;
- Operational and ash disposal risk;
- Scale risk and uncertainty regarding throughput tonnages and contracted supply;
- Inability to fully insulate councils from gate fee increases in commercial contracts; and
- Technology risk and the absence of reference plants operating in the Australian context.

However, as more facilities come online and the technology matures in Australia these risks are expected to reduce over time.

**Figure 1-2 Summary of recommended options based on system cost per tonne 2015/2016[1]**




[1] The cost per tonne includes the miscellaneous costs to implement a new collection system, including bin infrastructure for recycling (360L bins) and FOGO collection. The one-off miscellaneous costs are only a cost in year one. There are a few negligible miscellaneous cost carried through, for example printing brochures, that are carried through into year 2.

The analysis also examined weekly vs. fortnightly recycling collection systems to ameliorate the potential inconvenience of presenting three bins on a single collection day and to estimate any cost savings. The analysis finds that a fortnightly recycling service (currently provided by two of the five member councils) is considerably cheaper and with up to 50% of households being provided a new 360L recycling bin, the diversion from landfill rates can be largely maintained.

The costs and resource recovery rates of FOGO and GO systems were also compared (Table 1-3). The results demonstrate that for comparable 3 bin organic systems (Option 2C vs. 3A) FOGO options deliver significantly better recovery results for approximately the same cost (the difference in cost is less than 1% over the full planning horizon, but the recovery rate is an additional 9%. This includes the costs of education, kitchen caddies and other one-off transition costs for FOGO.

**Table 1-3 Summary of diversion potential of comparable GO vs. FOGO Option**

| Scenario | | System options | System details | System NPV ($m) | Recovery rate |
|---|---|---|---|---|---|
| 3 | 3 Bin | Option 3A | - Residual waste bin (red lid) to landfill<br>- GO to MAF<br>- GO residual to landfill<br>- FN recycling | $518.79 | 48% |
| 2 | 3 Bin | Option 2C | - Residual waste bin (red lid) to landfill<br>- FOGO to MAF<br>- FOGO residual to landfill<br>- FN recycling | $520.77 | 57% |

### 1.4.2 Recommendations

MRA recommends that SMRC implements a two stage model, which combines the resource recovery achievements of a three bin FOGO system (Option 2A now) with the higher diversion rates of EfW when commercially viable (Option 2E).

The Plan therefore recommends:

1. SMRC consider reverting to a fortnightly recycling collection service;
2. Implementation of 3 bin FOGO collection and composting systems forthwith; and
3. Consideration of EfW for the Residual waste bin (red lid) bin only when and if a proven EfW technology for the same waste stream achieves commercial backing and is both operationally and commercially viable in the long term in Western Australia.

The transition to a 3 bin FOGO collection could also occur under a staged implementation, which implements a GO collection first and a FOGO collection after the GO system in place.

### 1.4.3 Implementation staging and repurposing assets

As an owner of existing infrastructure, SMRC is uniquely placed to achieve economies of scale and efficiencies utilising its existing assets, including the 3,000m$^2$ receive hall, 10,000m$^2$ composting hall and weighbridge.

Implementation of source separated FOGO collection and processing is recommended as soon as is convenient to member councils. For the processing of FOGO, there are three primary alternative configurations:

1. MAF technology in a remote location (e.g. Bunbury MAF – Option 2E);
2. MAF technology in a local region (new site); or
3. MAF technology in the RRRC site.

Options 1&2 provide maximum rental contributions. These will be determined following the tender for FOGO processing.

All of these configurations allow SMRC to introduce FOGO systems as soon as is convenient and are all capable of delivering high-grade compost to Western Australia's nutrient depleted soils.

All implementation options involve decommissioning most or all of the WCF drums. The utility of maintaining one drum to pre-process FOGO should be determined via a trial. This trial should be commenced as soon as possible with particular emphasis on the organic composition relative to the average cost of processing through a drum.

Furthermore, the introduction of a FOGO bin has the additional benefit of pre-preparing the MSW bin for EfW processing since it removes much of the low calorific ("wet" materials such as food) from the future EfW stream.

The Plan recognises that SMRC has legacy costs associated with the RRRC (contracts, leases etc.). These legacy costs, when calculated and added to the total system costs (excluding BAU), do not affect the ranking of options shown in Table 1-2. However, it is noted that these costs should be fully quantified and mitigated as part of the implementation plan for the 3 bin FOGO system.

### 1.4.4 FOGO and EfW policy pre-conditions

The Plan gives significant weighting to the public policy position of the State Government. That is, that the State Government expects:

- The waste hierarchy to be implemented;
- Councils should have a 3 bin system separating food and/or green, recycling and residual;
- EfW should only be used for the residual bin (which may include food but must not include garden organics); and
- EfW contracts should not foreclose on future options for councils to pursue diversion through higher value recovery methods.

This Plan is underpinned by the State Government acting on, and enforcing, the principles outlined above. However, a letter from the Waste Authority (February 2013) allows councils to introduce 2 bin EfW so long as this does not foreclose on future higher order recovery streams. This is somewhat at odds with the Waste Hierarchy and the Premier's letter (January 2013) which states:

*"In order to ensure waste to energy facilities operate in support of the hierarchy they should draw their feedstock from the waste stream only after dry recycling and organics recovery processes have been applied."*

It is not clear which policy interpretation will be applied by the State Government to the current EfW proposals. The State Government's position needs to be clarified as a matter of urgency.

If 3 bin systems (GO or FOGO) are not required by the State Government, then EfW becomes a much more appealing scenario for SMRC (particularly when and if EfW risks are managed downwards).

EfW facilities are due to commence operation in the Perth area. SMRC should consider adopting EfW processing residuals only if, a proven EfW technology (which can be internationally proven) satisfies the following criteria:

1 It is operational at the same scale required;
2 On the same waste stream; and
3 Has 3 years of profitable operation.

### 1.4.5 Future use of the RRRC Site

Recommendations for future use of the RRRC Site based on collection and processing options analysis were explored to ensure efficiency and economic gains.

The recommendations relating to future use of the site are to:

- Tender the MRF to a commercial operator;
- Trial RRRC drums for FOGO;
- Tender WCF site for FOGO (with GW option);
- Based on tender price review GW processing (If < $50 (current cost) then roll GW into FOGO processing; retain gate revenues);
- Retain the weighbridge; and
- Lease vacant sheds as appropriate (based on collection model going forward).

### 1.4.6 Governance

Options for SMRC's governance were examined to explore potential efficiency and productivity gains. The alternative models involved outsourcing management and operational activities, overhead and office arrangements as well as services, to a single member council or alternative entities.

There were no obvious efficiency dividends to be gained by wholesale governance restructure. Overall the transition costs outweighed any benefits. The only possible dividends identified were associated with reducing the SMRC's statutory role and function (i.e. doing less of its core role), which are beyond the scope of The Plan and would involve statutory amendments.

The Plan recommends maintaining SMRC's role in service provision and contracting (along with its statutory functions as a regional council) but with a greater emphasis on outsourcing operational service delivery to private sector experts.

SMRC has already embarked upon this path by tendering the MRF operations. This is a valuable model for exploring potential cost savings in the WCF or the FOGO processing, should this recommendation be adopted.

It is recommended that member councils give permission for SMRC to conduct a full review of waste collection and management contracts in order to identify potential economies of scale, by facilitating council cooperation and joint contracts. In the long term it can also lead to alignment between council contracts, which may be fundamental to establishing new waste processing facilities throughout the region.

### 1.4.7 Recommended actions

Regional options and priority actions identified through stakeholder consultation and Plan development are summarised in Table 1-4.

**Table 1-4 Summary of actions**

| Collection Actions |
|---|
| 1. Conduct a 3 bin FOGO trial through the RRRC drums (the WCF) – retain or mothball the drums dependent on the outcome. |
| 2. Implement a 3 bin FOGO collection and composting system. |
| 3. Seek urgent clarification on government policy 3 bin v 2 bin EfW – Waste Authority v Premier. |
| 4. Conduct a weekly to fortnightly recycling bin fullness study. |
| 5. Consider reverting to a fortnightly recycling collection service across all councils. |
| **Processing Actions** |
| 6. Go to tender for FOGO processing and/or provision of composting technology. |
| 7. Optimise the use and revenue obtained from the RRRC by either leasing or converting vacant sheds into an alternative use (e.g. FOGO processing if implemented). |
| 8. Analyse the existing "operational management overheads" based on the existing 73,000tpa MSW to the WCF compared to 32,000tpa of FOGO through the RRRC drums (WCF). Identify options to eliminate or mitigate these overheads. |
| 9. Consider EfW for the MSW bin and processing residuals only if, a proven EfW technology (which can be internationally proven) satisfies the following criteria:<br>○ It is operational at the same scale required;<br>○ On the same waste stream; and<br>○ Has 3 years of profitable operation. |
| **Facility Actions** |
| 10. Tender MRF |
| 11. Trial RRRC drums for FOGO |
| 12. Tender WCF site for FOGO (with GW option) |
| 13. Review Green Waste processing (if >50,000 then roll the green waste into FOGO processing and retain commercial gate fees |
| 14. Retain the operation and ownership of the weighbridge |
| 15. Lease the vacant sheds as appropriate |

| **Regionalisation Actions** |
|---|
| 16. Consider working with Rivers Regional Council (RRC) to develop a regional 'hub' for green waste processing at the GWF. |
| 17. Submit a tender for MRF processing of RRC, City of Canning, WMRC, MRC and EMRC's comingled recycling (when services are tendered). |
| 18. Consider input into/partnering with RRC to develop the feasibility study for four regional processing 'hubs' for mattresses, HHW, batteries, C&D materials, whitegoods, e-waste, tyres, cars, asbestos and motor oil. |
| 19. Work with City of Canning and RRC to develop four regional hubs for household hazardous waste, batteries, motor oil, e-waste and building and construction permanent drop off sites (if the feasibility study demonstrates that the model is viable). |
| 20. Further discussions with RRC to set up a shared office/administrative support agreement. |
| 21. Further discussions with RRC for partnering and use of educational resources such as the Recycle Right brand. |
| 22. Consider tendering for FOGO processing should RRC (or any local government) move to 3 bin collection of organics (if SMRC becomes a FOGO processor). |
| 23. Work with City of Canning to develop a regional green waste processing site for member councils' green waste either at the current GWF or at Ranford Road Transfer Station. |
| 24. Work with EMRC, RRC and City of Canning to establish Hazelmere as a regional collection point for separated wood waste from verge side collections for processing in the Pyrolysis plant (when operational). |
| 25. Work with EMRC to develop a protocol for any future EfW contracts in order to minimise risk. |
| 26. Work with MRC to establish a regional mattress recycling and asbestos disposal point at Balcatta Recycling Centre. |
| 27. Continue inter-council cooperation through meetings of the Regional Executive Group. |
| Education/Engagement Actions |
| 28. Develop a comprehensive resident behaviour change program for 3 bin FOGO through development of Recycle Right or similar model. |
| 29. Continue Recycle Right or similar model campaign. |
| 30. Continue community advisory group. |
| 31. Continue to actively promote RRRC and SMRC activities via traditional educational channels such as TV, brochures, radio, tours, apps and social media. |
| 32. Continue to offer RRRC community based recycling services for HHW, batteries, polystyrene etc. |
| Governance actions |
| 33. Conduct a full cost accounting study to differentiate SMRC governance and coordination overhead functions and costs from those as a waste and recycling service provider. |

| |
|---|
| 34. If the FOGO bin collection system is adopted, explore cost reduction initiatives such as commercial rental of vacant shed space and reduction of any unnecessary management overhead expenses arising from the revised service delivery model. |
| 35. Advocate for the implementation of State policies and in particular for the government to clarify how the EfW policy will operate in regards to 2 bin and 3 bin systems. |
| 36. Continue to work with the Waste Authority. |
| 37. Continue to participate in Australian and International waste management groups. |
| 38. Conduct a full review of waste management contracts |

# Glossary

| Abbreviation | Definition |
|---|---|
| @Risk | Software used to perform a risk analysis on the two highest scoring Options. |
| $ | Dollar |
| ABS | Australian Bureau of Statistics |
| ACCUs | Australian Carbon Credit Units |
| AD | Anaerobic Digestion |
| AS/NZS | Australian Standards/New Zealand Standards |
| ATT | Alternative Thermal Treatment |
| AWT | Alternative Waste Treatment |
| ARRT | Advanced Resource Recovery Technology |
| BAU | Business as Usual |
| C&D | Construction and Demolition (waste) |
| C&I | Commercial and Industrial (waste) |
| CAG | Community Advisory Group |
| CBD | City Business District |
| CCM | Consolidated Cost Model |
| CEO | Chief Executive Officer |
| CER | Clean Energy Regulator |
| CFI | Carbon Farming Initiative |
| CMR | Comingled recyclables |
| COAG | Council of Australian Governments |
| $CO_2$-e | Carbon dioxide equivalent |
| CPI | Consumer Price Index |
| CPM | Carbon Pricing Mechanism |
| DEC | Department of Environment and Conservation |
| DER | Department of Environment Regulations |
| EfW | Energy from Waste (a.k.a. WtE) |
| EMRC | Eastern Metropolitan Regional Council |
| EPA | Environment Protection Authority |
| EPC | Engineering Procurement Construction |
| EPHC | Environment Protection and Heritage Council |
| ERF | Emissions Reduction Fund |
| EU | European Union |
| E-waste | Electronic Waste |
| FN | Fortnightly |
| FO | Food Organics (only) |

| Abbreviation | Definition |
|---|---|
| FOGs | Fats, Oils, Greases |
| FOGO | Food organics and garden organics |
| GF | Greenhouse Friendly |
| GHG | Greenhouse gas |
| GO | Garden organics (no food) |
| GW | Green Waste |
| GWF | Green Waste Facility |
| GWP | Global Warming Potential |
| ha | Hectares |
| HCL | Hydrogen Chloride |
| HDPE | High-density polyethylene |
| HF | Hydrogen Fluoride |
| HHW | Household Hazardous Waste |
| HRRP | Hazelmere Resource Recovery Park |
| IED | Industrial Emissions Directive |
| KPI | Key Performance Indicators |
| L | Litres |
| LFG | Landfill gas |
| LG | Local Government |
| LOI | Loss on Ignition |
| $ m | $1,000,000 |
| $m^2$ | Square meters |
| $m^3$ | Cubic meters |
| MAC | Ministerial Advisory Committee |
| MAF | Mobile Aerated Floor (composting) |
| MBT | Mechanical Biological Treatment |
| MCA | Multi-Criteria Analysis |
| MGB | Mobile Garbage Bin |
| MRA | MRA Consulting Group |
| MRC | Mindarie Regional Council |
| MRF | Materials Recovery Facility |
| MRWMD | Monterey Regional Waste Management District |
| MSW | Municipal Solid Waste collected in the kerbside green lidded bin as part of a two bin collection system (approximately 60-70% organics and 30-40% other) |
| MUDs | Multi-Unit Dwelling |
| MW | Megawatts |
| MWAC | Municipal Waste Advisory Council |

| Abbreviation | Definition |
|---|---|
| MWh | Megawatt hours |
| NGER | National Greenhouse and Energy Reporting |
| NOx | Nitrogen Oxides |
| NSW | New South Wales |
| Operational Management Overheads | Overheads associated with site operations not the SMRC coordination activities |
| OECD | Organisation for Economic Cooperation and Development |
| OEM | Original Equipment Manufacturer |
| OFMSW | organic fraction of MSW |
| pa | per annum |
| Plan | Strategic Waste Management Plan |
| PET | Polyethylene terephthalate |
| PMET | Pittsburgh Mineral & Environmental Technology |
| QLD | Queensland |
| Residual waste | Residual waste subsequent to any recycling process (after AWT processing, after EfW processing or after MRF Processing). |
| Residual waste bin | Red lidded bin used to collect residuals as part of a 3 bin collection system (estimated <50% organics and >50% other) |
| RDF | Refuse Derived Fuel |
| RET | Renewable Energy Target |
| RRC | Rivers Regional Council |
| RRRC | Regional Resource Recovery Centre |
| SA | South Australia |
| SMRC | Southern Metropolitan Regional Council |
| SSO | Source Segregated Organics (commercial food and garden organics) |
| SUDs | Single Unit Dwellings |
| SWMP | Strategic Waste Management Plan |
| t | Tonnes |
| TCLP | Toxicity characteristic leaching procedure |
| TOC | Total organic carbon |
| tpa | tonnes per annum |
| TS | Transfer Station |
| UK | United Kingdom |
| USA | United States of America |
| VKT | Vehicle Kilometres Travelled |
| VIC | Victoria |
| WA | Western Australia |
| WALGA | Western Australia Local Government Association |

| Abbreviation | Definition |
|---|---|
| WARR | Waste Avoidance and Resource Recovery |
| WCF | Waste Composting Facility |
| WK | Weekly |
| WMB | Waste Management Board |
| WMRC | Western Metropolitan Regional Council |
| WSP | Waste Service Provider |
| WtE | Waste to Energy (a.k.a. EfW) |
| ZWEDC | Zero Waste Energy Development Company |

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# 2 Introduction

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- Describing and analysing a series of ten full bin system collection and processing options;
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- Investigating alternative modes of governance for regional action (collaboration with other groups or councils) as a means of optimising services and cutting costs.

## 2.1 Background

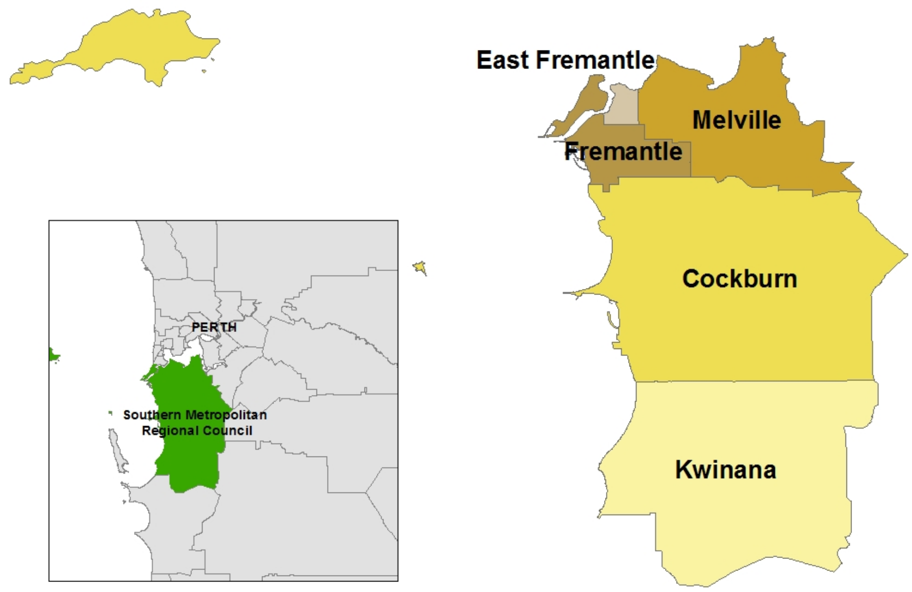
### 2.1.1 Southern Metropolitan Regional Council

Southern Metropolitan Regional Council (SMRC) is a Statutory Local Government Authority covering 340 square kilometres of the Southern Part of Metropolitan Perth, servicing a combined population of over 275,000 people. The SMRC includes the:

- City of Cockburn;
- Town of East Fremantle;
- City of Fremantle;
- City of Kwinana; and
- City of Melville.

SMRC is made up of one Regional Councillor elected from each local government member council, from which a Chairman is chosen.

**Figure 2-1 SMRC member councils**




The SMRC is constituted under the Local Government Act, 1995 and an Establishment Agreement as required by the Act binds the Member Councils. The Establishment Agreement includes the Regional Purpose, Objectives and Existing Undertakings.

The Regional Purpose of the SMRC is to:

- Plan, coordinate and implement the removal, processing, treatment and disposal of waste for the benefit of the communities of the member councils;

- Influence Local, State and Federal Governments in the development of regional waste management policies and legislation; and
- Prepare, facilitate and implement programmes, measures and strategies for the reduction of greenhouse gases[2].

The objectives of the Regional Local Government are:

a) Without loss being incurred by the Regional Local Government, to carry out the Regional Purposes so that services and facilities are provided to the consumer at a reasonable cost and with due regard for community needs; and
b) To reduce the quantity of waste disposed of at landfill sites in accordance with targets set by the Regional Local Government.

The SMRC's existing undertakings are to provide for:

a) Research and education with respect to the removal, processing, treatment and disposal of waste; and
b) The administrative functions of the Regional Local Government related to any purpose other than a Project.

Resource recovery is one of three strategic focus areas of SMRC, with minimising waste to landfill a key priority. At the centre of SMRC's current resource recovery operations is the $100 million Regional Resource Recovery Centre (RRRC) in Canning Vale.

The RRRC is made up of 3 resource recovery facilities:

- A Materials Recovery Facility (MRF) for the sorting of comingled recyclables and recovery of paper, plastics, glass and metals (from kerbside yellow top bin);
- A Waste Composting Facility (WCF) for composting MSW (from kerbside collected MGB's and commercial, source separated food and garden organics); and
- A Green Waste Facility (GWF) (a green waste grinder) for processing source separated green waste into mulch.

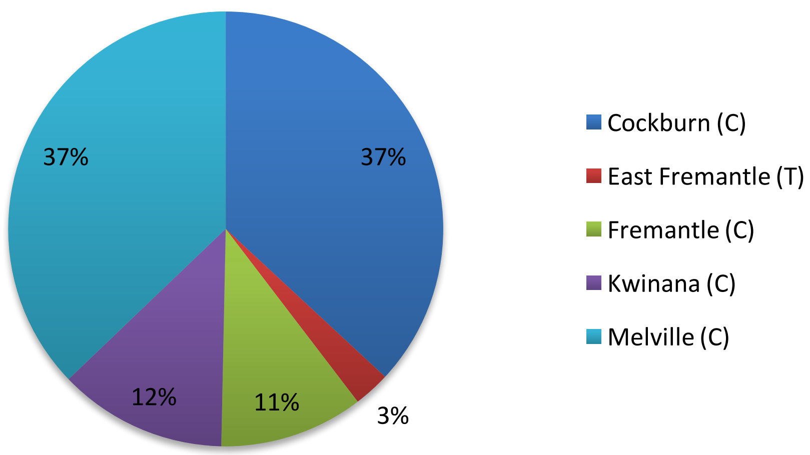
All member councils process MSW, that is MSW collected through the green-lidded kerbside bin, through the WCF, with the exception of City of Kwinana (Kwinana), which contributes to waste management solutions through membership of SMRC but does not process waste through the RRRC WCF.

## 2.2 SMRC member councils

Figure 2-2 shows the percentage breakdown of the total population in the SMRC region by Council. The largest councils by population are City of Melville (Melville) and City of Cockburn (Cockburn), which are each home to 37% of the total population, or approximately 100,000 people each. The smallest council by population size is the Town of East Fremantle (East Fremantle), which is home to just over 7,800 people, or 3% of the total population of SMRC (Figure 2-2).

[2] SMRC Strategic Waste Management Plan 2013

**Figure 2-2 Percentage composition of total SMRC population (2014)**




## 2.2.1 Population growth rates

In the ten years leading up to 2014, the population of each individual member council grew from 1.2% - 4.8% (Table 2-1). The lowest average growth rate was recorded for Melville, which grew at an average rate of 1% per annum. The council that experienced the largest average growth rate was Kwinana that saw an average growth rate of 4.8%. The total weighted average growth rate for the SMRC region was 2.5% over the past 10 years.

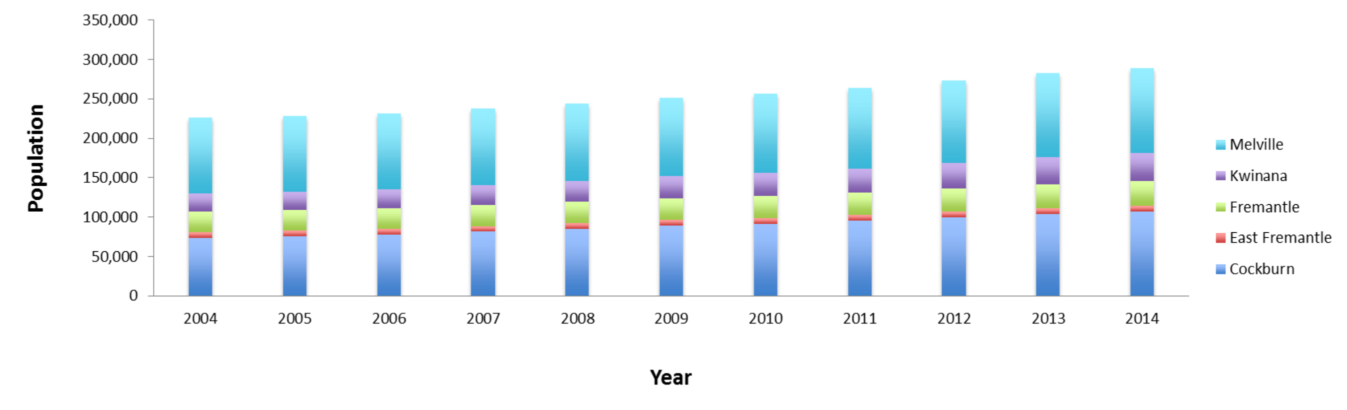
**Table 2-1 Estimated resident population growth rate for SMRC member councils**

| Member Council | Average growth rate (2004-2014) |
|---|---|
| City of Cockburn | 3.7% |
| Town of East Fremantle | 1.2% |
| City of Fremantle | 1.7% |
| City of Melville | 1.0% |
| City of Kwinana | 4.8% |
| **Average (weighted)** | 2.5% [3] |

Total population growth in the SMRC region from 2004 and 2014 accounted for an additional 62,255 persons as seen in Figure 2-3. The largest population growth was seen in Kwinana. This population growth has been largely attributed to the introduction of affordable housing, work opportunities and transport links to the CBD. Further information on individual member council's demographics can be found in Appendix A.

[3] Weighted average by population size

Figure 2-3 SMRC historical population trends based on estimated resident population (ABS, 2015)




### 2.2.2 Demography and employment

The largest group by age is 0-14 years old, except for Fremantle where it is 25-34 year olds. Table 2-2 shows the largest age groups and main employing industry by member council. The main employment sector in Kwinana, as well as in Cockburn, is manufacturing. The manufacturing industry has seen a decline in employment over the past ten years due to a high Australian dollar, subdued global growth, competitive pressures and lower consumer confidence[4]. Therefore, this decline may, in time, lead to a change in population growth rates and demographics.

**Table 2-2 Largest age group and main employment sector by member council**

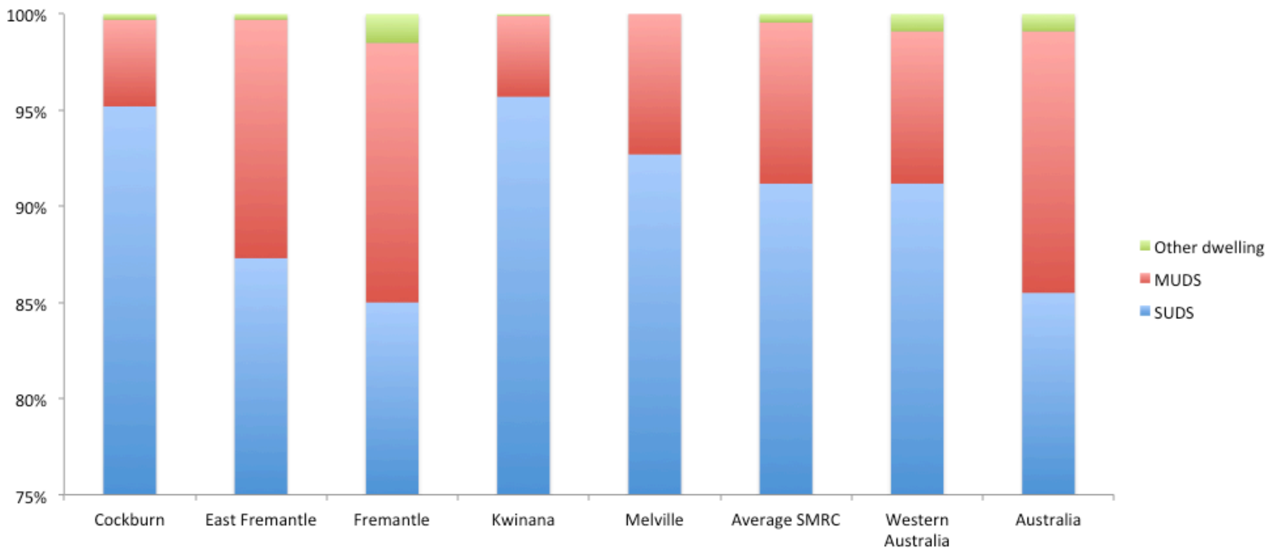
| Member Council | Largest Age Group | Main Employing Sector |
|---|---|---|
| City of Cockburn | 0-14 years | Manufacturing |
| Town of East Fremantle | 0-14 years | Education and Training |
| City of Fremantle | 25-34 years | Healthcare and Social Assistance |
| City of Melville | 0-14 years | Healthcare and Social Assistance |
| Kwinana | 0-14 years | Manufacturing |

### 2.2.3 Household types

The majority of households within the SMRC member councils are Single Unit Dwellings (SUDs) (Figure 2-4). (The 'other' category accounts for institutional settings such as boarding houses, residential colleges, corrective and detention institutions, nursing homes and other welfare institutions). East Fremantle and Fremantle have a lower than average number of SUDs compared to other SMRC member councils, as well as the Western Australian and Australian averages. Cockburn, Kwinana and Melville have above average numbers of SUDs.

[4] Australian Government Department of Employment, Industry Outlook, Manufacturing, 2014.

**Figure 2-4 Dwelling types in SMRC, Western Australia and Australia**




## 2.3 Waste infrastructure

### 2.3.1 The Regional Resource Recovery Centre (RRRC)

SMRC owns and operates its the Regional Resource Recovery Centre (RRRC), located in Canning Vale on behalf of its Member Councils. The RRRC is central to waste management in the SMRC region. This infrastructure is financed by four of the current member councils, Cockburn, Melville, East Fremantle and Fremantle with the parties bound by a Project Participants Agreement.

The RRRC has been fully operational since 2005 and receives, recycles and processes household and business waste from the member councils as well as neighbouring councils. All of the member councils, except Kwinana, use the Waste Composting Facility (WCF), the Materials Recovery Facility (MRF) and the Green Waste Facility (GWF). Kwinana only uses the MRF under contract with SMRC and uses the City of Rockingham's Millar Rd landfill for MSW waste disposal. The RRRC has been designed to recover 85% of household waste, and is currently achieving 72%.

### 2.3.2 WCF

The WCF has a capacity to process 109,200 t/year of household MSW. The MSW is sorted, digested through drums, screened and aerated to convert it into relatively low quality compost. The compost produced is taken offsite and blended for use. Whilst SMRC currently have a market for the compost output, the market value of this product is fairly low and the material is being transported significant distances for use. Therefore, the SMRC has invested in additional infrastructure to improve the quality of the material through additional screens to reduce the small plastics and glass particulates (from July 2015).

### 2.3.3 MRF

The MRF can process in excess of 90,000 t/year of source separated kerbside recyclable materials (rigid plastics, glass, paper, cardboard, aluminium and steel). The process is conducted with a series of conveyor belts and sorting screens, which sort the materials for baling prior to shipment to appropriate manufacturers who use the recycled materials.

### 2.3.4 GWF

The GWF has a processing capacity of 30,000 t/year. The facility grinds clean source separated green waste from council verge collections into mulch, which is then collected and further processed by an external contractor. In addition to the verge collected material, residents and commercial operators can drop additional source separated green waste at the facility itself.

### 2.3.5 Maintenance and Audit Facility

The site also has a purpose built Maintenance and Audit Facility. A full infrastructure analysis is provided in Section 11.

**Figure 2-5 RRRC aerial photograph**

# 3 Legislative framework review

## 3.1 National framework

The Commonwealth Government has limited constitutional powers to engage directly in domestic waste management issues. This responsibility rests largely with State, Territory and Local governments. However, the Commonwealth Government has recently taken on a strategic role in waste policy development, releasing the National Waste Policy in 2010.

### 3.1.1 National Waste Policy

The aims of the National Waste Policy are to:

> *'Avoid the generation of waste, reduce the amount of waste (including hazardous waste) for disposal, manage waste as a resource and ensure that waste treatment, disposal, recovery and re-use is undertaken in a safe, scientific and environmentally sound manner, and contribute to the reduction in greenhouse gas emissions, energy conservation and production, water efficiency and the productivity of the land.'*

A number of strategies have been identified within the National Waste Policy, which are to be pursued through a multi-jurisdictional approach. These include a national framework for product stewardship and extended producer responsibility.

More recently the Environment Protection and Heritage Council (EPHC) met to establish 6 key areas of reform for the National Waste Policy: taking responsibility, improving the market, pursuing sustainability, reducing hazard and risk, tailoring solutions and providing the evidence.

The National Waste Policy incorporates 16 strategies including working to remove market impediments to the development of effective markets for recovered resources, improving certainty, reducing costs for governments and business, and facilitating investment in necessary infrastructure.

A product stewardship framework will provide support through voluntary accreditation of community and industry run recycling schemes. Key focus areas include mercury containing lights, tyres, packaging, workplace recycling, public place recycling, televisions and computers recycling.

The process by which the Policy has effect is through a range of collective multilateral processes (e.g. Council of Australian Governments (COAG), EPHC and related commonwealth-state working parties), and then via State policy intent and regulation.

The EPHC has seen a rapid progression of initiatives, which will affect the collection, and recycling of a range of minor streams such as waste paint, batteries, packaging, air conditioners, refrigerators, TV, e-waste and tyres.

### 3.1.2 National Greenhouse and Energy Reporting Scheme

The National Greenhouse and Energy Reporting (NGER) Act 2007 establishes a national system for reporting greenhouse gas emissions, energy consumption and production by corporations. Its development was initiated through the COAG in 2006. The Clean Energy Regulator (CER) currently administers the NGER Act 2007.

Data reported under the NGER Act 2007 underpinned the Carbon Pricing Mechanism (CPM) and Carbon Farming Initiative (CFI) - now repealed and replaced by the Emissions Reduction Fund (ERF). Monitoring, reporting and auditing of Council's and business' greenhouse gas emissions data are essential to maintain the environmental and financial integrity of the ERF.

The National Greenhouse and Energy Reporting (Measurement) Determination Act 2008 provides methods and criteria for calculating greenhouse gas emissions and energy data under the National Greenhouse and Energy Reporting (NGER) Act 2007.

Key features of the NGER Act 2007 are:

- Reporting of greenhouse gas emissions, energy consumption and production by large corporations;
- Public disclosure of company level greenhouse gas emissions and energy information;
- Consistent and comparable data available for decision making, in particular, the development of the ERF; and
- A reduction in the number of greenhouse and energy reports required across State, Territory and Australian Government programs.

Importantly for waste activities, the Department of the Environment has recently released an amendment to the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* that will apply from the 2015-16 reporting year. It includes updated Global Warming Potentials (GWPs) for methane in particular from 21 to 25.

This means that all emissions from waste (or emissions reduction projects) will increase by 20% from 1 July 2015 onwards.

### 3.1.3 The Emissions Reduction Fund

The Direct Action Plan has replaced the Carbon Price Mechanism as the primary legislation directed at meeting Australia's commitment to reduce GHG emissions. The objective of the Direct Action Plan is to assist Australia to meet its emissions reduction target of 5% below 2000 levels by 2020. Direct Action consists of a number of initiatives including:

- A $2.5 billion Emissions Reduction Fund (ERF) to support direct action by business to reduce emissions;
- Boosting renewable energy, especially solar; and
- Support for emerging technologies through the Renewable Energy Target (RET).

Through the ERF, the Government purchases lowest cost abatement (in the form of ACCUs) from a wide range of sources, providing an incentive to businesses, households and landowners to reduce emissions.

In order to participate in the ERF, project proponents must carry out a project in accordance with a methodology determination to appropriately estimate abatement from certain activities. The CFI methodologies, which this policy replaces, provide the basis for the ERF methodologies - which are currently subject to consultation with industry and the public.

Approved methods for the waste and recycling sectors include:

- Landfill gas capture and destruction;
- Alternative Waste Treatment; and
- Wastewater treatment.

New methods which should be ready for the next auction include:

- Diversion of Source Separated Organics (including Food and Garden waste);
- Biofilters;
- Phytocaps;
- Energy from waste; and
- Waste avoidance projects.

The Direct Action Plan was passed into law in October 2014 and the first allocation of funds was held on April 15-16$^{th}$. A total of 47 million tonnes of CO2-e was purchased at an average price of $13.95 per tonne. Of this, the waste industry accounts for nearly 17 million t CO2-e or 35% of total volume purchased, proving that the waste industry continues to play a major role in emissions reduction efforts.

To make good on these contracts, create carbon credits and generate revenue, existing and prospective project proponents need to:

- Register a project with the Clean Energy Regulator as soon as possible;
- Forecast emissions over the next 7 years;
- Register for the next auction;
- Bid at auction;
- If successful, carry out the project, and report progress;
- Deliver abatement in accordance with the delivery schedule; and
- Receive funds from the government for the abatement.

The SMRC's Waste Composting Facility (WCF) has a strong record of carbon emissions reductions. Commencing with the Greenhouse Friendly (GF) programme during 2005-10, followed by the Carbon Farming Initiative (CFI) between 2010-12 and most recently Australian Carbon Credit (ACCU's) under the Emissions Reduction Fund (ERF).

SMRC has successfully navigated the complex and various programme rules, external and internal audit regimes and to date have sold almost 450,000 carbon credits worth $3.4 million into both the voluntary and compliance markets with a further 118,000 carbon credits contracted into the ERF over the next five years.

### 3.1.4 Hazardous waste

The Department of the Environment administers and implements the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*. The Act was developed to enable Australia to comply with specific obligations under the *Basel Convention on the Control of the Transboundary Movements of Hazardous Wastes and their disposal*, a Convention set up to control the international movements of hazardous wastes.

The Convention first came to force in 1992 and puts an onus on exporting countries to ensure that hazardous wastes are managed in an environmentally sound manner in the country of import. It also places obligations on countries that are party to the Convention. These obligations are to:

- Minimise generation of hazardous waste;

- Ensure adequate disposal facilities are available;
- Control and reduce international movements of hazardous waste;
- Ensure environmentally sound management of wastes; and
- Prevent and punish illegal traffic.

Australia signed the Basel Convention in 1992. The Convention is implemented in Australia by the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*.

Therefore the main functions of the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*. include:

- Processing of export, import and transit permit applications under the Act;
- Ensuring compliance and enforcement with the Act;
- Preparing, implementing and amending legislation relating to the international movements of hazardous waste to, from or through Australia;
- Formulating and implementing policies relating to the international movements of hazardous waste to, from or through Australia;
- Providing administrative assistance to the Hazardous Waste Technical Group which has been established to provide guidance to the Department of Sustainability, Environment, Water, Population and Communities on hazardous waste management;
- Participating in International forums such as the Basel Convention and OECD (Organisation for Economic Cooperation and Development) which deal with the international movements of hazardous waste; and
- Consulting, preparing and providing information to stakeholders on the Act and the permit process.

Therefore, the export of mixed solid waste is not permitted under the Act. However, there is potential for processed waste, such as residual waste for Processed Engineered Fuel that is in compliance with all technical criteria adhering to contamination, to hold to the Act and be exported.

## 3.2 State framework

### 3.2.1 Waste Avoidance and Resource Recovery (WARR) Act, 2007

The Waste Avoidance and Resource Recovery Act (WARR) Act is the primary Act governing resource recovery in Western Australia. The primary objective of the WARR Act is to contribute to both sustainability and the protection of human health and the environment. It promotes:

- The most efficient use of resources, including resource recovery and waste avoidance;
- A reduction in environmental harm, including pollution through waste;
- A consideration of resource management through avoidance of unnecessary resource consumption and disposal; and
- Resource recovery, which includes reuse, reprocessing, recycling and energy recovery.

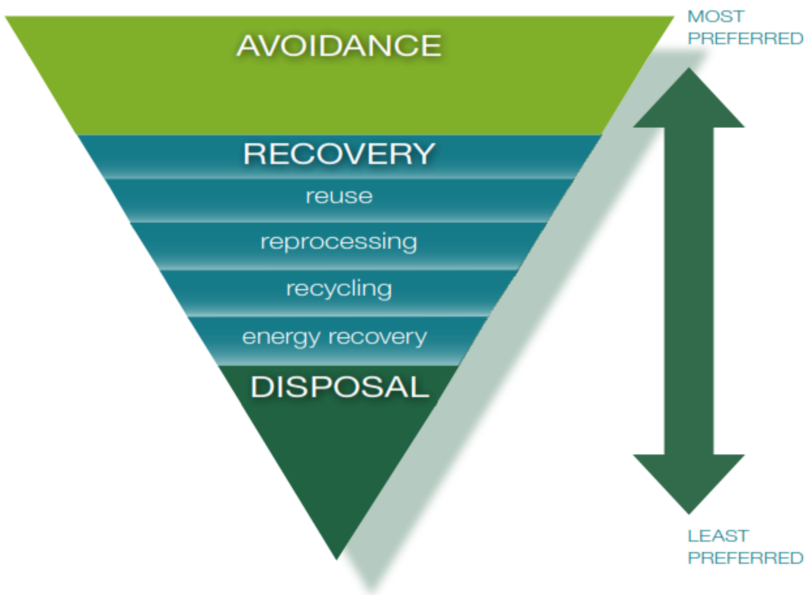
The principles set out in the Environmental Protection Act 1986, section 4 are also reflected in the WARR Act.

The creation of a state-wide waste strategy by the Waste Authority is also required by the *Waste Avoidance and Resource Recovery Act 2007* under Part 4, Division 1.

The purpose of the waste strategy is to set out:

- A long term strategy for continuous improvement of waste services, waste avoidance and resource recovery, benchmarked against best practice; and
- Targets for waste reduction, resource recovery and the diversion of waste from landfill disposal.

**Figure 3-1 WARR Act Waste Hierarchy**




Section 5 of the WARR Act sets out a Waste Hierarchy, which ranks waste management options in order of general, environmental desirability (Figure 3-1). Generally, the higher waste is managed up the hierarchy, the lower the impact and risk to the environment and communities. The intention of the waste hierarchy is intended to be used alongside other assessment tools such as cost benefit analysis to guide decision making.

Divisions of the WARR Act relating to the specific powers requiring Local Government to produce and report on waste management plans have been summarised below. For the full list of specifications, refer to the full WARR Act, available from the Government of Western Australia, Department of Premier and Cabinet.

### Division 1, Section 34 Power to request report on waste strategy compliance

The CEO may request any entity to provide a report on:

1. Its compliance with the waste strategy; or
2. The reasons for any specified non-compliance by that entity with the waste strategy

### Division 3, Section 40 Waste Plans

The CEO may by written notice enquire a local government to include within its plan for the future a waste plan outlining how, in order to protect human health and the environment, waste services provided by the local government will be managed to achieve consistency with the waste strategy.

### Division 3, Section 41 CEO's powers in relation to waste plan

If the CEO is of the opinion that a waste plan should, but does not, include a matter referred to in section 40(3), the CEO may, by written notice, require the local government to modify the waste plan to include that matter.

### Division 3, Section 42 CEO may prepare or modify a waste plan

When a notice has been served on a local government under section 41(4), the CEO may, after consulting and having regard to the views of the Waste Authority and the local government, take all such steps and prepare all such documents as are necessary to ensure compliance with the notice referred to in section 40(4) or 41(1), as the case requires, as if the CEO were the local government.

### Division 3, Section 44 Report on waste plan

The CEO may require a local government to submit a report to the CEO on the implementation of its waste plan.

## 3.2.2 Western Australian Waste Strategy: "Creating the Right Environment", 2012

The *Western Australian Waste Strategy: "Creating the Right Environment"* was developed by the Waste Authority in 2012 and guides the State towards the long-term strategic direction and priorities for WA over the next decade, which includes providing knowledge, infrastructure and incentives to commence a shift to a low-waste society.

Strategic targets have been set based on known resource recovery performance during 2009/10. The targets are described as being 'ambitious but achievable' improvements to Western Australia's resource recovery performance (Table 3-1). While these targets are state-wide are include both the Commercial and Industrial (C&I) and Construction and Demolition (C&D) sectors, only domestic waste management falls within the realm and responsibility of Local Governments in the WARR Act 2007.

**Table 3-1 Western Australian Waste Strategy diversion targets**

| Waste Stream | 2009/10 Recovery | Diversion by 30 June 2015 | Diversion by 30 June 2020 |
|---|---|---|---|
| Municipal Solid Waste (Metropolitan Region) | 26% | 50% | 65% |
| Municipal Solid Waste (Major regional centres) | 15% | 30% | 50% |
| Construction and Demolition Waste (State-wide) | 29% | 60% | 75% |
| Commercial and Industrial Waste (State-wide) | 46% | 55% | 70% |

## 3.2.3 Review of Waste Avoidance and Resource Recovery Act 2007

Section 99 of the WARR ACT requires that the Minister carry out a review of the WARR Act after the fifth anniversary.

On the 1st December 2014 the Department of Environment Regulation released a discussion paper for public consultation. The key potential issues and reforms outlined in the discussion paper were that current waste collection and processing arrangements vary considerably across the Perth Metropolitan region, which results in inefficiencies. Inefficiencies are caused by an inability to achieve economies of scale and coordinate significant supplies of waste. Regional Councils coordinate waste processing services on behalf of Local Government.

Aligning waste planning with State plans and strategies mandate compulsory membership of groups that coordinate procurement of waste services. Revising Regional Councils to create efficiency and fewer waste groups in the Metropolitan area allows a focus on waste processing and recycling facilities that divert waste from landfill.

A number of recommendations were made in the submission by WALGA on behalf of its members. These include:

- The State Government facilitates the formation of three Regional Subsidiaries within the Perth/Peel area to undertake a range of regional waste management functions;
- The State Government establish Groups for C&I and C&D wastes;
- The State Government establish an overarching Perth/Peel Waste Management Group to implement the State Waste Strategy in this region;
- The Association provides ‘in principle support’ for Regional Subsidiaries as the preferred governance approach for waste management;
- If Regional Subsidiaries are not enacted then the Regional Council model is the preferred option for regional structures;
- That the Metric Regional Council Working Group be re-established, and its Terms of Reference be amended to:
  - Allow for work on the transition to a new governance model for waste management;
  - Include the Department of Environment Regulation; and
  - Include metropolitan Local Government membership.
- That the State Government:
  - Increase the hypothecation of funds raised through the WARR Levy;
  - Use the provisions for Extended Producer Responsibility contained within the WARR Act;
  - Introduce a Container Deposit Scheme in WA;
  - Adopt a strategic waste infrastructure plan; and
  - Establish an independent Waste Agency, funded by the WARR Levy, to allow for a separation of policy and program activity from the regulatory function of the DER.

### 3.2.4 Review of Waste Avoidance and Resource Recovery Levy Act 2007

The Waste Avoidance and Resource Recovery Levy Act 2007 (WARR Levy Act), provides for a landfill levy to be applied to waste received at metropolitan landfills and metropolitan waste received at landfills outside the metropolitan area. The objectives of the landfill levy are twofold:

- To act as an economic instrument to reduce waste to landfill by increasing the price of landfill disposal; and
- To generate funds for a range of environmental purposes.

As per the Regulations, the Waste Avoidance and Resource Recovery Levy for 2015/16 is set at the level of $55/tonne for putrescible waste and $60/m3 for inert waste. This is demonstrated in Table 3-2.

**Table 3-2 Landfill levy rates as of January 2015**

| Period | Putrescible/tonne | Approx. inert per tonne* | Inert/$m^3$ |
|---|---|---|---|
| Current to 31 December 2014 | $28 | $8 | $12 |
| 1 January 2015 to 30 June 2016 | $55 | $40 | $60 |
| 1 July 2016 to 30 June 2017 | $60 | $50 | $75 |
| 1 July 2017 to 30 June 2018 | $65 | $60 | $90 |
| 1 July 2018 to 30 June 2019 | $70 | $70 | $105 |
| 1 July 2019 onwards | $70 | $70 | $105 |

*One cubic metre of inert waste *in situ* within the landfill is treated as equivalent to 1.5 tonnes

In accordance with the Waste Avoidance and Resource Recovery Act 2007 (WARR Act), not less than 25% of the forecast levy amount in each year is allocated by the Minister for Environment to the WARR Account. The Budget reflects the Targets in the waste strategy in relation to diversion of waste from landfill.

Table 3-3 shows the WARR Account as outlined in *Government of Western Australia 2015/16 Budget*, for the previous two years and projections for the year 2015/16. Income for the total Levy is estimated at $104,849,000.

**Table 3-3 WARR Account as per the Government of Western Australia 2015/16 Budget**

| Year | Opening balance | Income | Expenditure | Closing Balance |
|---|---|---|---|---|
| **2013/14** | $18,238,000 | $11,445,000 | $13,569,000 | $16,144,000 |
| **2014/15** | $16,144,000 | $15,750,000 | $18,422,000 | $13,422,000 |
| **2015/16 (estimated)** | $13,442,000 | $26 750,000 | $29,720,000 | $10,472,000 |

Funds in the WARR Account are used for programs supporting the Waste Strategy through the business plan as well as the operations of the Waste Authority and the implementation of the WARR and WARR Levy Acts and associated regulations.

### 3.2.5 Waste Authority

The Waste Authority is a statutory authority, which was formed under the WARR Act 2007. It replaced the Waste Management Board (WMB), which had no statutory authority.

The Waste Authority is comprised of five members appointed by the governor on the recommendation of the Minister for Environment. The Waste Authority is responsible for:

- Delivery of a Waste Strategy to guide the State towards action, which encourages waste avoidance and maximises the recovery of materials that might be otherwise destined for landfill;
- Advising the Minister for Environment on matters of interest pertaining to the environment and health performance; and
- Releasing a Position Statement to address recommendations based on the advice provided. Recent relevant position papers are summarised below.

### 3.2.5.1 Waste Authority 2014-15 Business Plan

The 2014-15 Business Plan, is the Waste Authority's third in support of the *Western Australian Waste Strategy: Creating the right environment.* The Annual Business Plan sets out the expenditure the Waste Authority will administer from the WARR Account on behalf of the State Government. It focuses on the following key area: planning, regulation, best practice, economic instruments, engagement, data and measurement, strategy and policy development and review, and program and administration support.

The WARR Act stipulates that funds from the WARR Account will be applied to support waste management activities and the diversion of waste from landfill through the recycling and recovery of waste. In the 2014-15 Business Plan the Waste Authority has recognised a clear link between funds provided from the WARR Account and these activities.

Following an increase to the landfill levies from 1 January 2015, more than $130 million will be available over five years for reinvestment in key program areas that deliver on-ground infrastructure and services. Additional focus and resources have been allocated to levy-related compliance activities and to a targeted illegal dumping team to ensure that those adhering to appropriate standards are not disadvantaged by individuals and organisations that do not adopt compliant practices.

The Plan also identifies that supporting infrastructure development offers a more sustainable approach than funding ongoing operations. The application of funds from the WARR Account will be focussed on encouraging investment in infrastructure either directly or by creating the demand environment where infrastructure investments are more likely to be made.

### 3.2.5.2 Waste to Energy Position Statement (Thermal Treatment)

The Waste Authority, along with the Environmental Protection Authority provided advice to the minister on the environmental and health performance of waste to energy (WtE) technologies, focusing on the thermal treatment of waste with energy recovery.

The position paper supports that Energy Recovery is a recognized option, which can be used along with a range of other waste management processes and technologies along different points of the waste hierarchy. It is a *'recognised option at the lower end of the waste hierarchy, which may be suitable for residual waste'* as *'energy recovery is more favourable than disposal to landfill'*. Therefore the Waste Authority *'considers best practice WtE processes to be a preferable option to landfill for the management of residual waste but not at the expense of reasonable efforts to avoid, reuse, reprocess or recycle waste'*.

The Waste Authority also advises that waste management practices should be consistent with the waste hierarchy, especially with regards to long-term supply arrangements, which may have the potential to undermine the viability of future higher value waste management options, such as recycling. Therefore, the Waste Authority *'promotes governance arrangements that accommodate flexibility in waste management and processing'*.

Further, the Waste Authority also recommends that *'Waste to energy plants must be sited in appropriate current or future industrial zoned areas with adequate buffer distances to sensitive receptors'* and that '*Buffer integrity should be maintained over the life of the plant'.* However, the Waste Authority also recognises the benefits of siting waste infrastructure close to the source of waste generation in order to reduce *'traffic impacts from the movement of waste, such as greenhouse impacts, traffic congestion and community amenity'.*

#### 3.2.5.3 Source Separation of Waste Position Statement

The Source Separation of Waste Position Statement was released by the Waste Authority in January 2014 to outline the Waste Authority's position on source separation as a contributor to achieving the diversion targets from the Western Australian Waste Strategy: Creating the Right Environment.

The position statement is consistent with the Waste Authority's Communications on the Waste Hierarchy (2013), Better Bins: Kerbside Collection Guidelines (2014) and Position Statement on Recycled Organics (2009).

*'The Waste Authority:*

- *Recognises that source separation provides more homogenous and higher value waste streams, allowing for better resource recovery;*
- *Recognizes that source separation reduces contamination of waste streams;*
- *Recognizes that source separation can support the diversion of waste from landfill;*
- *Considers the broader application of source separation of waste to be best practice for improving resource recovery and reducing the volume of residual waste in Western Australia;*
- *Believes source separation supports achieving Waste Strategy targets and outcomes;*
- *Considers source separation to be consistent with the waste hierarchy; and*
- *Will consider source separation favourably in its decision making.'*

For comparison, a summary of the NSW Energy from Waste Policy has been included in Appendix E NSW Energy from Waste policy.

The Waste Authority has also released the *Better Practice Kerbside Collection Guidelines* and developed a pilot program to support the adoption of 2-3 bin systems. MWAC has a Municipal Regional Council Working Group that has replaced the Forum of Regional Councils.

#### 3.2.5.4 Government Waste Policy – EfW clarification

The proposed approach recommended in this SWMP is consistent with the policy settings of the West Australian Government as set out in Waste Avoidance and Resource Recovery Act 2007. These policy priorities, specifically the separation of recyclables via 3 bin systems, were clarified in the letters of the Premier on the 24$^{th}$ January 2013 and the Chairman of the Waste Authority on the 12$^{th}$ of February 2013 respectively.

Premier 24 Jan 2013:

- *“Where waste avoidance, reuse, reprocessing and recycling are able to be deployed they are preferred to energy recovery.*

- *In order to ensure waste to energy facilities operate in support of the hierarchy they should draw their feedstock from the waste stream only after dry recycling and organics recovery processes have been applied. Waste to energy facilities should only use feed stock destined for landfill. In those situations where local governments have a three bin collection system that separates green and/or food organic waste (green bin) from dry recyclates (yellow bin) and residual waste (red bin), only treatment of the contents of the red bin using waste to energy would be considered consistent with the hierarchy”.*

It is worth noting that the Premier’s letter permits the 3rd bin to hold either GO or FOGO. That is, Food does not strictly need to be collected separately for the residual bin to be able to go for EfW.

Chairman Waste Authority 12 Feb 2013:

- *“Where a local government operates a three bin collection system which recovers dry recyclables and garden and/or food organics in two of the bins, and sends the waste in the third (residual) bin for energy recovery, this would be considered consistent with the waste hierarchy.*

- *Where a local government operates a two bin collection system which recovers dry recyclables in one bin, and processes the residual mixed waste from the second bin through a mechanical biological treatment process, the waste from the treatment process could be sent for energy recovery and be considered consistent with the waste hierarchy.*

- *However, in the case where a local government operates a two bin collection system as described above but does not process this waste in some way, the sending of waste from the second bin directly to energy recovery would not be consistent with the waste hierarchy. Where local government follows this path, the Waste Authority will have a firm expectation that it will in future pursue diversion through higher value recovery methods, to ensure consistency with the waste hierarchy is achieved.”*

Most importantly, according to the Chairman’s letter, EfW can currently be used on a 2 bin system so long as there is a willingness and a capacity to pursue higher value recovery methods in the future. This is somewhat inconsistent with the Premier’s requirements (above) which require a 3 bin system from the outset. This leads to multiple interpretations of the State Government’s position, in the market. It needs to be clarified by the Government urgently. In particular if 2 bin systems are permitted to go to EfW, then when and what pre-conditions will require the introduction of 3 bin systems. Again, it is worth noting that the Chairman’s letter permits the 3rd bin to hold either GO or FOGO. That is, Food does not strictly need to be collected separately for the residual bin to be able to go for EfW.

### 3.2.6 WA Local Government Association

The WA Local Government Association (WALGA) is an independent association that lobbies and negotiates on behalf of local governments in WA.

WALGA has a dedicated standing committee, the Municipal Waste Advisory Council (MWAC) that provides resources and information to support WA local governments. The goal of MWAC is to facilitate, encourage and promote economically sound, environmentally safe and efficient waste management practices for Western Australia, endorsed and supported by Local Government (WALGA 2015).

MWAC activities include:

- Statewide co-ordination of recycling issues;
- Review of waste management legislation;
- Production of position papers on waste management; and
- Maintaining Wastenet, a website with resources for waste management issues relevant to WA local governments.

### 3.2.7 Metropolitan Local Government Review Panel

In June 2011 a Metropolitan Local Government Review Panel was appointed to examine the current and anticipated regional, social, environmental and economic issues affecting, or likely to affect, the growth of metropolitan Perth in the next 50 years and recommend the most appropriate local government structures and governance models for Metropolitan Local Government. Following this process, the Local Government Advisory Board carried out extensive inquiries into the current metropolitan local government boundaries and recommended changes to the Minister for Local Government. The board has made specific recommendations to reduce the number of Perth Metropolitan Local Governments from 30 to 12.

The proposed changes would result in the amalgamation of some SMRC councils (with both surrounding councils and of current SMRC councils). The proposed local government amalgamation structures, include:

- Amalgamation of the Cities of Melville, and parts of Cities of Canning and Cockburn;
- Amalgamation of the Cities of Fremantle and East Fremantle with parts of the Cities of Melville and Cockburn. (This also includes Rottnest Island.); and
- Amalgamation of the City of Cockburn with the City of Kwinana (Northern parts of Cockburn will be amalgamated with Cities of Melville and Fremantle).

The most significant change would be the potential addition of 26,300 households from the City of Canning to the SMRC service area. Such an increase in population may also lead to an increase in the volume of waste received for processing by the RRRC.

However, in February 2015 the State Government announced that planned changes to Perth's metropolitan local government boundaries were "on hold"[5]. Therefore, for the purposes of this plan, amalgamations of councils have not been included in the main options analysis. They have been examined in a sensitivity analysis.

[5] Department of Local Government and Communities, May 2015.

# 4. Historical waste data review

In order to understand trends in SMRC residual waste generation and recovery through the RRRC, a review of SMRC historical waste data was undertaken.

## 4.1 Existing waste collection systems

All SMRC member councils have a two-bin collection system for residents. This includes a green-lidded MGB for household MSW and a yellow-topped MGB for all comingled recyclable materials. Each SMRC council also provides residents with a collection service for verge collected bulk green waste and hard waste at various times of the year.

Table 4-1 details the current kerbside collection services offered by each member council.

**Table 4-1 SMRC existing waste collection services**

| Waste Stream | City of Cockburn | City of Fremantle | Town of East Fremantle | City of Kwinana | City of Melville |
|---|---|---|---|---|---|
| **MSW** | Weekly 240L | Weekly 240L | Weekly 240L | Weekly 240L | Weekly 240L |
| **Comingled recycling** | Weekly 240L | Fortnightly 240/360L bin | Weekly 240L | Fortnightly 240L | Weekly 240L |
| **Bulk hard waste and whitegoods** | 2 per year | 2 per year | 1 per year | 2 per year | 1 per year |
| **Bulk Green waste** | 2 per year | 4 per year | 4 per year | 4 per year | 3 per year |

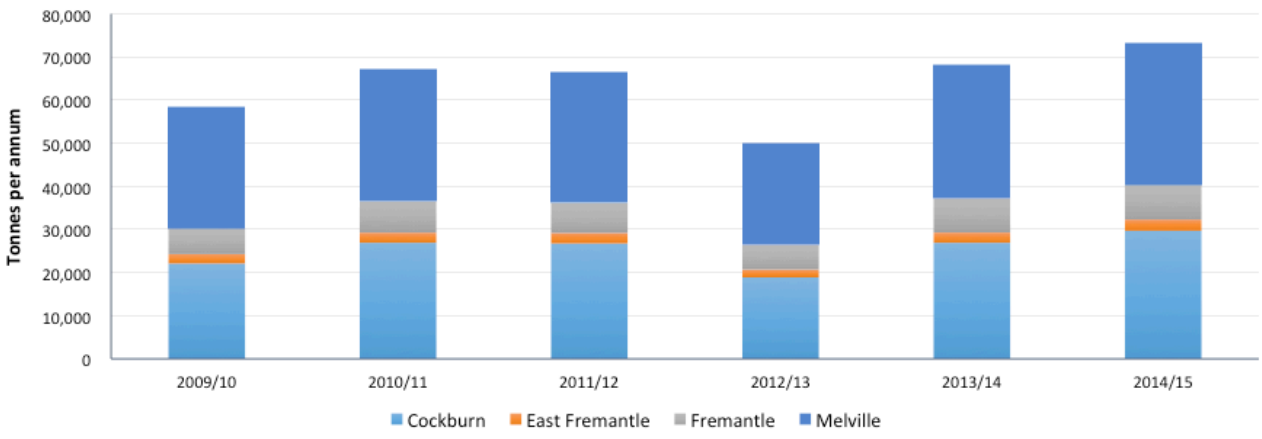
## 4.2 Historic waste trends – RRRC WCF (WCF)

### 4.2.1 Member waste

Kerbside MSW (MSW received via the green-lidded kerbside Mobile MSW Bin (MGB), that is 60% organic material and 40% other material) from the four SMRC member councils (sending MSW to the WCF at the RRRC) from 2009-2015 is shown in Figure 4-1. The key points are:

- MSW tonnes received at the WCF have increased from 59,000 t in 2009 to 71,000 in 2014/15;
- Cockburn and Melville contribute significantly more MSW to the WCF than Fremantle and East Fremantle, which is to be expected given the larger population size of these two member councils; and
- Tonnes of MSW received from Fremantle and East Fremantle has remained relatively constant across all years, while MSW received from Cockburn and Melville has fluctuated. A large reduction in residual waste received was seen in all councils in 2012/2013 due to combination of licence restrictions on incoming MSW and a brief shutdown for odour upgrades.

Figure 4-1 Tonnes MSW from SMRC member council to WCF 2009/2015

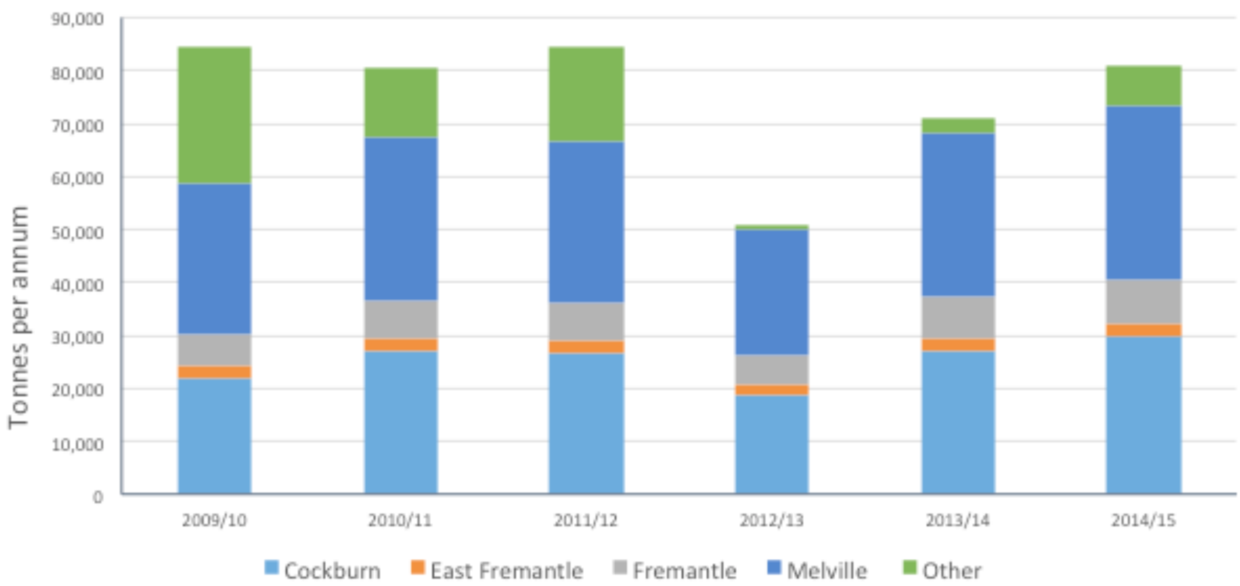



### 4.2.2 Total waste

The WCF also receives waste from other sources.

Figure 4-2 shows the total tonnes received at the WCF from 2009-2015; from SMRC member councils and other sources. In 2014/15 just over 80,000 tonnes were processed. This has been relatively constant since 2009.

Figure 4-2 Tonnes MSW from SMRC member councils and other sources to RRRC 2009/2015

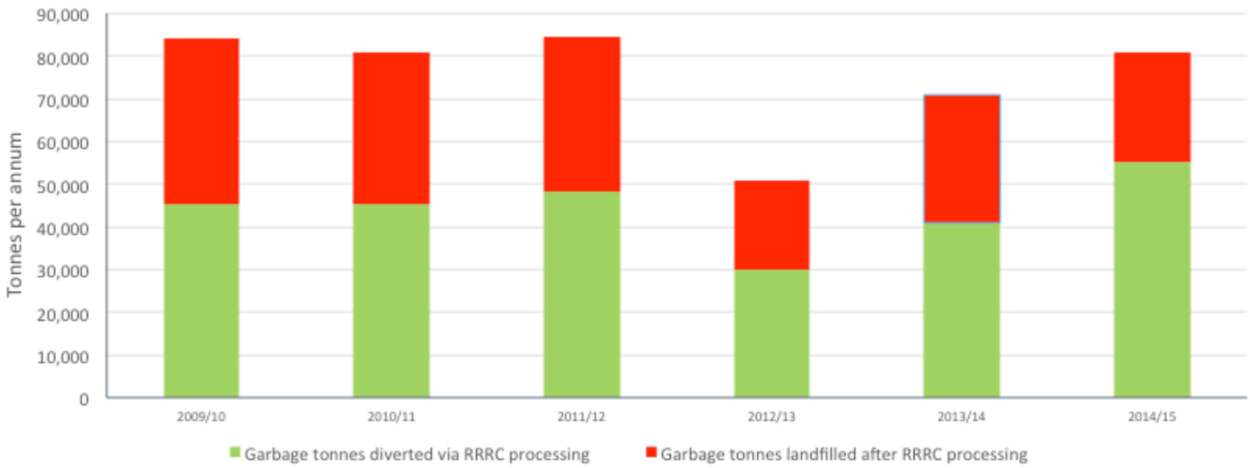



### 4.2.3 Recycling rates

The overall recycling diversion performance of the WCF from 2009-2015 is shown in Figure 4-3.

Over half of total MSW was diverted from landfill via WCF processing. The largest diversion was seen in 2014/15.

**Figure 4-3 WCF diversion performance 2009- 2015**

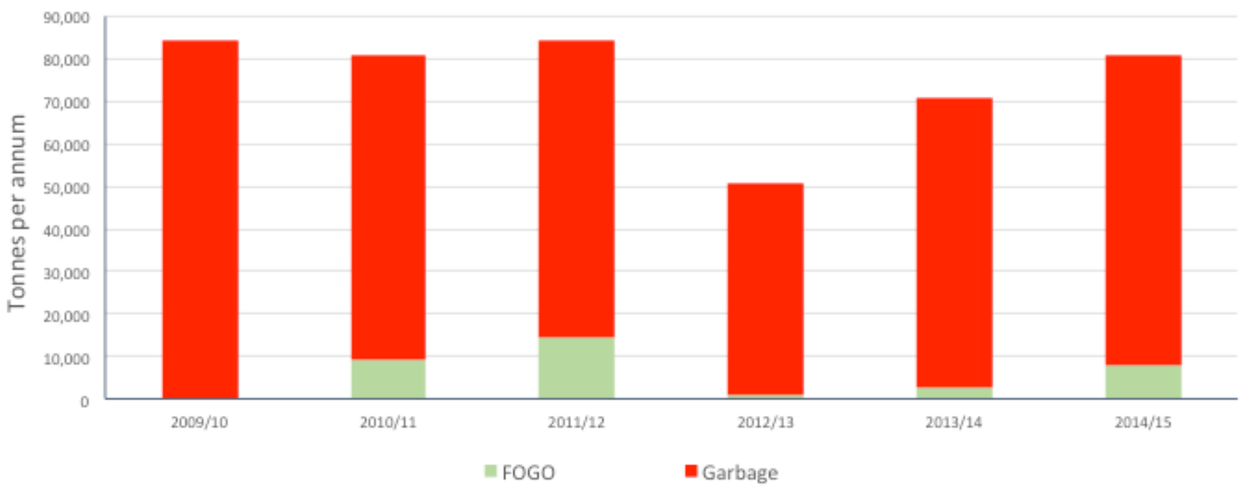



### 4.2.4 Waste composition

Figure 4-4 shows the composition of all waste entering the WCF.

The significant majority is household MSW. There is a small amount of source separated Food Organics and Garden Organics (FOGO) and FOGO received at the WCF originates from source-separated commercial waste, which is mainly supermarket waste.

**Figure 4-4 WCF composition (MSW and FOGO)**




## 4.3 Waste generation 2013/14

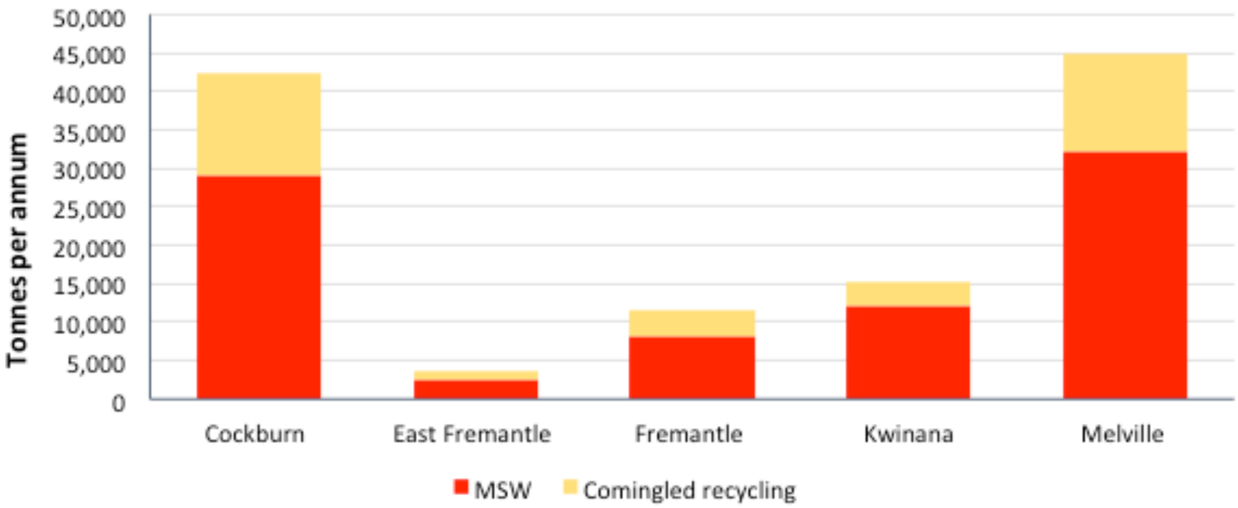
In analysing options to achieve the state waste diversion targets and SMRC's waste objectives, it is important to understand the current baseline for MSW and comingled recycling (recycling).

The total tonnes collected from households in 2013/14 are detailed in Table 4-2 and comingled recycling generated by SMRC member councils and collected via kerbside waste collections in 2013/14 is shown in Table 4-2.

Table 4-2 Waste generation (tpa) by member council 2013/14

| Council | MSW | Recycling | Green waste | Bulk verge | Total |
|---|---|---|---|---|---|
| City of Cockburn | 29,218 | 13,138 | 1,790 | 2,596 | **46,742** |
| Town of East Fremantle | 2,557 | 1,087 | 236 | 212 | **4,092** |
| City of Fremantle | 8,045 | 3,607 | 1,269 | 886 | **13,807** |
| City of Kwinana | 11,984 | 3,202 | 1,615 | 1,530 | **18,330** |
| City of Melville | 32,193 | 12,827 | 4,823 | 2,159 | **52,002** |
| **SMRC** | **83,997** | **33,861** | **9,733** | **7,383** | **134,973** |

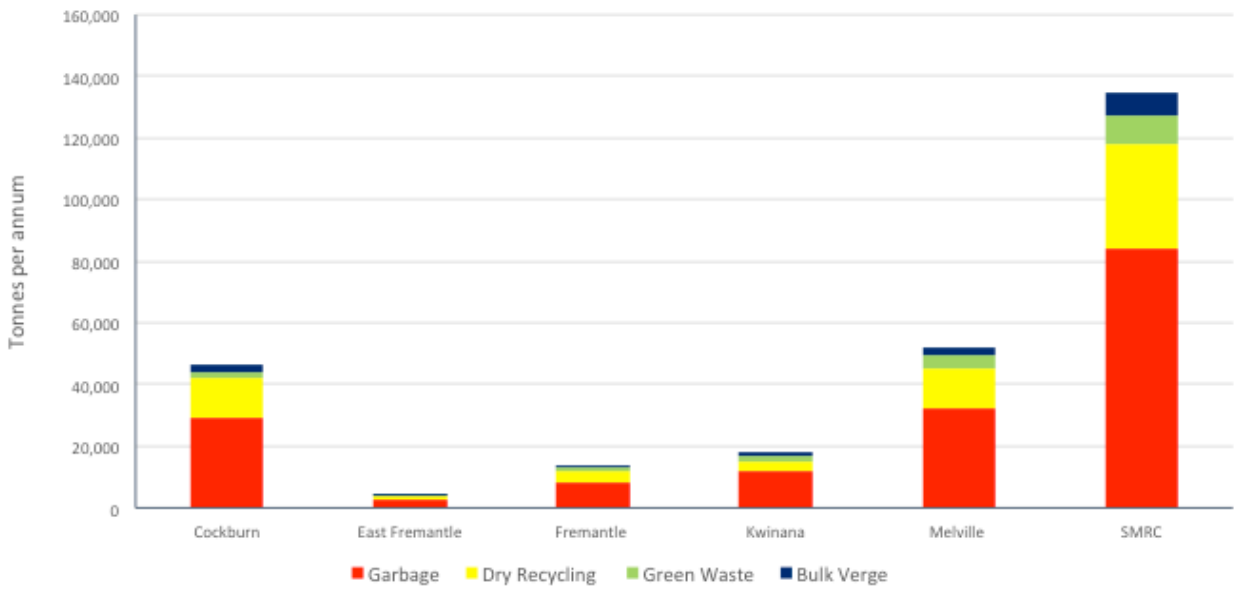
Figure 4-5 Total MSW and recycling collected in each member council




More than half of all kerbside MSW collected was MSW, with varying proportions of recycling for each member council.

The total waste collected by member council including green waste collected and bulk verge collection is detailed in Figure 4-6.

Figure 4-6 Total waste generation by member council per waste stream 2013/14




## 4.4 Member councils diversion rates 2013/14

The total tonnes of waste landfilled and recovered from each member council during 2013/14 are displayed in Figure 4-7.

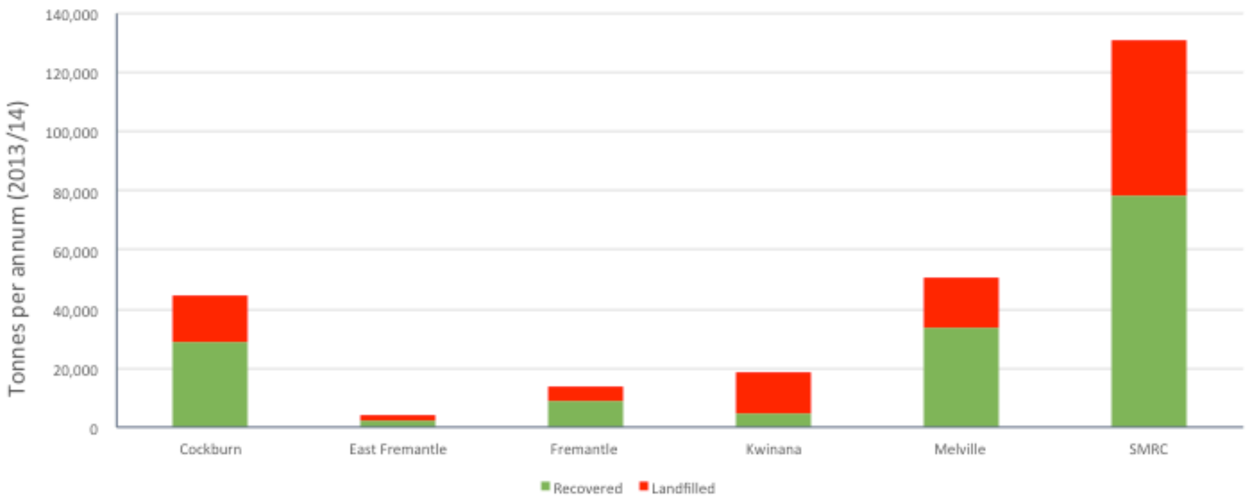
"Recovered" includes:

- Ferrous metal portion of the bulk verge collection;
- Green waste collected and recycled; and
- The portion of the residual waste which is diverted via the WCF.

Of the total tonnes generated approximately 70% is recovered by the SMRC:

- This exceeds the 50% diversion target set by the Western Australian State Government for 2015;
- Kwinana has the largest proportion of landfilled waste; and
- Melville has the largest total tonnage of landfilled waste as shown in Figure 4-7.

**Figure 4-7 Member council landfill and recovered waste 2013/14**




## 4.5 MSW composition

Figure 4-8 shows the weighted average composition of SMRC member council's collected kerbside MSW.

Over 65% of the MSW stream is organic material, including recyclable paper and cardboard. Approximately 15% is recycling, i.e. materials, which could be collected in the kerbside recycling bin (plastic containers, aluminium containers, glass and paper and cardboard).

**Figure 4-8 Weighted average composition of SMRC MSW**

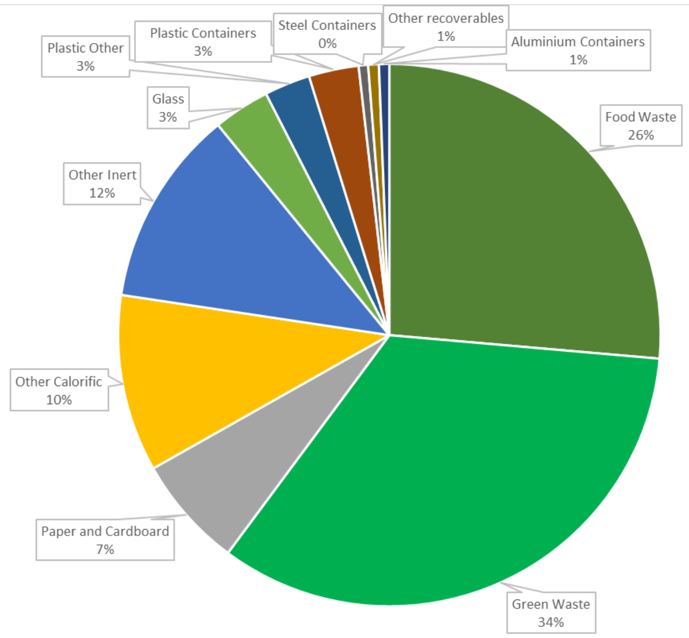
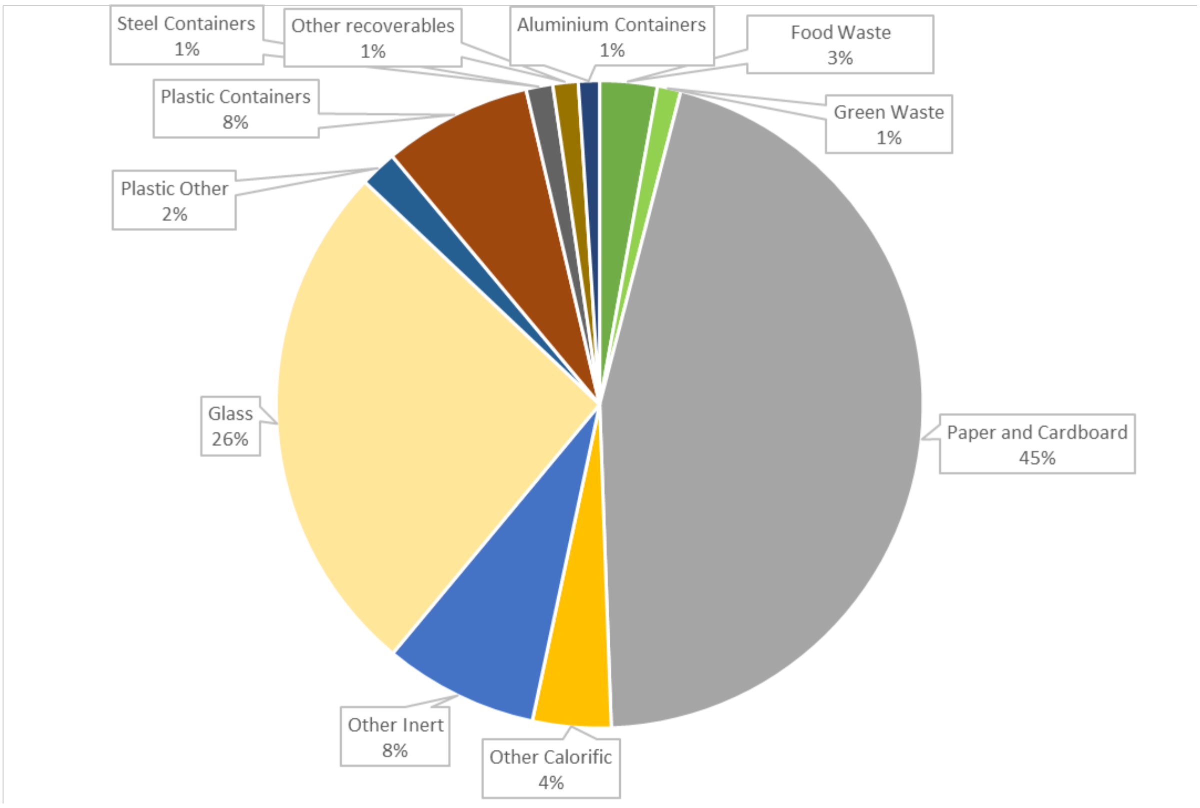



Figure 4-9 details the weighted average composition of SMRC member council's recycling.

The main components by weight are paper and cardboard and glass. There is just over 16% contamination in the recycling bins (other inert, other calorific, food waste and green waste).

There is potential to increase the feedstock of organic material to the WCF by just over 1,500 tonnes per annum if the food and green waste can be transferred from the comingled recycling bin to the MSW bin.

**Figure 4-9 Weighted average composition of SMRC recycling**




## 4.6 Other household generated wastes

In addition to the abovementioned waste streams there are additional opportunities for resident drop off through a series of transfer stations within the region.

## 4.7 Green waste from member councils parks and gardens

Member councils are also responsible for green waste processing as a result of maintenance on parks and gardens.

## 4.8 Waste generation forecasting to 2023

A projection of waste generation rates in the SMRC region, based on 5 years of historic data is provided in Figure 4-10. Four scenarios are modelled based on household and population forecasts for 2023.

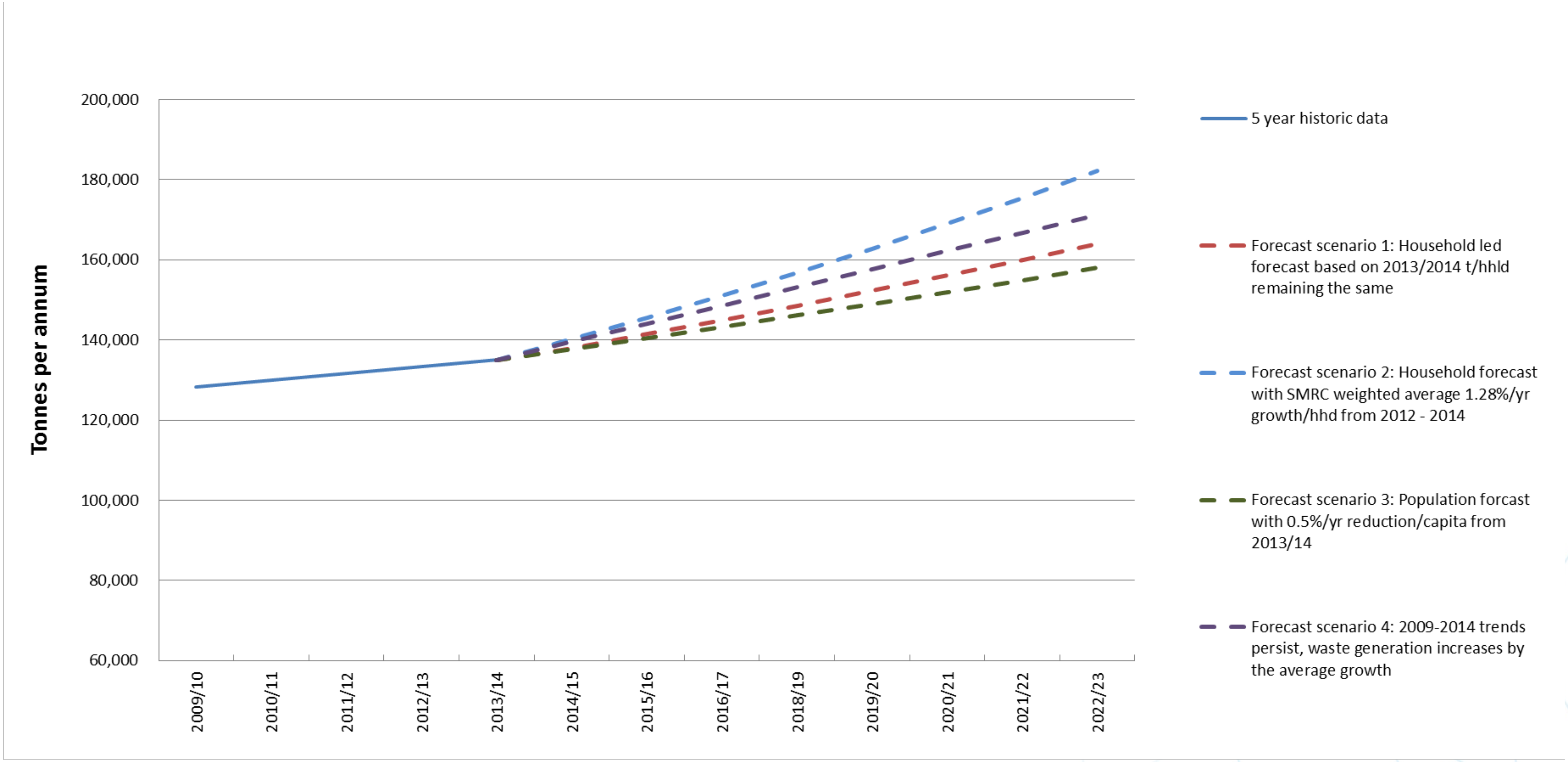
**Scenario 1** models a household-led forecast based on the assumption that tonnes per household remain the same as in 2013/14 per individual member council household. With no further increases in per household waste generation.

**Scenario 2** models a household-led forecast with the weighted average SMRC waste generation per household growth of 1.28% per annum.

**Scenario 3** models a per capita-led forecast with the assumption that a 0.5% annual reduction from the 2013/14 waste generation rate can be achieved through active engagement in programs, such as food waste avoidance education programs.

**Scenario 4** forecasts the 2013/14 SMRC waste generation per capita continuing to 2023. This scenario of 'no-action' leads to the greatest increase of household waste volumes per year and is the least favourable outcome in terms of decoupling waste generation from population growth.

**Figure 4-10 SMRC Waste generation projections to 2023**



**Scenario 1** forecasts that with no further increases in current household waste generation 164,041 tonnes of waste will be generated in 2023.

**Scenario 2** forecasts 182,312 tonnes of waste generated by 2023.

**Scenario 3** forecasts the best-case outcome, with the slowest increase in waste generation to 158,045 tonnes of waste generated by 2023.

**Scenario 4** forecasts 171,252 tonnes of waste generated by 2023. Taking no action to slow or decrease current per capita waste generation leads to the least favourable projected outcome.

**Figure 4-11 MSW projection to 2023**

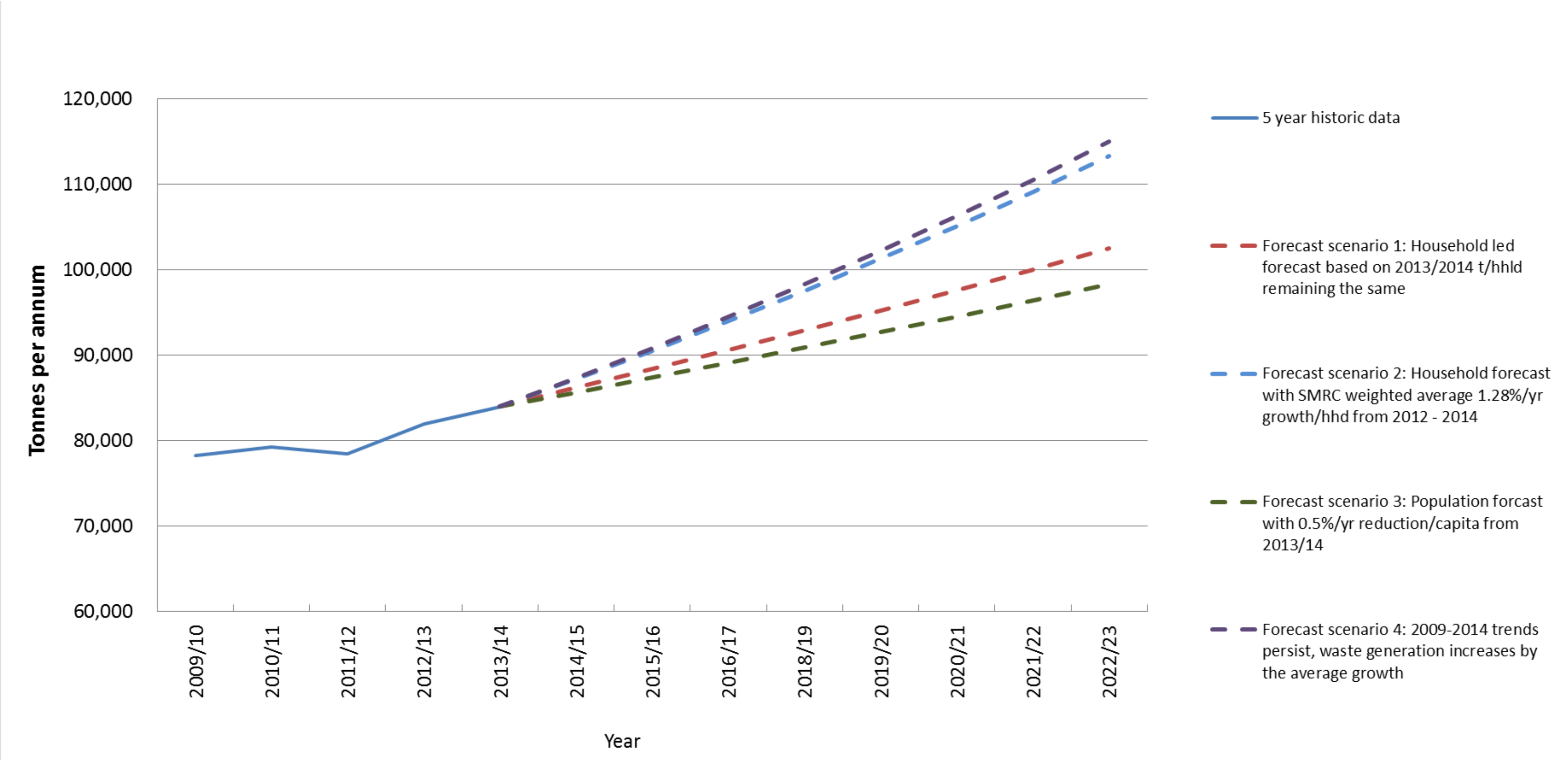


Figure 4-11 demonstrates that should MSW generation continue at the same rate per household as at current then SMRC member councils would be producing 102,508 tonnes of MSW per annum by 2023.

However, if MSW continues to grow at the same rate as the average weighted SMRC increase of 1.28% per household per annum, member councils will generate an estimated 113,303 tonnes of MSW per annum.

If member councils introduce measures to decrease waste generation by 0.5% per household per annum, then total waste generation by 2023 is forecast to be approximately 98,319 tonnes per annum.

Figure 4-12 demonstrates that should comingled recycling generation continue at the same rate per household as at current then SMRC member councils would be producing 41,003 tonnes of recycling per annum by 2023.

However, if recycling continues to grow at the same rate as the average weighted SMRC increase of 1.28% per household per annum, member councils will generate an estimated 45,675 tonnes of MSW per annum.

If recycling generation decreases by 0.5% per household per annum, then total recycling generation by 2023 is forecast to be approximately 39,634 tonnes per annum.

Recycling generation increased at a faster rate than MSW from 2009. This growth has become more steady in the 6 years leading up to 2014, therefore it is unlikely the rate of increase will follow the same trend. However, if it did then member councils would be producing 83,838 tonnes of comingled recyclables by 2023.

Figure 4-13 demonstrates that should green waste generation continue at the same rate per household as at current then SMRC member councils would be producing 12,616 tonnes of green waste per annum by 2023.

However, if green waste continues to grow at the same rate as the average weighted SMRC increase of 1.28% per household per annum, member councils will generate an estimated 13,128 tonnes of green waste per annum.

If green waste generation decreases by 0.5% per household per annum, then total generation by 2023 is forecast to be approximately 11,392 tonnes per annum.

If green waste generation continued along the same overall trend to 2023, then member councils would be generating an estimated 15,512 tonnes per annum by 2023.

**Figure 4-12 Comingled recycling projection to 2023**

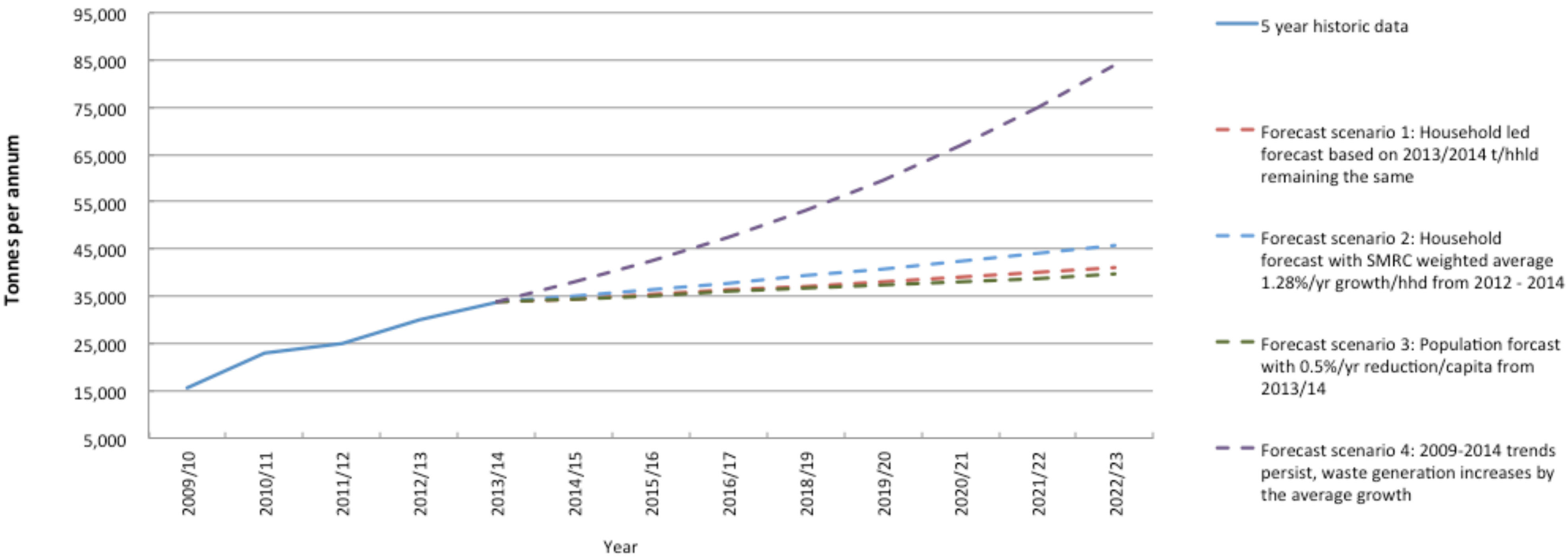
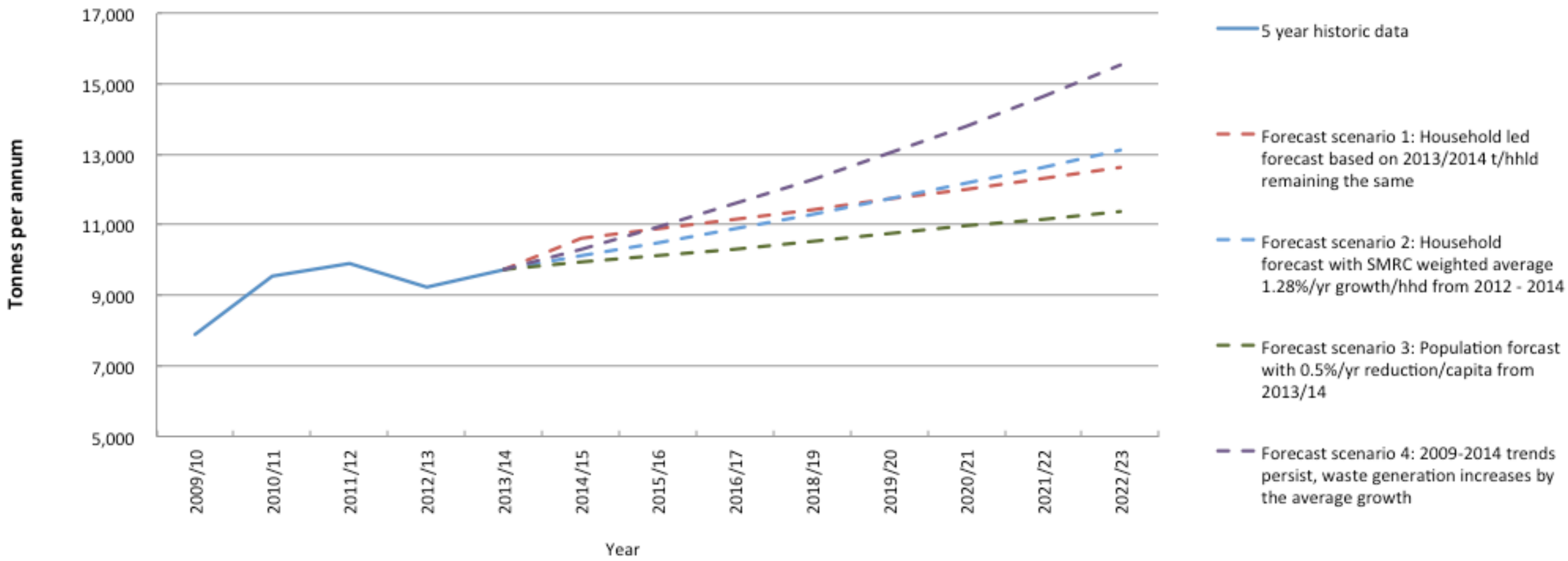


**Figure 4-13 GW projection to 2023**



## 4.9 Commercial & Industrial and Construction & Demolition waste

It is estimated that approximately 31% of all waste generated in Australia is generated by the Commercial & Industrial (C&I) sector and 26% from the Construction & Demolition (C&D) sector[6].

The most recently available data (2010), states that approximately 3,172,000 tonnes of waste was generated in WA. It is likely that the amount of waste will have increased in the years leading up to the present day.

Using this estimate, approximately 951,000 tonnes of waste is generated in the C&I sector and 825,000 in the C&D Sector per annum in WA (Table  and Table 4-4).

Due to a lack of region specific data available, the total tonnes of C&I and C&D waste generated in Perth and SMRC were estimated based on population data. Approximately 78% of WA's population live in Perth and 11% of them live in the SMRC region.

**Table 4-3 Estimated tonnes and composition of C&I waste in WA using population data**

| Sector | Unit | Organic | Non-organic | Other | Total |
|---|---|---|---|---|---|
| **C&I (National)** | % | 7 | 18 | 75 | 100 |
| **C&I (WA)** | tpa | 66,000 | 171,000 | 714,000 | **951,000** |
| **C&I (Perth)** | tpa | 51,480 | 133,380 | 556,920 | **741,780** |
| **C&I (SMRC)** | tpa | 7,260 | 18,810 | 78,540 | **104,610** |

**Figure 4-4 Estimated tonnes and composition of C&D waste in WA using population data**

| Sector | Unit | Organic | Non-organic | Other | Total |
|---|---|---|---|---|---|
| **C&D (National)** | % | 2 | 72 | 16 | **100** |
| **C&D (WA)** | tpa | 17,000 | 594,000 | 214,000 | **825,000** |
| **C&D (Perth)** | tpa | 13,260 | 463,320 | 166,920 | **643,500** |
| **C&D (SMRC)** | tpa | 1,870 | 65,340 | 235,40 | **90,750** |

[6] Australian Bureau of Statistics, 2012.

In summary, conservative estimates for C&I and C&D waste in the region are:

- 104,610 tonnes of C&I waste generated per annum in the SMRC region; and
- 90,750 tonnes of C&D generated per annum in the SMRC region.

The organic waste of interest to SMRC was calculated to be:

- 9,130 tonnes of organic waste generated by both C&I and C&D in the SMRC region; and
- 64,740 tonnes of organic waste generated per annum in the Perth region.

A proportion of this organic stream may be available to a FOGO processing unit in the future. However, it cannot be contracted in large tonnages (i.e. it is sourced from large numbers of cafes, restaurants, building sites etc.) and is generally not contracted for greater than 3 years. Therefore it cannot be completely depended upon when assessing the commercial viability of proposals.

# 5 Stakeholder consultation

## 5.1 Objectives

The objective of the SWMP consultation process was to provide a comprehensive stakeholder analysis for the development of the SWMP.

The stakeholder analysis was designed to provide detailed and comprehensive information as follows:

- The identification of potential actions and waste projects that could be undertaken at the regional level;
- Political impacts of action; and
- Action required to address the impacts.

The stakeholder analysis has been used to identify possible actions for inclusion in this Plan.

## 5.2 Stakeholder definition

For the purposes of this report, stakeholders are defined as those organisations (governmental and non-governmental), sectors or groups of individuals, which either benefit from or have a positive or negative impact upon the SWMP.

## 5.3 Results

Data gathered as a part of the Stakeholder Consultation was analysed and the brief summary actions are detailed in Table 5-1.

**Table 5-1 Findings of Stakeholder Discussions – Local and Regional Government**

| Stakeholder | Potential regional actions identified | Potential impact of action | Action required to address negative impact |
|---|---|---|---|
| **City of Fremantle** | Consider changing bin sizes for MUDs with a new service.<br><br>Have decided not to adopt a three bin system including FOGO due to budget constraints. | Improve resource recovery and increase participation from MUDs in any new service. | Include action to develop MUD specific services and education in any new service provision. |
| **Town of East Fremantle** | Consider moving recycling from weekly to fortnightly in a 3 bin system. | Potential political implications of reducing the frequency of collection. | The cost implications and political acceptability to be examined as part of the options analysis. |

| Stakeholder | Potential regional actions identified | Potential impact of action | Action required to address negative impact |
|---|---|---|---|
| **City of Melville** | Council would like to look at the role of SMRC after 2018. | Alternative models of governance to be considered. | A full analysis of governance in SMRC to be considered as part of business and contracts analysis. |
| | Council would like to transition to 3-bin system. | Compliance with the Waste Authority's recommended 3-bin system. | 3-bin FOGO option to be considered highly politically acceptable in options analysis. |
| | Consideration of social acceptability of the use and location of any EfW facility needs to be taken into account. | Community backlash if EfW facility built too close to households. | SWMP needs to mention the contract risk of the EfW proposals.<br>EfW for a 2 bin system to score low for political acceptability in options analysis.<br>Recommendations need to consider EfW as a part of a suite of options, not the whole picture. |
| | Will not consider the purchase of additional infrastructure. | Increased cost of running RRRC; debt. | No new infrastructure to be considered in the SWMP but consideration to be given to SMRC acting as a SMRC can act as a contract manager, co-ordinator and procurement of services, for example for kerbside collection services on a broad scale. |
| **City of Kwinana** | Kwinana has signed a contract with Phoenix energy already. | Kwinana tonnes will not be available now or into the future. | Kwinana tonnes not to be considered in current or future options analysis unless the Phoenix Energy Project does not get financial close. |
| | Collection Issues for MUDS. | Improve resource recovery and increase participation from MUDs in any new service. | Include action to develop MUD specific services and education in any new service provision. |
| **City of Canning** | Disbanding of City of Canning under LG reform process. | City of Canning was to be disbanded and split 4 ways between City of Gosnells, Melville and South Perth. City of Melville would have geographically inherited the | City of Canning are not to be disbanded so regionalisation of services and assets can be considered. |

| Stakeholder | Potential regional actions identified | Potential impact of action | Action required to address negative impact |
|---|---|---|---|
| | | waste transfer station if the reform went forward. | |
| | City of Canning will consider expanding services for green waste grinding and processing. | Expansion of regional services. | Include potential regionalisation of green waste processing in SWMP actions. |
| | City of Canning are currently re-tendering for recycling processing and disposal. | Availability of potential additional input tonnes for the RRRC MRF. | If re-tendered then SMRC should make a submission. |
| | Possibility of consideration of change in future bin systems when new Council is elected (no certainty). | Council may consider changing to a 3-bin system in the future, but for now 2 bin system must be assumed. | Currently staying with 2-bin system so City of Canning's tonnes of source separated FOGO will not be available in options analysis. |
| | Alternative waste industry hub development. | Potential of expanding the Ranford Road site and making it a regional processing hub. | |
| **City of Cockburn** | Potential withdrawal from SMRC. | Changed membership composition. | Include analysis of governance in business and contracts chapter. |
| | City of Cockburn will consider 3-bin system and trial commercial services. | More politically acceptable 3 bin GO system. | 3 bin FOGO to be included in options analysis, but Cockburn will only score highly on political acceptability for green waste. |
| **SMRC** | Purchase of additional infrastructure. | Increased cost of running RRRC; debt. | No new infrastructure to be considered in the SWMP but consideration to be given to SMRC acting as a contract manager, co-ordinator and procurement of |

| Stakeholder | Potential regional actions identified | Potential impact of action | Action required to address negative impact |
|---|---|---|---|
| | | | services, for example for kerbside collection services on a broad scale. |
| | MRF operations to be tendered to a commercial operator. | Reduction in member loans and MRF gate fee. | Assume MRF will be tendered out as part of the SWMP actions. |
| | Alternate Composting Options. | SMRC to consider using drums to process FOGO and other external composting facilities such as the Bunbury MAF. | Options analysis to include SMRC processing FOGO and 'other' composting facility and compare. |
| | EfW must be based on the residual of a 3 bin system.<br>2-bin EfW is not consistent with the Waste Hierarchy and therefore the Waste Authority's position. | Reduced waste to landfill; EfW processing requires a 3 bin system. | Different options comparing the reduction of waste to landfill including EfW processing (should facilities be operational in the future) but 2 bin EfW options will not score highly in the MCA as they are inconsistent with the Waste Authority's position. |
| **The Waste Authority** | The Waste Authority's position on EfW is that it preferences 3 bin (at least green waste) source separation before EfW. | 2-bin EfW is not consistent with the Waste Authority's position. | 2-bin EfW option will score low for 'political acceptability' in analysis. |
| | The Waste Authority will consider a levy on an EfW facility as stipulated in the WARR Act. | This is a potential risk for options using an EfW technology. | To be considered in risk modelling of options. |
| | The Waste Authority's position on preferred bins is a 3-bin system | 3-bin system options are more politically acceptable than 2. | 3-bin systems to score more highly for 'political acceptability'. |

| Stakeholder | Potential regional actions identified | Potential impact of action | Action required to address negative impact |
|---|---|---|---|
| | Current EfW contracts are built on the assumption of the bottom ash being successfully processed into bricks. | There is a risk to Council, should the ash not be successfully turned into bricks. | Add this cost risk to the risk analysis for collection options. |
| **RRC** | All 'committed' MSW tonnes are committed to Phoenix Energy Contract. | No tonnes available for processing at the WCF, unless State Government stipulates a requirement for a third bin prior to processing at an EfW, at which time the green waste tonnes may become commercially available. | RRC tonnes not to be considered in current or future options analysis unless the Phoenix Energy Project does not get financial close or if the State Government stipulates a requirement for three bin separation prior to EfW. |
| | RRC member councils would consider processing comingled recycling at the RRRC MRF if it was competitively priced. | SMRC to consider tendering for RRC comingled recycling tonnes should they become commercially available. | A potential action for consideration to be included. |
| | RRC to look at processing hubs for comingled recyclables, mattresses and other small streams. | SMRC to work with RRC to develop regional recycling hubs. | A potential action for consideration to be included. |
| **EMRC** | Red Hill transfer station has the capacity to accept additional material. | SMRC could work with EMRC to establish Red Hill as a regional facility for some streams. | A potential action for consideration to be included. |
| | Hazelmere Resource Recovery Park (HRRP) has development consent for a wood waste pyrolysis plant. | SMRC could work with EMRC to promote the HRRP for clean wood waste processing. | A potential action for consideration to be included. |

| Stakeholder | Potential regional actions identified | Potential impact of action | Action required to address negative impact |
|---|---|---|---|
| | EMRC member councils have not signed up to any upcoming EfW contracts. | Should EfW come online then SMRC could work with EMRC to develop a protocol for any future EfW contracts to minimise risks should either/both decide to consider and EfW contract in the future. | A potential action for consideration to be included. |

# 6 Review of existing waste management plans and strategies

## 6.1 Strategic vision, themes and targets

In setting the strategic vision, themes and targets for SMRC it is important to understand and review all existing, relevant SMRC and individual member council strategic plans to identify alignments. Progress against previous Strategic Waste Management Plan's actions has been reviewed; as well as additional relevant council plans. Those reviewed are listed in Table 6-1 with their key relevant strategic themes.

**Table 6-1 Summary of existing strategic plans reviewed**

| Council | Strategic plan | Strategic themes |
|---|---|---|
| **SMRC** | 1. *Strategic Waste Management Plan (2008)*<br>2. *SMRC Strategic Community Plan 2013-2023* | 1. Increasing the volume of recyclable and recovered material;<br>2. Ensuring resources recovered are reused; and<br>3. Sourcing and developing innovative options for the recovery of waste. |
| **City of Cockburn** | 1. *Strategic Community Plan 2012-2022*<br>2. The City of Cockburn Waste Management and Education Strategy 2013-2023 | 1. To reduce waste, energy and greenhouse gas emissions in order to be environmentally responsible and sustainable by 2022; and<br>2. To support the community and businesses to reduce resource consumption, recycle and manage waste. |
| **Town of East Fremantle** | 1. *Strategic Community Plan 2013 – 2023* | 1. Residents to have a greater choice and access to infrastructure and services, while protecting and maintaining physical and environmental assets for future generations. |
| **City of Fremantle** | 1. *Strategic Plan 2010-15*<br>2. *Strategic Plan Community Update February 2015* | 1. To achieve an organisational reduction in carbon emissions by 2020; and<br>2. To implement commercial recycling. |
| **City of Kwinana** | 1. Strategic Community Plan 2013-2023 | 1. Ensuring that project timeframes for waste and recycling infrastructure are matched to population growth. |
| **City of Melville** | 1. *Community Plan for the City of Melville 2007-2017*<br>2. *Local Commercial and Activity Centres Strategy* | 1. Provide for valuing the natural environment and minimising resource use in activity centres; and<br>2. Reduce the net use of building materials, reduce need for maintenance and encourage use of renewable materials. |

## 6.2 Review of Strategic Plans

### 6.2.1 SMRC

The SMRC Strategic Community vision is to be 'leaders in delivering innovative and sustainable waste management solutions for the benefit of our communities and the environment'. This vision comprises of three key focus areas: Resource Recovery, Business Sustainability and Stakeholder Relationships.

Within the focus area of Resource Recovery, the following values have been identified:

- Minimising waste to landfill is at the core of SMRC business;
- Delivering effective waste management solutions;
- Identifying partnership opportunities to deliver waste management solutions; and
- Working toward solutions that value-add to residual products.

In order to deliver solutions that divert waste from landfill, SMRC has developed 3 core objectives:

- Increasing the volume of recyclable and recovered material;
- Ensuring resources recovered are reused; and
- Sourcing and developing innovative options for the recovery of waste.

In 2012, SMRC achieved a diversion rate from landfill of 63%, which exceeds the Western Australian Waste Strategy (2012) targets for Metropolitan Perth of 50% by 2015 and almost achieves the 2020 target of 65%.

#### 6.2.1.1 Community attitudes to waste and recycling and SMRC performance

SMRC commissioned a phone survey in 2015 to measure waste attitudes and behaviour, to track SMRC brand perceptions, and evaluate opinion about the Regional Resource Recovery Centre (RRRC). There was a 4% increase in awareness of the SMRC from 2014, with the highest awareness in the City of Fremantle and among RRRC local residents.

Of those respondents aware of SMRC:

- 65% believe SMRC is achieving its vision, agreeing that it is a leader in waste management and resource recovery;
- 77% of were satisfied with the overall performance of the SMRC;
- On average, 45% gave high performance ratings for recycling, separating and converting organic waste, reducing landfill and removing contaminants within SMRC;
- Half of SMRC residents have a favourable opinion of the RRRC;
- Respondents expressing unfavourable opinions were concerned primarily with odours, as well as communications, cost and effectiveness. However, 75% of respondents living in proximity to the RRRC stated they experienced little to no impact of odour from the facility;
- Contamination of waste streams was considered the most important waste management activity (85%); followed by recycling (83%), waste reduction (78%) and education (76%);
- There was a high satisfaction rate with current collection services for general waste (97%), recycling (91%) and verge side bulk (84%); and

- 52% would like more information about waste and recycling, with over half of respondents unaware of SMRC's performance in relation to education strategies, noting:
  - Only 1% of residents are receiving the SMRC e-newsletter and interest has decreased by 13% since 2014;
  - 11% are aware of the recycle right campaign; and
  - 95% of respondents kept waste calendars distributed by SMRC, indicating print media is highly effective in waste communication.

### 6.2.2 City of Cockburn

The City of Cockburn's Strategic Community Plan 2012-2022 is a long-term plan, articulating aspirations and strategic priorities for the community. The plan consists of seven key themes that frame the main objectives, and details Cockburn's aims to reduce waste, energy and greenhouse gas emissions in order to be environmentally responsible and sustainable by 2022.

The theme of 'Infrastructure' details council's objectives for the creation and maintenance of sporting, educational, social facilities, waste infrastructure and other civic requirements for the community. The plan states that the community and businesses will be supported to reduce resource consumption, recycle and manage waste.

The City of Cockburn Waste Management and Education Strategy 2013-2023 outlines the City's directions for the minimisation, management and education around waste within the City of Cockburn operations. The vision of the Plan is to lead and support a community that avoids waste generation, reduces environmental impacts and considers the waste that is produced as a valuable resource to be reused, recovered and recycled. The Plan outlines Cockburn's commitment to waste avoidance and innovative waste solutions through its partnership with SMRC. An innovative action outlined in the Plan includes determining the feasibility of a 3-bin organics system in collaboration with SMRC member councils, to be delivered over 2015/16 at a value of $20,000. The Waste Management and Education strategy also outlines the City's targets for the recovery and reduction of MSW, C&I, C&D, E-waste and Household hazardous wastes (Table 6-2).

**Table 6-2 Cockburn Resource Recovery Targets**

| Waste Stream | Actual 2013 | Target 2015 | Target 2020 |
|---|---|---|---|
| Kerbside MSW | 58% | 60% | 62% |
| Kerbside Recycling | 85% | 86% | 91% |
| Bulk Verge Collection - Junk | 2% | 10% | 40% |
| Bulk Verge Collection – Green waste | 100% | 100% | 100% |
| C&D | 0% | 10% | 75% |
| C&I | 2% | 10% | 75% |

### 6.2.3 Town of East Fremantle

The Town Of East Fremantle's Strategic Community Plan 2013 – 2023 forms part of the council's Integrated Planning and Reporting Framework and sets out the Town's long term vision, aspirations and key strategies for the future. The Town's vision is broken down into 3 key focus areas:

- Community Identity;
- Lifestyle; and
- Infrastructure & Services.

The Plan also states that East Fremantle strives for increased environmental sustainability by being involved in organisations, such as the Southern Metropolitan Regional Council, and by promoting good environmental sustainability practices.

The following actions were identified to achieve the outcome of maintaining physical and environmental assets:

- Maintaining the Town's physical and environmental character;
- Looking for new ways to share the responsibility to support community amenities; and
- Identifying the changing needs of the community and assessing facilities and infrastructure available to support those needs.

To achieve this, East Fremantle will need to work with residents and ratepayers, government agencies, community groups and local businesses.

The Plan also details that by 2023 sustainable practices will be supported in the community, with East Fremantle leading by example in areas of waste and energy sustainability.

The following action has been identified to achieve the outcome of preserving the environment through sustainable practice:

- Promoting sustainable environmental management and use of sustainable resources.

### 6.2.4 City of Fremantle

The City of Fremantle's Strategic Plan 2010-15 sets out 7 strategic imperatives that articulate a vision for Fremantle to be recognised as a unique city of cultural and economic significance. The City of Fremantle's Plan makes a commitment to the community to focus on providing strong environmental leadership for the benefit of current and future generations.

Fremantle set a 5-year target of an organisational reduction in carbon emissions. 3 year plans / projects to improve waste management are:

- Implementing commercial recycling; and
- Preparing a business plan to implement weekly household recycling.

### 6.2.5 City of Kwinana

The City of Kwinana's Strategic Community Plan 2013-2023 is a long-term strategic plan that develops common goals to guide the whole community in working together to achieve community aspirations. The Plan is central to addressing rapid growth within the region, as Kwinana is the fastest growing local government area in the SMRC.

In developing the Plan, each household within the Kwinana was invited to participate in the Kwinana 2030 Visioning Survey during September 2012. Waste services / verge collections were identified as one of the lowest priorities for change amongst residents of the City of Kwinana.

A key aspiration for Kwinana is to promote the idea of '*its all here - services, facilities, diverse lifestyles*'. An objective of this aspiration is to create diverse places and spaces where people can enjoy a variety of lifestyles. In order to achieve this Kwinana has taken a proactive and strategic approach to planning for significant infrastructure needed for the future, such as waste disposal and recycling facilities to ensure that project timeframes are matched to population growth.

### 6.2.6 City of Melville

The City of Melville operates two strategies that contribute towards the City's waste management goals.

The Community Plan for the City of Melville 2007-2017 sets out long-term goals that help guide all sections of the community in working together to achieve community aspirations. The City of Melville community vision describes the desire to provide accessible natural and built facilities, with a responsibility to future generations by taking into account the consequences of current actions. Environmental well-being has been identified as one of three key areas contributing to a sustainable future community.

The City of Melville currently has incentives to encourage households and businesses to reduce waste, water and energy usage, which are detailed in the Plan. Household and commercial recycling, environmental education and informed decision-making have been identified as areas for future opportunities and challenges. An action that has been identified to address these opportunities and challenges is the provision of an effective and efficient waste service.

The City of Melville's Local Commercial And Activity Centres Strategy outlines the City's contribution to a metropolitan area planned for future sustainability and has identified a capacity of change in waste management. Two goals relating to resource use are outlined in this strategy.

1. Provide for valuing the natural environment and minimising resource use in activity centres; and
2. Reduce the net use of building materials, reduce need for maintenance and encourage use of renewable materials.

Resource minimisation strategies may include, but are not limited to, building rating systems, renewable energy, recycling and use of durable or renewable materials. Developers will need to demonstrate how resources such as materials, energy and water will be minimized.

The City encourages use of building and landscaping materials that are durable, low maintenance and sourced from renewable resources where possible.

## 6.3 Progress on 2008 SWMP actions

Actions from the previous Strategic Waste Management Plan have been previously reviewed[7] for progress; the results are listed in Table 6-3.

**Table 6-3 SWMP actions review**

| Initiative | Status |
|---|---|
| Inter Regional Council Cooperation | 1. SMRC participates in:<br>• Operational Waste Managers group; and<br>• Municipal Waste Advisory Council. |
| Weekly Recycling | 1. Regional implementation:<br>• Cockburn – 2011;<br>• East Fremantle –2012;<br>• Melville –2012;<br>• Fremantle – fortnightly recycling service with option of 360L bins; and<br>• Kwinana – Considering 360L bins for 2014/15.<br>2. Waste audits conducted in Cockburn and Melville in August 2013 to measure impact of weekly recycling. |
| Three bin collection service | 1. Three bin collection model presented to Fremantle January 2014.<br>2. Hyder report on three bin system presented to council November 2013.<br>3. $7.5 million in funding in 2014 to implement the Better Practice Kerbside Collection Guidelines. |
| Conduct waste audits | 1. Kwinana Bin Tagging Trial – An engagement and enforcement program to increase recycling and reduce contamination in the kerbside recycling system funded by WALGA. The program is based on a pilot trial conducted in SA that reduced contamination by 60%. The Kwinana trial commenced in February 2015 and was due for completion in April 2015. |
| Verge Collections | 1. Each council provides verge collections at specified times throughout the year (Table 4-1). |

[7] Review of SMRC Strategic Waste Management Plan Status Report (June 2014)

| Initiative | Status |
|---|---|
| Introduce standardised public place recycling | 1. Fremantle:<br>• 50 public recycling bins installed and trial is being conducted to assess community use and value.<br>2. Cockburn:<br>• Be Wise About Waste at Events and Public Places Programs; and<br>• Waste Management and Education Strategy 2013-23 allocated $10,000 to determining the effectiveness of public place recycling in 2013/14. $50,000 was also allocated to implementation of public place recycling in 2014/15 with $60,000 allocated each year from 2015-2018. |
| Centralised drop off centre proposed for Melville | 1. Discontinued. |
| Community drop off facilities | 1. Feasibility study on establishing a drop off service for new recyclables such as mattresses to be included in Regional SWMP 2014/15. |
| Garden City (Melville) Recycling | 1. Recycling introduced. |
| E-waste Collection Service Feasibility Study | 1. Assessment of E-waste options for Metropolitan Perth, WA in 2009 recommended establishing permanent drop-off sites. |
| Implementation of E-Waste collection service | 1. Free e-waste collection day at RRRC funded by WA Waste Authority as part of the E-Waste Recycling Grant Program. |
| Household Hazardous Waste (HHW) | 1. Factsheets available through Recycle Right website and mobile app.<br>2. HHW survey conducted. |
| Implement a Carbon Pollution Reduction System | 1. Due to removing organics from MSW, the WCF reduces carbon impact and generates carbon credits. |
| Tiered Gate fee at Landfill | 1. Cost and funding continuously evaluated for each business activity as part of annual budget. |
| Second Regional Resource Recovery Centre | 1. Feasibility of working with another regional group to combine services as a second Regional Resource Recovery Centre study to be included in scope of SWMP. No new infrastructure to be funded by member councils. |
| Minimise MSW | 1. Perth Bin Hire awarded contract to transport glass to C&D recycling site.<br>2. SMRC regularly invites tenders for the purchase of recovered recyclables every 3 – 4 months. |

| Initiative | Status |
|---|---|
| Green Waste Processing Facility Review | 1. DER issued new license for RRRC in April 2014 lifting restrictions on green waste processing during summer. Green Waste Processing Facility review included in the SWMP. |
| Accept shredded green waste | 1. All clean green waste is accepted at the GWF. |
| Commercial recycling | 1. MRF business options paper discussed with Regional Executive Group.<br>2. New commercial contract for MRF.<br>3. Submission of tenders to provide a process service.<br>4. Processing of C&I waste is part of SMRC 2023 vision. |
| Centralised C&D facility feasibility study | 1. City of Fremantle conducted a C&D recycling Pilot Trial, which identified barriers to C&D recycling and determined whether a resource kit improved recycling rates. A larger trial was recommended to determine potential improvements to recovery rates. |
| Kwinana Industrial Resource Recovery Park, Postans | 1. Accommodating the demands of Industry for consolidated waste disposal in the Postans area is included in the City of Kwinana Draft Local Planning Strategy 2015. |
| C&D Facility Implementation | 1. WA State Government Investigation into Waste Management Infrastructure Scenarios 2013 found that strengthening of policy frameworks in relation to C&D processing facilities is required in order to support their development. |
| Temporary transfer station at the Henderson Waste Recovery Park | 1. Completed in 2012. |
| Strategic planning of waste infrastructure | 1. New operating license for WCF and GWF approved by DER and commenced March 2014.<br>2. Re-commence Regional Executive Group meetings to focus on strategic relevance.<br>3. Ongoing investigation into best uses scenarios for current technology and site.<br>4. DER issued new license for RRRC in April 2014 increasing the processing capacity of WCF to 95,000tpa.<br>5. Final screen upgrade for WCF has been included in the 2015/16 budget.<br>6. Investigation of the feasibility of public-private partnerships to be included in MRF review.<br>7. Potential for alternative uses of site is part of SWMP and Long Term Financial Plan. |

| Initiative | Status |
|---|---|
| Establish community based air quality research project | 1. Monthly Field Ambient Odour Assessments are conducted in the community adjacent to the RRRC, with results published on SMRC website. |
| Regional Education Program | 1. RRRC community tours:<br>• New tour guides employed to increase number of group visits;<br>• Free tours run first Saturday of every month; and<br>• During 2013/14, government ministers from Australian federal, state and local governments toured the facility, as well as local community groups and international visitors from Malaysia and Singapore.<br>2. Recycle Right Campaign:<br>• Website launched in 2012;<br>• Introduced new mobile app in 2013;<br>• Highly Commended in Local Government category of the WA Waste Authority's Infinity Awards 2013; and<br>• Ongoing promotion to other customers (Appendix B 'Recycle Right').<br>3. Community Advisory Group (CAG):<br>• Reviewed Terms of Reference;<br>• New members appointed; and<br>• Facilitated attendance at local events. |
| Inter-council workshops | 1. SMRC workshop on strategies for implementing Recycle Right engaged Regional Waste Managers, Sustainability Officers and Communications teams from member councils. |
| Facilitate Australian and international waste management user group | 1. SMRC is a participant of:<br>• Waste Management Association of Australia;<br>• Australian Council of Recycling; and<br>• Waste Educators Networking Group. |
| State Government to assist in education for recycling | 1. SMRC supports WALGA Waste Position and State Government's Waste Communication Plan. |
| Government leadership on sustainability | 1. AS/NZS ISO 14001:2004 re-certification of the RRRC.<br>2. SMRC assisted State Government and Waste Authority in modelling for the Better Bin Collection Systems.<br>3. Submission to Metropolitan Local Government Reform Review on Regional Councils.<br>4. Advocate for enhanced packaging design controls and extended producer responsibility.<br>5. Advocate for legislation that limits the disposal of unprocessed MSW. |

| Initiative | Status |
| --- | --- |
| Education of community | 1. Greenfingers TV.<br>2. Partnership with Guru productions to produce 7 TV segments.<br>3. Participation and/or promotion of community events including:<br>• International Composting Awareness Week;<br>• Plastic Free festival in Fremantle;<br>• Cockburn Sustainable September; and<br>• School holiday incursions.<br>4. SMRC introduced its flagship recycle right education program in 2012. |
| Promotion of commercial recycling | 1. Local businesses are regularly encouraged to participate in events such as Eco May and Plastic Free July.<br>2. Kwinana can provide 240L-recycling bins to businesses. |
| E-news letter | 1. Monthly e-newsletter with updates about SMRC activities and useful recycling tips. |
| Scrap metal bins in council depots | 1. City of Rockingham Millar Rd Landfill accepts scrap metal. |
| Oily rag and oil filter recycling | 1. City of Rockingham Millar Rd Landfill accepts oil waste. |
| Policy development | 1. Community Engagement Plan adopted by council June 2014.<br>2. 'Recycle Right' adopted at SMRC ordinary council meeting June 2014 with request that each member council consider adopting it in July 2014. |
| Waste Management Plans for development activities | 1. No new projects in 2013/14. |
| Investigate DrumMUSTER | 1. Claw Environmental Metro Collections in Welshpool administered the nearest DrumMUSTER location, however, Claw is no longer operating. |
| Dry Cell Battery Recycling | 1. Grant received in 2009 from WA Waste Authority for collection and recycling programs – now complete.<br>2. Battery recycling drop off locations available through Recycle Right website and mobile app. |

SMRC has made progress on a number of the 2008 SWMP actions, primarily through strategic planning of waste infrastructure and regional education programs. Individually, councils have also progressed 2008 SWMP actions by undertaking waste audits and innovative trials of new collection services. A coordinated approach to waste management from all councils would provide the most effective progress on waste management actions.

## 6.4 Compliance to WARR Act

The strategies and plans listed above have also been reviewed for compliance to the regulations within the WARR Act 2007, which stipulates a series of requirements for local government. Individually, Cockburn is compliant through its existing waste management plan and education strategy, while other member councils only partially meet the requirements (Table 6-4).

Table 6-4 demonstrates that this SWMP ensures all other member councils are compliant via a regional approach.

**Table 6-4 Summary of existing strategic plans reviewed**

| WARR Act 2007 Requirement | SMRC SWMP | Cockburn | Fremantle | East Fremantle | Kwinana | Melville |
|---|---|---|---|---|---|---|
| Population and development profiles for the district | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Assessment of significant sources and generators of waste received by the local government | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Assessment of the quantities and classes of waste received by the local government | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Assessment of the services, markets and facilities for waste received by the local government | ✓ | ✓ | | | | ✓ |
| Assessment of the options for reduction, management and disposal of waste received by the local government | ✓ | ✓ | | | | ✓ |
| Strategies and targets for managing and reducing waste received by the local government | ✓ | ✓ | ✓ | | ✓ | |
| Strategies and targets for the efficient disposal of waste received by the local government that cannot be recovered, reused or recycled | ✓ | ✓ | | | | ✓ |
| Implementation programme that identifies the required action, timeframes, resources and responsibilities for achieving these strategies and targets | ✓ | ✓ | | | | |

# 7 Strategic Waste Management Plan - vision

## 7.1 SWMP vision

SMRC and its Members will be leaders in delivering innovative and sustainable waste management solutions for the benefit of our communities and the environment. The delivery of the vision is achieved by undertaking actions across three Key Focus Areas:

- Business Sustainability;
- Resource Recovery; and
- Stakeholder Relationships.

This will be achieved by:

- Placing waste minimisation to landfill at the core of the business;
- Delivering waste management solutions that are effective and efficient;
- Identifying partnership opportunities to deliver waste management solutions;
- Working towards solutions that add value to residual products;
- Attracting new customers and partners to optimise processing capacity;
- Delivering sustainable waste management solutions in an efficient and effective manner;
- Reflecting the current commercial environment, and developing the flexibility to continually evolve as conditions change;
- Understanding and integrating the expectations of member councils into a governance structure that is equitable and representative;
- Providing the community with the right level of knowledge and education so that positive waste separation behaviour change happens in the household; and
- Placing education as a foundation for addressing all areas of the waste hierarchy paramount in the reduction of waste to landfill and a significant role in delivering an efficient operation.

## 7.2 Plan targets

In order to reach the targets set by the State government the following targets have been set and are outlined in Table 7-1.

**Table 7-1 SWMP targets**

| Stream | Target (2020) |
|---|---|
| Municipal Solid Waste | Increase recovery rate for MSW by 5% |
| Commercial and Industrial Waste | Work with member councils to set a baseline for C&I waste and install measures to improve on this by 5% |

# 8 Collection options analysis

The options analysis for SMRC was conducted in the following four stages:

1. Two recycling waste service options were quantitatively and qualitatively modelled and scored;
2. Ten full system domestic waste service options were quantitatively and qualitatively modelled and scored;
3. Sensitivity testing was conducted on the three highest scoring full system options to determine the impact of modifying key assumptions; and
4. A risk analysis was performed to conduct more detailed sensitivity testing on the two highest scoring full system options.

In addition to the above, three 3 bin GO systems were modelled and a provided in Appendix I 3 bin GO options analysis for comparison purposes.

All options were modelled using MRA's CCM to calculate the quantitative results for each option. The outputs of the CCM analysis are:

1. Total cost:
    a. Cost per ($/t); and
    b. Net present value ($m) across a 20 year planning horizon.
2. Recovery rate;
3. Greenhouse gas emissions; and
4. Vehicle kilometres travelled.

The options were then qualitatively assessed against SMRC's key priorities for waste management:

5. Political acceptability and compliance with state policy criteria; and
6. Community engagement and participation criteria.

In total, each option was assessed against these six criteria.

## 8.1 Recycling options analysis

### 8.1.1 Background

Since 2002 and prior to this study, it has been documented that the amount of comingled recyclables collected in the SMRC region has increased at a rate of 12.5% above population growth. In general, 240L recycling bins are of inadequate capacity for many residents, with a 2005 survey indicating that over 50% of bins were at maximum capacity and as a result, 39% of recyclable materials continue to end up in MSW bins (SMRC, 2008).

A weekly recycling collection trial run was conducted for 300 households (Doherty, 2008). For 8 months from February to October 2006, the recycling behaviour of the test area was compared to a 'business as usual' control area. On average, the trial area generated 10.3kg of comingled recyclables per bin per week, a volume greater than the control area, which generated an average of 6.8kg per bin per week. It is estimated that region-wide, this would equate to a 40% increase in comingled recyclables collected, diverting 16,000 tonnes of recyclables from landfill (Doherty, 2008). The value of these additional recyclables is estimated to be $18 per household per year, with a carbon abatement of 60kg per household per year (Doherty, 2008). Contamination levels during the trial remained consistent, falling within a range of 11-17% (Doherty, 2008). A 360L bin study was not conducted as part the trial.

An end-of-trial survey indicated a strong support by residents for the weekly recycling service and a willingness to pay an extra $0.50-$1.00 per week for the service (Doherty, 2008). It was therefore recommended to implement a weekly recycling collection service in SMRC. The weekly collection service was thus implemented in Cockburn, East Fremantle and Melville.

A fortnightly 360L bin collection service could provide an additional 50% in bin capacity compared with a fortnightly 240L collection service. This additional volume could address bin fullness and provide sufficient capacity to hold the recyclables observed in the MSW bin (39%), without significantly increasing collection costs.

Currently 20% of existing households present a full bin each week (Doherty, 2008). Of these, an estimated 10% of households actually utilise the 480L available. That is, 90% of households would be fully serviced by a fortnightly 360L bin. This suggests that a fortnightly 360L may be both practical and a cost saving.

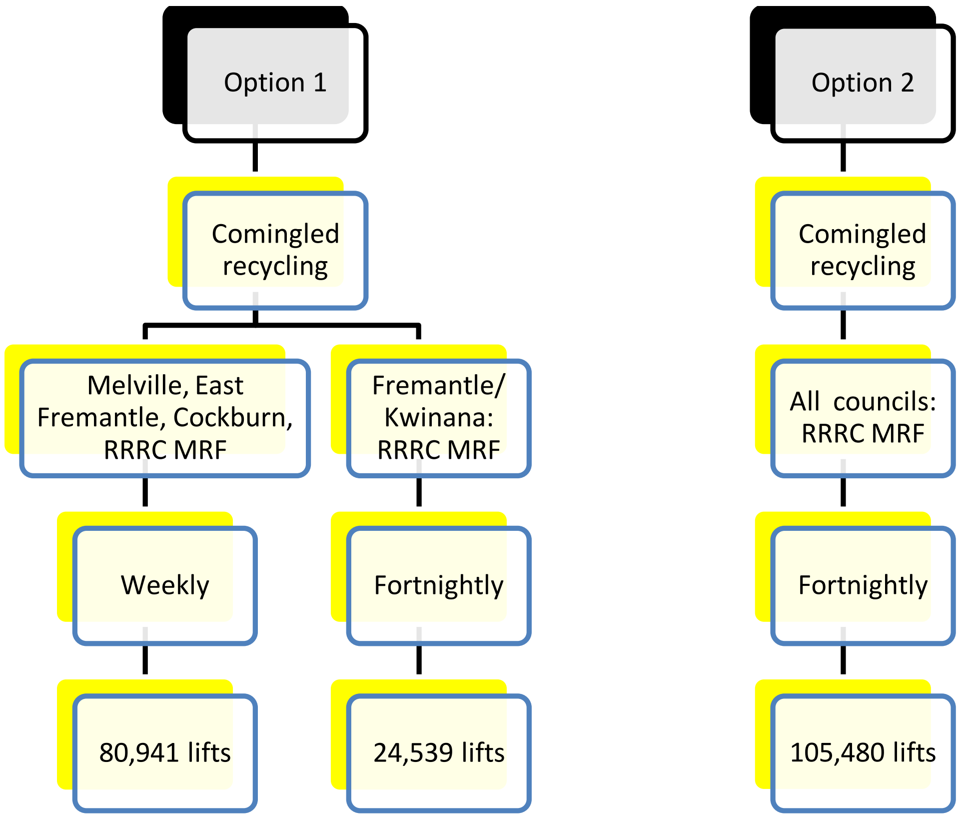
For the purpose of the analysis used in this study, it was conservatively assumed that the same number of tonnes would be collected and the same recovery rate would be achieved by both options. This could be achieved by the introduction of a fortnightly collection service coupled with the introduction of 360L bins to households that require additional capacity (estimated to be 50%).

### 8.1.2 Recycling options

MRA analysed two recycling systems in isolation to the full system domestic waste services to study the feasibility of introducing a fortnightly recycling collection service for all member councils. The options analysed are summarised below:

**Option 1:** Business as usual employs a split collection frequency for kerbside recycling, which is dependent on the member council. Three council members (Cockburn, East Fremantle and Melville) currently offer a weekly recycling service. Fremantle and Kwinana offer a fortnightly collection service.

**Option 2:** All weekly collection services are converted to a fortnightly collection service, with 50% of households receiving a 360L bin resulting in a consistent recycling collection system across the SMRC.




### 8.1.3 Quantitative results

The quantitative results from the CCM provide total system costs, greenhouse gas emissions, vehicle kilometres travelled and resource recovery rates for each option.

### 8.1.4 Recycling costs

The net present value of each recycling option was calculated and is summarised in Table 8-1.

**Table 8-1 Net present value of recycling options over 20 year planning horizon**

| Recycling option | | Recycling NPV ($m) |
|---|---|---|
| **1** | Option 1: BAU weekly/fortnightly collection service | $167.18 |
| **2** | Option 2: Fortnightly collection service with 50% 360L bins | $128.67 |

**Key**

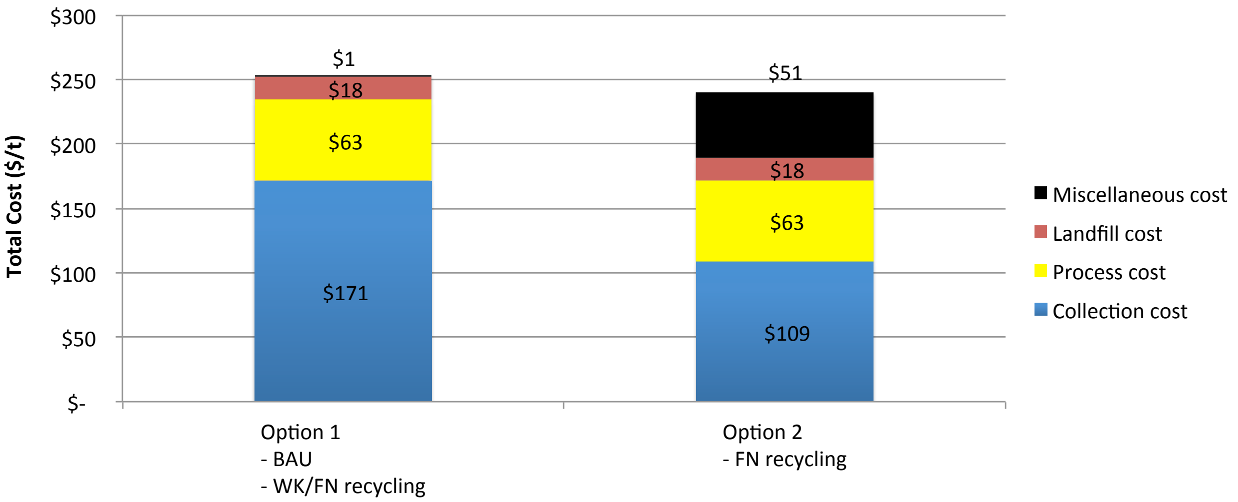
Poorest performing option

Best performing option

Although the lift rate cost increases under a fortnightly collection system ($1.35/lift compared with $1.20/lift due to additional admin overhead allocation), the reduction in bin lifts outweighs the higher lift rate cost, resulting in a net reduction in cost of $38.5m over the planning horizon. This analysis assumes that all bins are lifted during each collection run, rather than relying on residents to wait until their bins are full before presenting them at the kerbside.

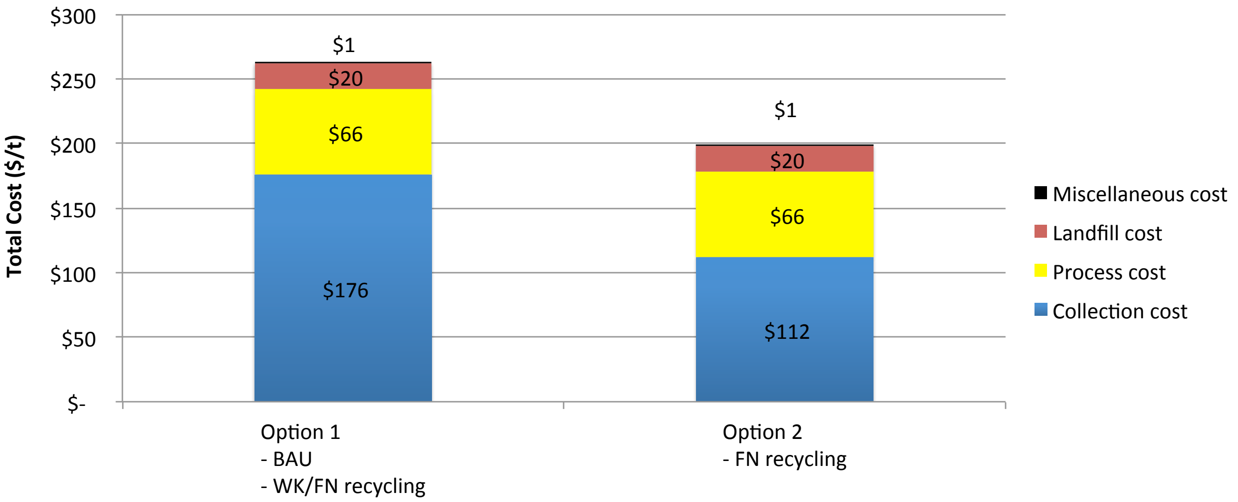
The total cost per tonne has also been provided for 2015/2016 (Figure 8-1). The cost per tonne includes the miscellaneous costs to implement a new collection system, including pamphlets, forums and 360L bins to 50% of households in 2015/2016 (See Appendix D for more information). Despite these significant one off costs, Option 2 is still a lower cost alternative than Option 1 in the first year of implementation (Figure 8-1).

**Figure 8-1 Recycling cost per tonne 2015/2016**




Post implementation, the savings between the two systems become more apparent. In year 2 (2016/2017), a 32% reduction in cost is observed (Figure 8-2).

**Figure 8-2 Recycling cost per tonne 2016/2017**



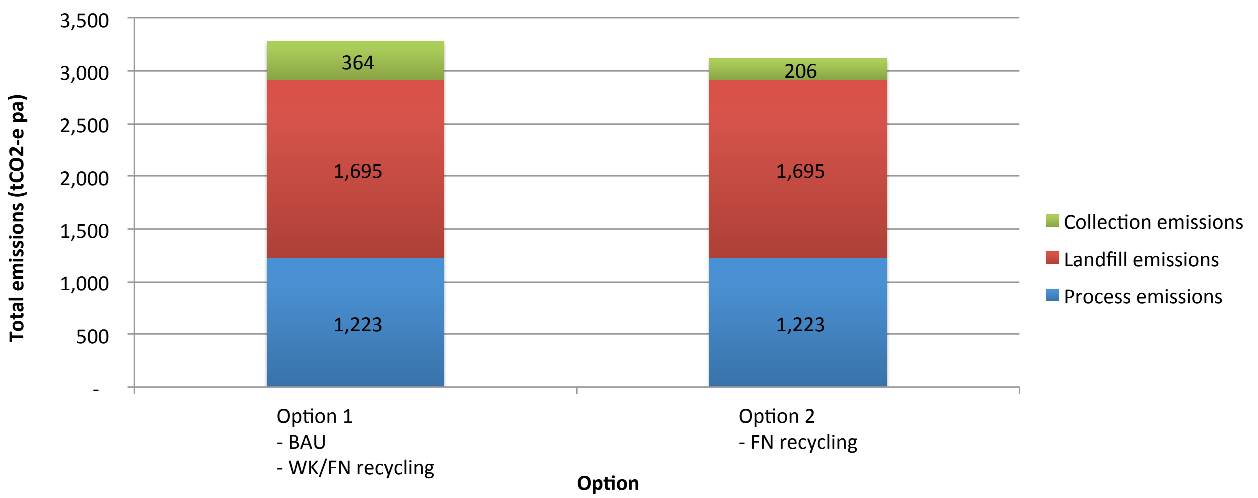
### 8.1.5 Recycling recovery rates

However, it should be noted that offering resident a voluntary option to uptake a 360L bin delivers a minimal uptake particularly if the bin is charged for. A targeted education program needs to accompany such an initiative and consideration of the bin being provided free of charge. Implementation needs to be supported by council staff conducting bin fullness and contamination surveys in order to optimise the take-up.

### 8.1.6 Recycling greenhouse gas emissions

The variations in greenhouse gas emissions between options are marginal (5% reduction from Option 1 to Option 2), as landfill and processing emissions stay consistent across each option (Table 8-3). These emissions combined significantly outweigh the small improvements in collection emissions resulting from reduced truck runs.

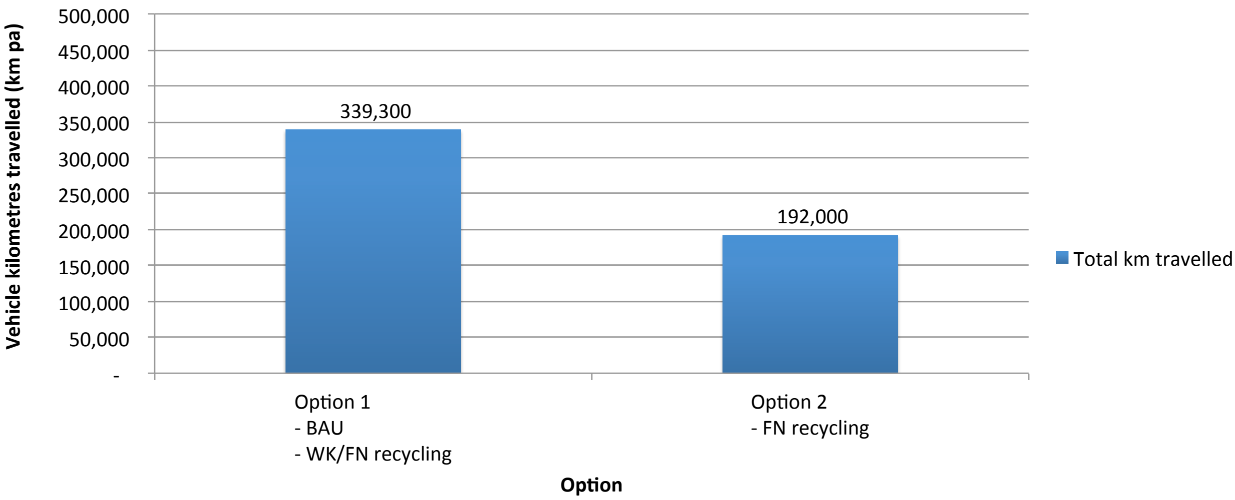
**Figure 8-3 Recycling greenhouse gas emissions**




### 8.1.7 Recycling vehicle kilometres travelled

Although the same haulage distance between the end of a run (when the truck is full) and the RRRC MRF is applicable to each option (conservatively assuming the same number of tonnes are collected in a fortnightly service due to the introduction of 360L bins), the total kilometres in Option 2 is significantly lower than Option 1. This is because less distance is travelled during fortnightly collection runs compared with weekly collection runs.

**Figure 8-4 Recycling vehicle kilometres travelled**




### 8.1.8 Recycling discussion and recommendations

It is recommended from a cost perspective that SMRC member councils who have implemented weekly recycling consider reverting to a fortnightly recycling collection service with 50% of households receiving a 360L bin. This service change offers the following benefits to those offering weekly recycling collections:

1. A 23% reduction in collection costs for Melville, East Fremantle and Cockburn (calculated from the net present value of each option); and
2. A 43% reduction in vehicle kilometres travelled.

The risks associated with reverting to a fortnightly collection service are:

1. Community concern regarding a reduction in service; and
2. A small possible reduction in recycling recovery rates.

If recycling bins in all member councils were shifted to fortnightly services, with the modelling assuming that 50% of households would receive a 360L bin, it achieves a 23% reduction in collection costs (calculated from the net present value of each option). 360L bins are under the modelling assumptions, to households that require the additional capacity, rather than to all households (many of whom will not need it). In short, less than 20% of households require the current 480L service (2 X 240L, weekly). The results show costs are optimised with 50% of households having 240L fortnightly, and another 50% of households having 360L fortnightly.

### 8.1.9 3-Bin placement

The other main purpose (other than cost) of reverting to fortnightly recycling is to avoid residents having to place 3 bins on the footpath on Week 1 and 2 bins on Week 2 (if and when a 3-bin system is introduced). If council believes residents are willing to place 3 bins at once, then the cost savings are the main driver (Figure 8-5). However, it is worth considering that, by way of comparison 48% of all Councils in NSW have 3 or 4 bins and a large proportion of them, which include inner city councils with a far smaller plot size than those of the SMRC region, have 4 bins and therefore put at least 3 bins out on a regular basis with no issue.

**Figure 8-5 Three bin presentation**

| Week | Weekly Recycling | Fortnightly Recycling |
|---|---|---|
| 1 |  FN W W |  W FN |
| 2 |  W W |  W FN |

However, it is recognised from the results of the Weekly Kerbside Recycling Collection Trial conducted in 2008 that a small loss of some recyclables may arise for households who require more than 360L per fortnight. This is estimated at 10% of households but it is not possible to quantify the small possible loss of recyclables. The evidence suggests only 10% of households require 480L per fortnight (i.e. weekly fortnightly services) with 50% of households being provided a 360L volume per fortnight most of the demand is satisfied.

It is recommended that SMRC repeat the trial of 2008 but comparing a reversal of the weekly to fortnightly services. This decision to revert recycling to fortnightly can be made at anytime without impacting the broader and more strategically important full bin and processing options.

To ensure that those residents who need larger recycling volume are serviced adequately Council could work with the collection contractors to record recycling bins which are overflowing or full for two weeks in a row; and

a) Provide these households a 360L bin (for free which will pay for itself in 6 months due to the increase in recyclables collected); or
b) Continue to offer a weekly collection to those households (more expensive).

Specifically, SMRC should consider;

1. Bin tags advertising a 360L service attached to all recycling bins before changing back to fortnightly;
2. Promotion through council newsletters; and
3. High-level media such as television adverts in each member council to promote alternative bin sizes.

Both would require consultation with the collection contractor. In order to increase recycling rates it is recommended that a commitment to more communications and education expenditure is made, delivered via the 'recycle right' brand.

## 8.2 Full system options analysis

### 8.2.1 System options

The emergence of 3 bin EfW options provides a complex and diverse range of bin collection and processing options to SMRC councils. After considerable deliberation, the SMRC selected the following ten waste management options for detailed analysis. They are divided according to the following bin infrastructure systems:

- Scenario 1: 2 bin MSW and comingled recycling; and
- Scenario 2: 3 bin FOGO (food and garden organics) depleted MSW, comingled recycling and FOGO.

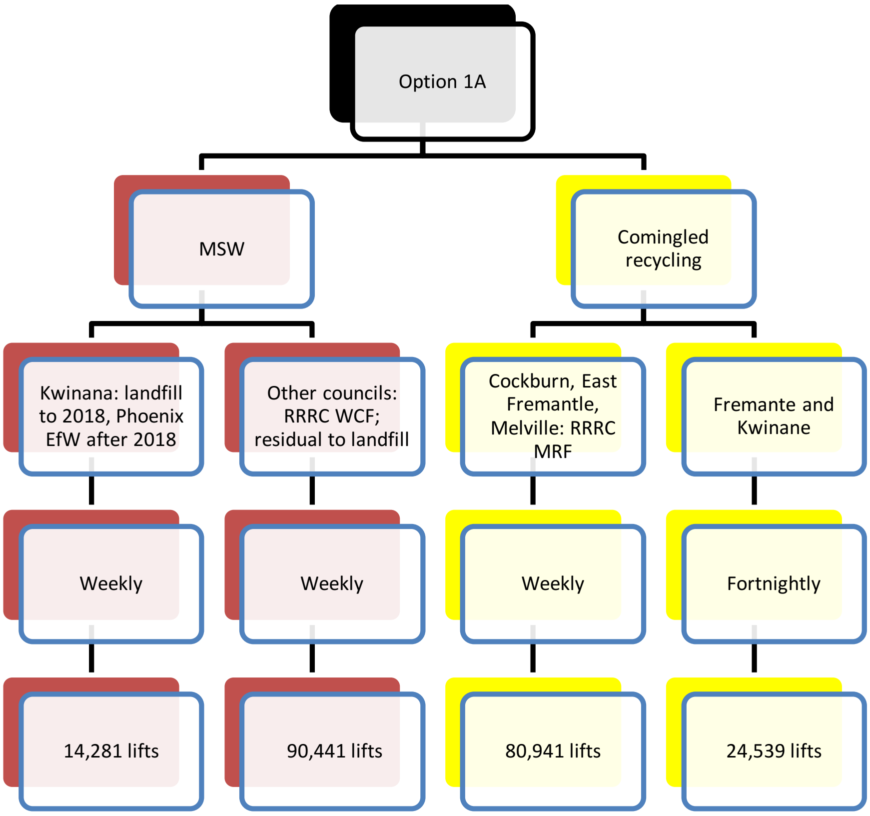
To facilitate comparison of options, it was assumed that all hypothetical facilities were available in 2015 onwards to process SMRC's respective waste streams. The transition arrangements are assumed to be minimal over the planning horizon.

All options assume that Kwinana's waste is processed by Phoenix's EfW facility.

GO only composting options were also considered (Appendix I 3 bin GO options analysis).

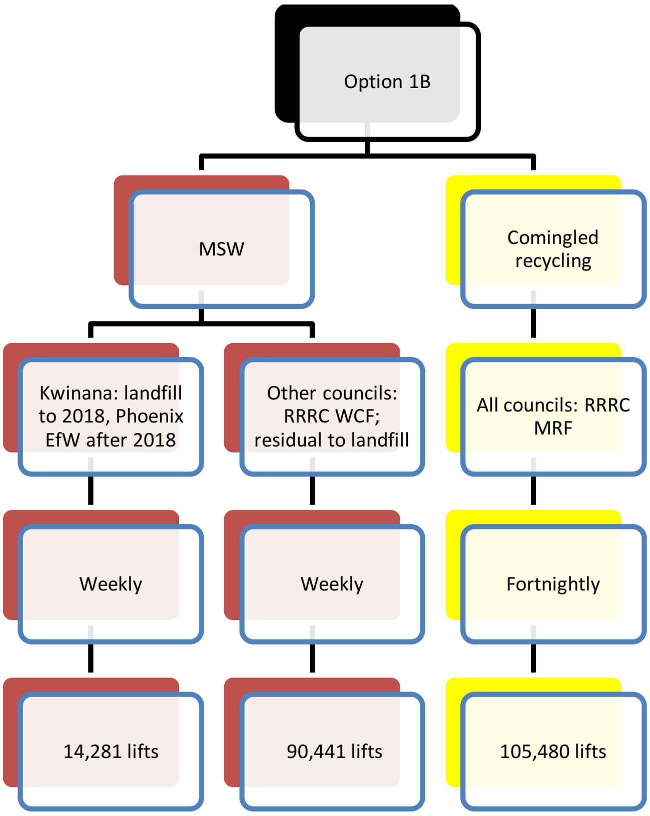
### 8.2.2 Option 1A: 2 bin BAU; MSW to WCF; AWT residual to landfill; FN/WK recycling

Business as usual employs a two-bin system. MSW is sent to the WCF (where residual is sent to landfill) and comingled recyclables are sent to the RRRC MRF. Three council members (Cockburn, East Fremantle and Melville) offer a weekly recycling service. Fremantle and Kwinana offer a fortnightly collection service.


Option 1A
MSW
Comingled recycling
Kwinana: landfill to 2018, Phoenix EfW after 2018
Other councils: RRRC WCF; residual to landfill
Cockburn, East Fremantle, Melville: RRRC MRF
Fremante and Kwinane
Weekly
Weekly
Weekly
Fortnightly
14,281 lifts
90,441 lifts
80,941 lifts
24,539 lifts

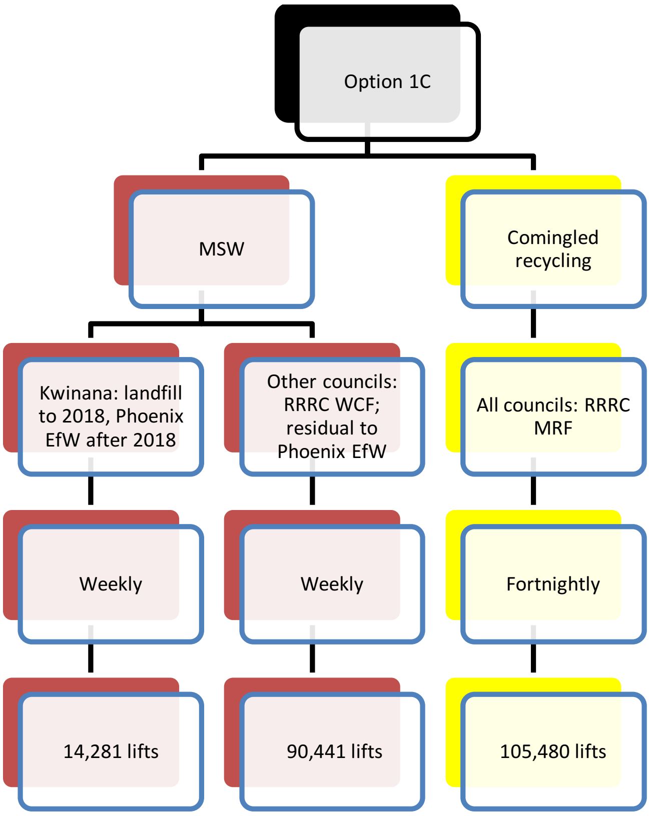
### 8.2.3 Option 1B: 2 bin; MSW to WCF; AWT residual to landfill; FN recycling

Option 1B is consistent with Option 1A: BAU, however all recycling services are converted to a fortnightly collection schedule.



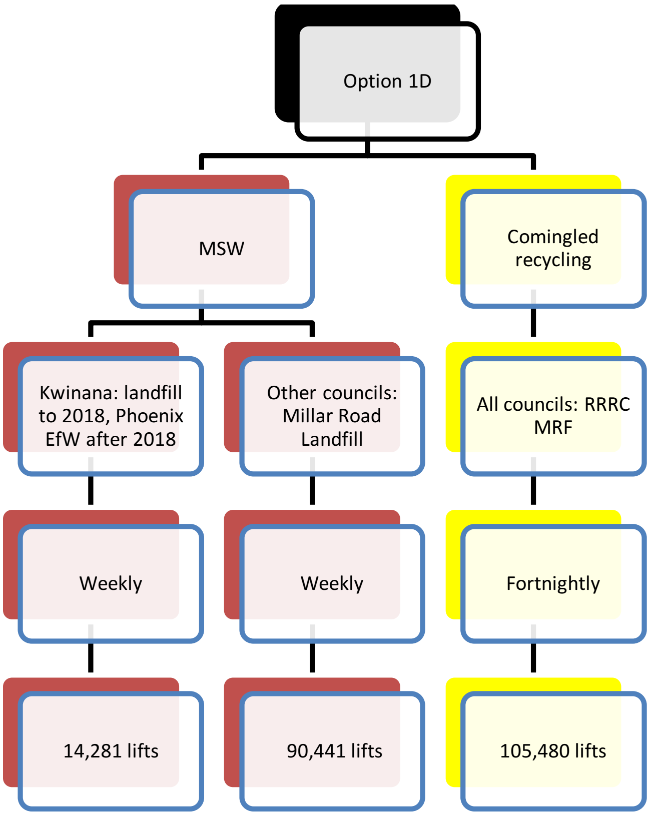
### 8.2.4 Option 1C: 2 bin; MSW to WCF; AWT residual to EfW; FN recycling

Option 1C reverts all comingled recycling to a fortnightly collection service and sends AWT residual waste to an EfW facility in place of landfill.



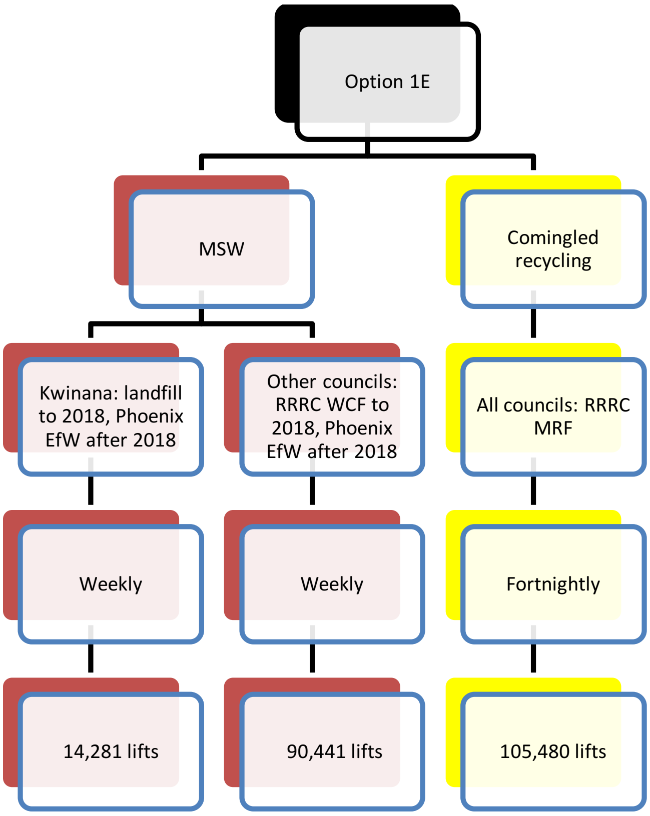
### 8.2.5 Option 1D: 2 bin; MSW to landfill; FN recycling

Option 1D reverts all comingled recycling to a fortnightly collection service and sends all MSW to landfill.



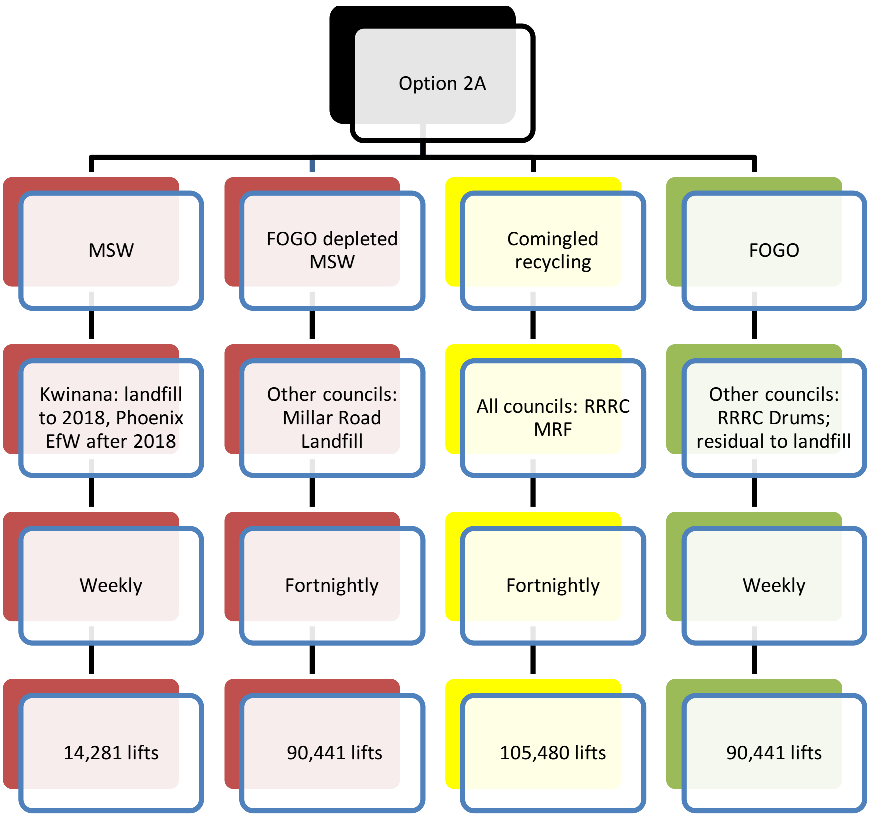
### 8.2.6 Option 1E: 2 bin; MSW to EfW; FN recycling

Option 1E reverts all comingled recycling to a fortnightly collection service and sends all MSW to an EfW facility.



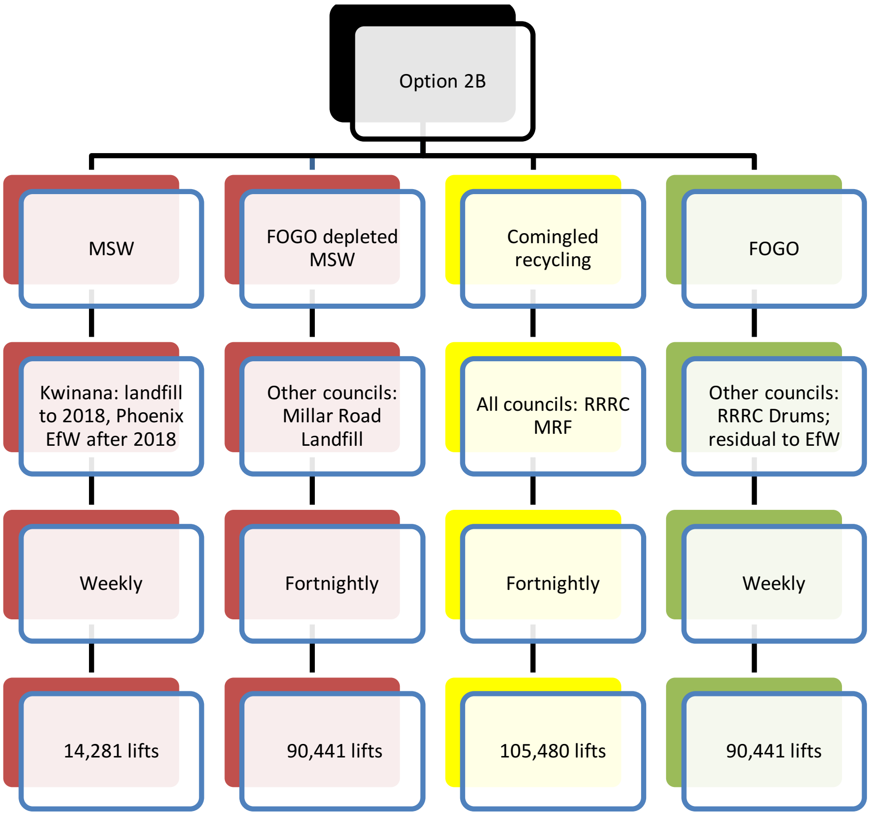
### 8.2.7 Option 2A: 3 bin; MSW to landfill; FOGO to RRRC drums

Option 2A reverts all comingled recycling to a fortnightly collection service. FOGO depleted MSW is sent to landfill, FOGO to the scaled down RRRC Drum facility (currently used to process mixed waste) and FOGO processing residual is sent to landfill.



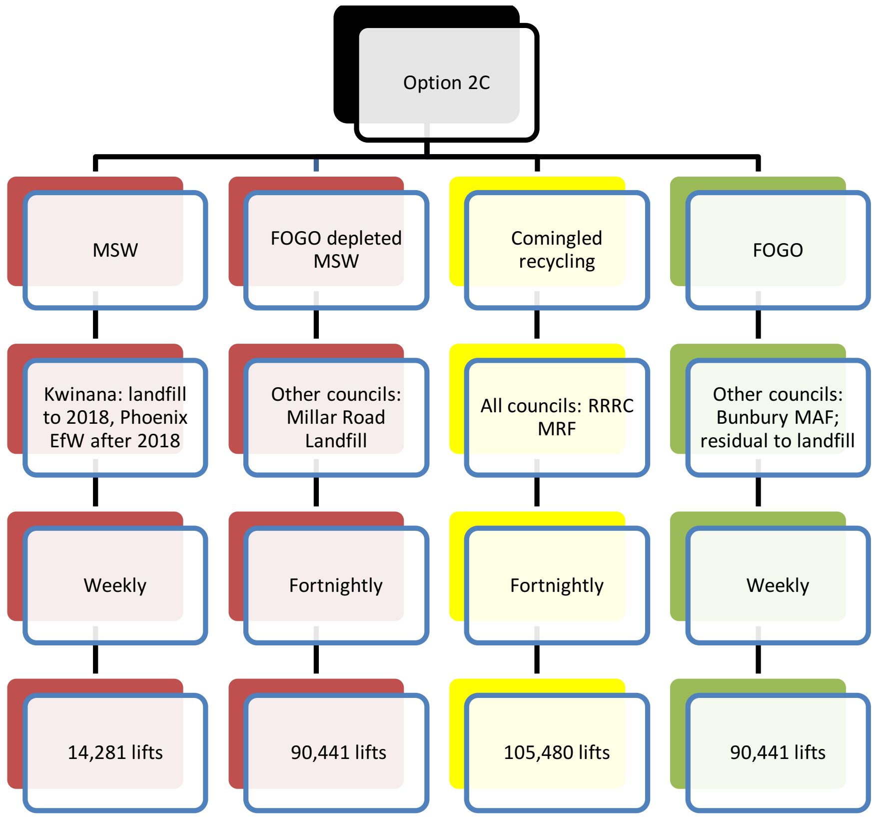
### 8.2.8 Option 2B: 3 bin; MSW to landfill; FOGO to RRRC drums

Option 2B mimics Option 2A, however residual waste from FOGO processing is sent to an EfW facility.



### 8.2.9 Option 2C: 3 bin; MSW to landfill; FOGO to MAF; FOGO residual to landfill; FN recycling

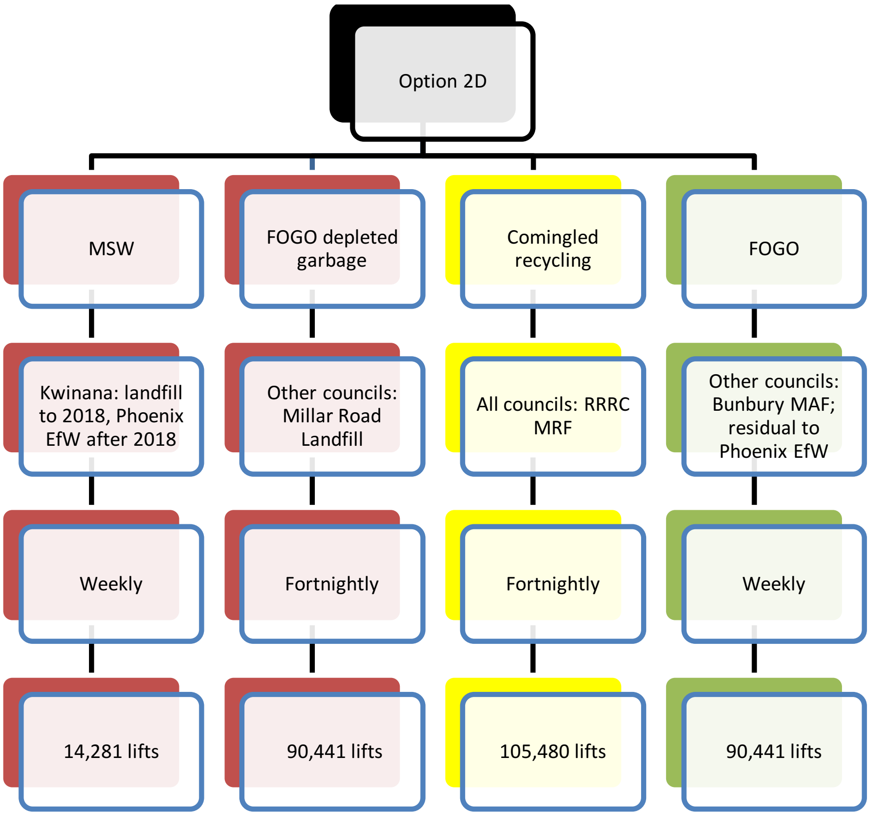
Option 2C reverts all comingled recycling to a fortnightly collection service. FOGO depleted MSW is sent to landfill, FOGO to an alternative composting facility (Bunbury MAF for the purpose of this analysis) and FOGO processing residual is sent to landfill.




Bunbury MAF was selected as an existing operating alternative. However, it is not necessarily the only option (site or technology). This option assumes any composting system analysis is the service of WCF to Bunbury.

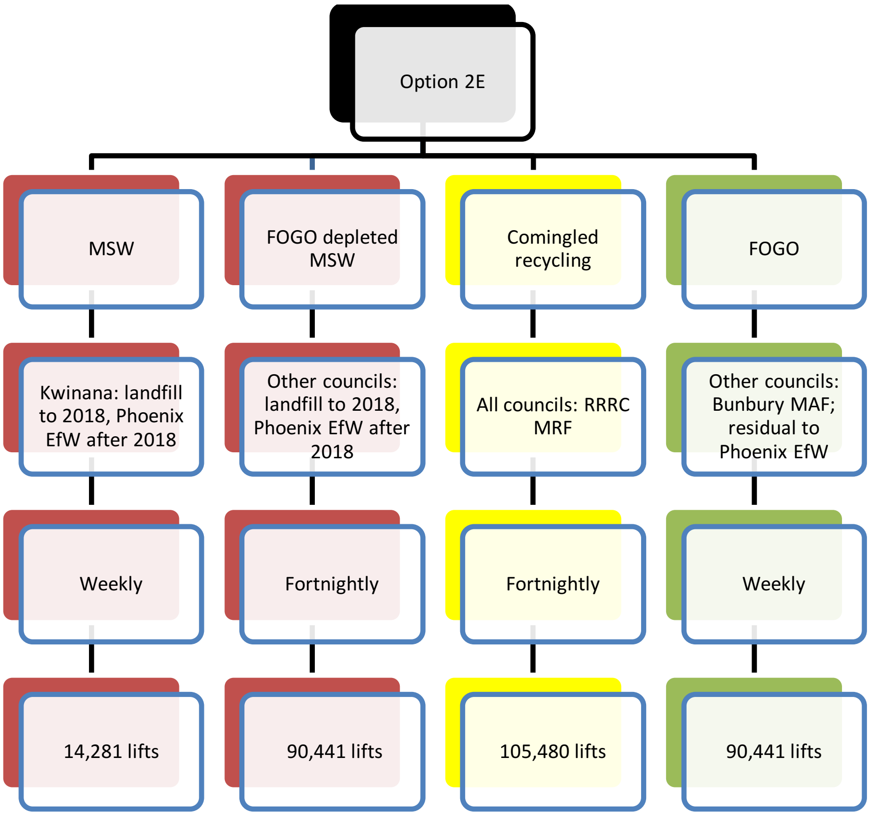
### 8.2.10 Option 2D: 3 bin; MSW to landfill; FOGO to MAF; FOGO residual to EfW; FN recycling

Option 2D mimics Option 2C, however residual waste from FOGO processing is sent to an EfW facility.



### 8.2.11 Option 2E: 3 bin; MSW to EfW; FOGO to MAF; FOGO residual to EfW; FN recycling

Option 2E reverts all comingled recycling to a fortnightly collection service. FOGO depleted MSW is sent to EfW, FOGO to an alternative composting facility (Bunbury MAF) and FOGO processing residual is sent to EfW.



## 8.3 All system quantitative results

The quantitative results from the CCM provide total system costs, greenhouse gas emissions, vehicle kilometres travelled and resource recovery rates for each option.

### 8.3.1 Total system costs

The full system costs are driven by the gate fees of the primary facilities in each option. Table 8-2 shows the calculated net present value of each system option while the full list of CCM assumptions is provided in Appendix D System option modelling assumptions.

**Table 8-2 2015 gate fee summary**

| Facility | 2015 gate fee |
|---|---|
| WCF (73,000tpa) | $242/t |
| RRRC MRF (34,000tpa) | $80/t |
| FOGO Drums (previous WCF) (73,000tpa) | $185/t |
| FOGO Composting Facility (Bunbury) (32,000tpa) | $100/t |
| Millar Road Landfill (general MSW) | $114/t |
| Millar Road Landfill (class 3 – EfW bottom ash) | $127/t |
| Millar Road Landfill (class 4 – EfW fly ash) | $211/t |
| Phoenix EfW | $115/t |
| Biovision | $235/t |

The total cost for each system is driven by the cost of the primary method of disposal/processing for MSW (the heaviest stream across all options/scenarios). The results show:

- As landfill and EfW options are similarly priced ($114.22/t and $115/t respectively) the least cost options are Option 1D and Option 1E;
- However, Option 1D (landfill) is more expensive in the long term, as incremental increases to the landfill levy exceed the CPI increases modelled for the EfW gate fee;
- This is followed by all options in scenario 2 (3 bins), as the cost to dispose or process FOGO and FOGO depleted MSW streams is less than the cost to process mixed residual waste through the WCF, despite the introduction of a third collection service; and
- Option 1A (BAU) has the highest cost of all scenarios due primarily to the higher processing cost of the AWT and the inclusion of a weekly recycling collection service.

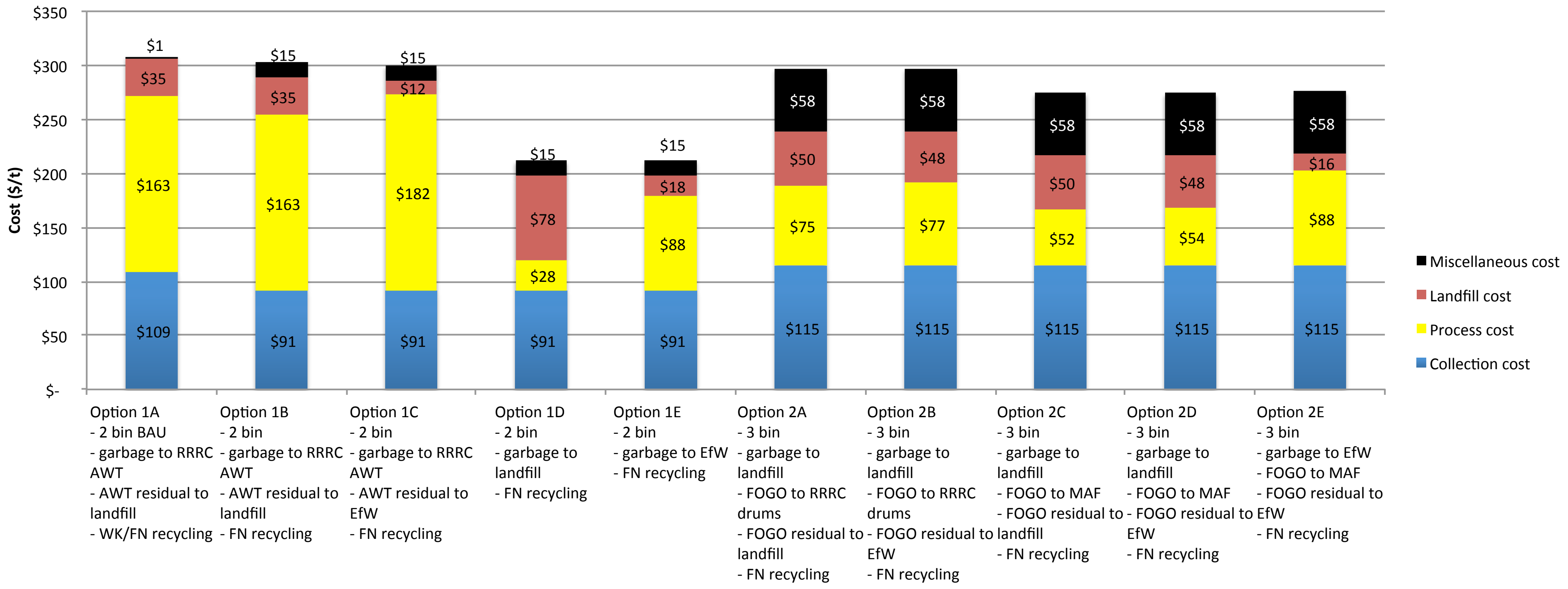
**Table 8-3 NPV of full system options over 20 year planning horizon**

| Scenario | | System Options | | System NPV ($m) |
|---|---|---|---|---|
| 1 | 2 Bin | Option 1A BAU | - MSW to WCF<br>- AWT residual to landfill<br>- WK/FN recycling | $715.49 |
| | | Option 1B | - MSW to WCF<br>- AWT residual to landfill<br>- FN recycling | $676.98 |
| | | Option 1C | - MSW to WCF<br>- AWT residual to EfW<br>- FN recycling | $668.09 |
| | | Option 1D | - MSW to landfill<br>- FN recycling | $469.92 |
| | | Option 1E | - MSW to EfW<br>- FN recycling | $462.26 |
| 2 | 3 Bin | Option 2A | - MSW to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to landfill<br>- FN recycling | $573.13 |
| | | Option 2B | - MSW to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to EfW<br>- FN recycling | $572.49 |
| | | Option 2C | - MSW to landfill<br>- FOGO to MAF<br>- FOGO residual to landfill<br>- FN recycling | $520.77 |
| | | Option 2D | - MSW to landfill<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | $519.76 |
| | | Option 2E | - MSW to EfW<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | $519.33 |

### 8.3.2 Cost per tonne

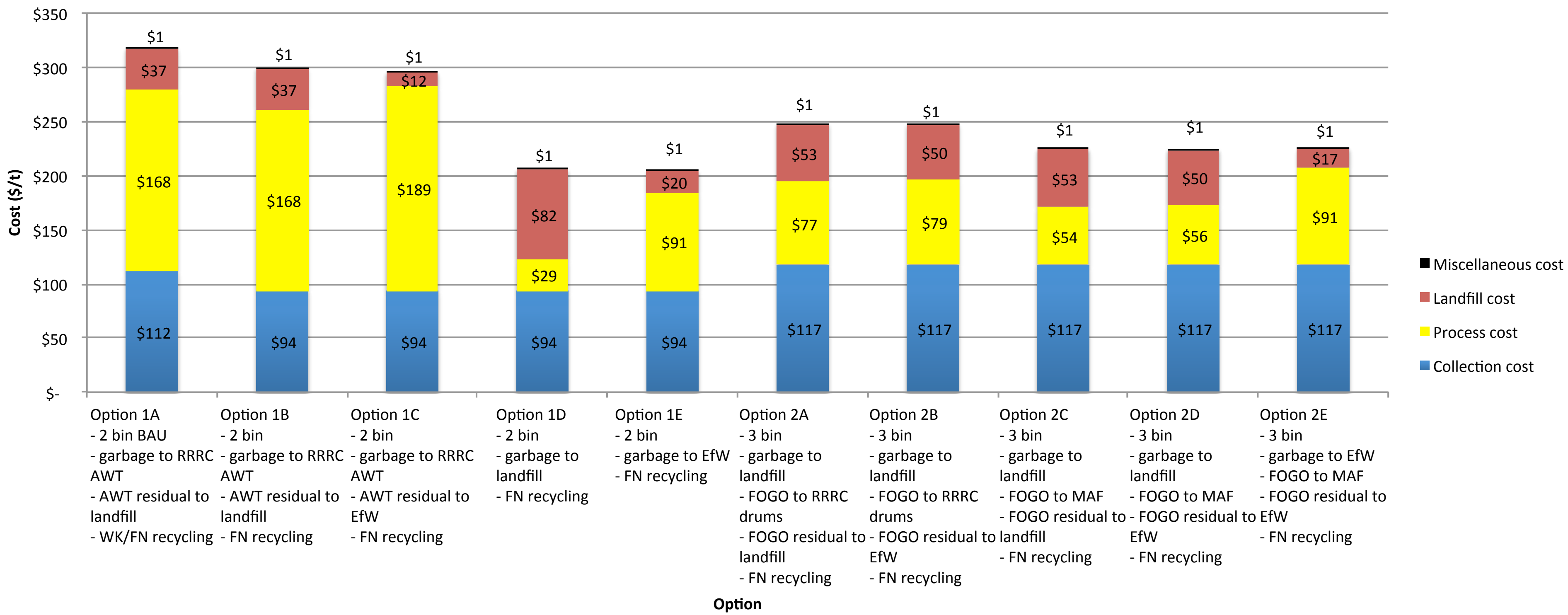
The total cost per tonne has also been provided for 2015/2016 (Figure 8-6) and 2016/2017 (Figure 8-7). The cost per tonne includes the miscellaneous costs to implement a new collection system, including bin infrastructure for recycling (360L bins) and FOGO collection. Despite these additional one off costs, all Scenario 2 (3 bin) options cost less per tonne than Options 1A through to 1C that utilise the existing WCF facility. The cost savings become more apparent after implementation.

**Figure 8-6 System cost per tonne 2015/2016[8]**




[8] One-off capital costs are bought and realised in year one so are not depreciated. A small number of miscellaneous costs are included as an annual cost, such as brochures.

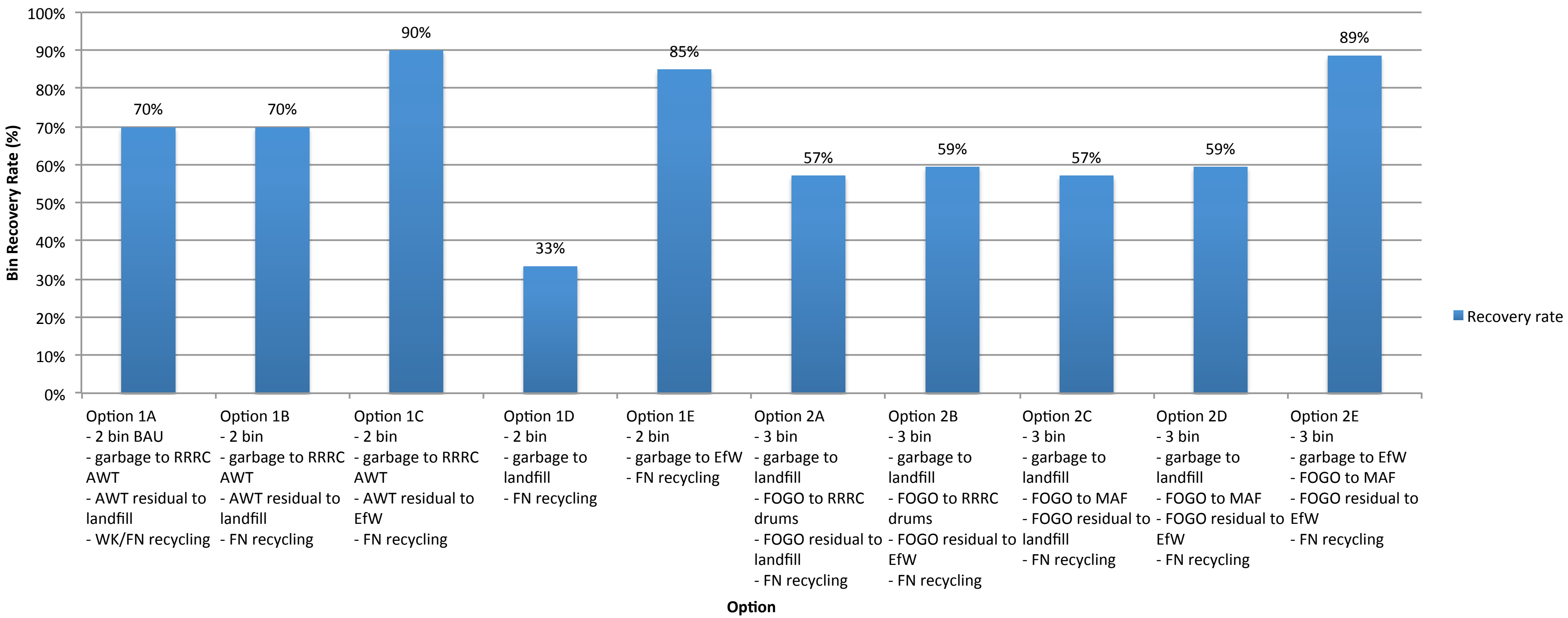
**Figure 8-7 System cost per tonne 2016/2017 excluding one-off capital**



### 8.3.3 System recovery rates

The recovery rates under each scenario were calculated (Figure 8-8). The highest recovery rate is achieved by Option 1C, as MSW waste is first processed via the WCF and all residual waste (40% of WCF input) is then processed through the Phoenix EfW facility. The comparably high recovery rate of Option 2E is less reliant on EfW and is driven by source separation and organics recycling. Although Option 1D offers one of the least cost alternatives to SMRC, it achieves the lowest diversion rate across all options as it is reliant on landfill disposal for all MSW.

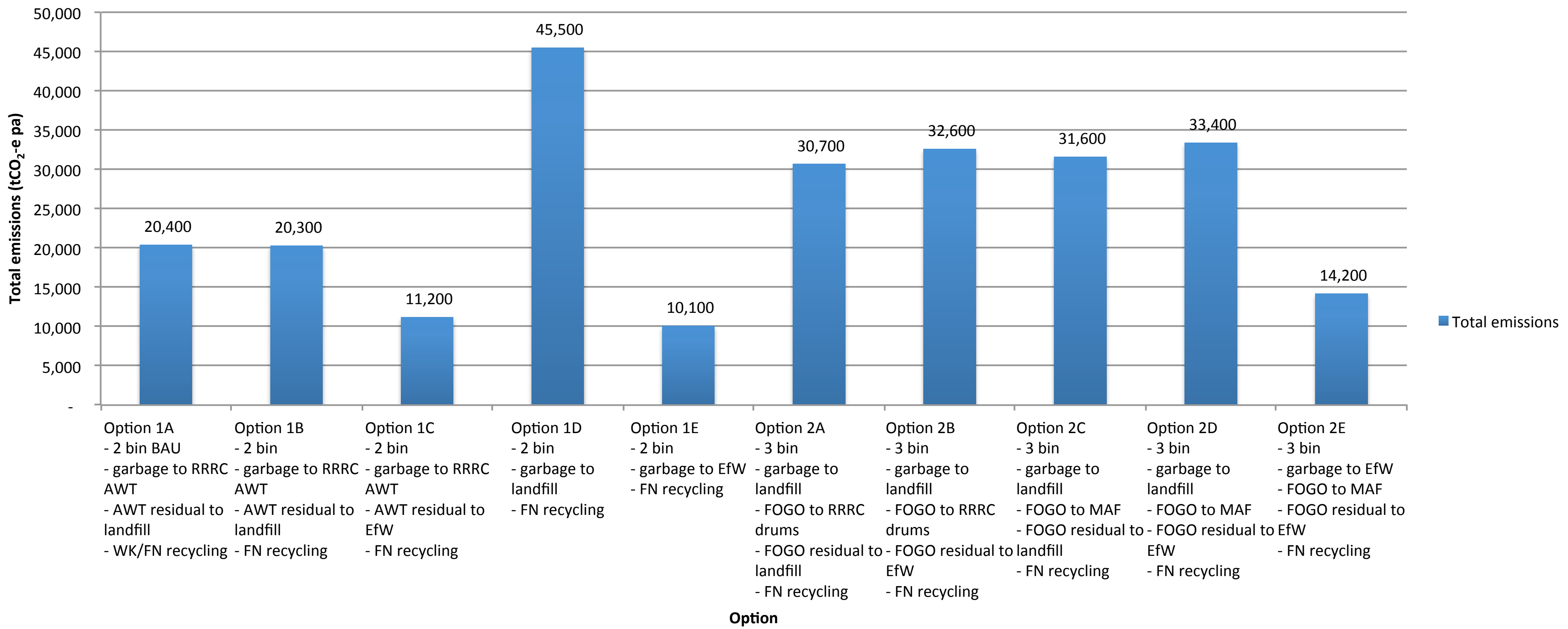
**Figure 8-8 System recovery rates**



## 8.3.4 System greenhouse gas emissions

The greenhouse gas emissions for each option were calculated, taking into consideration processing, collection and landfill emissions (Figure 8-9). The highest emissions profile can be seen for Option 1D, as all MSW is sent to landfill under this scenario. Of the three bin options, Option 2E performs well, as all residual wastes (excluding MRF residuals) are processed through the Phoenix EfW facility, reducing landfill emissions. The emissions profile of the EfW facility would need to be confirmed prior to more detailed greenhouse gas emission modelling being conducted.

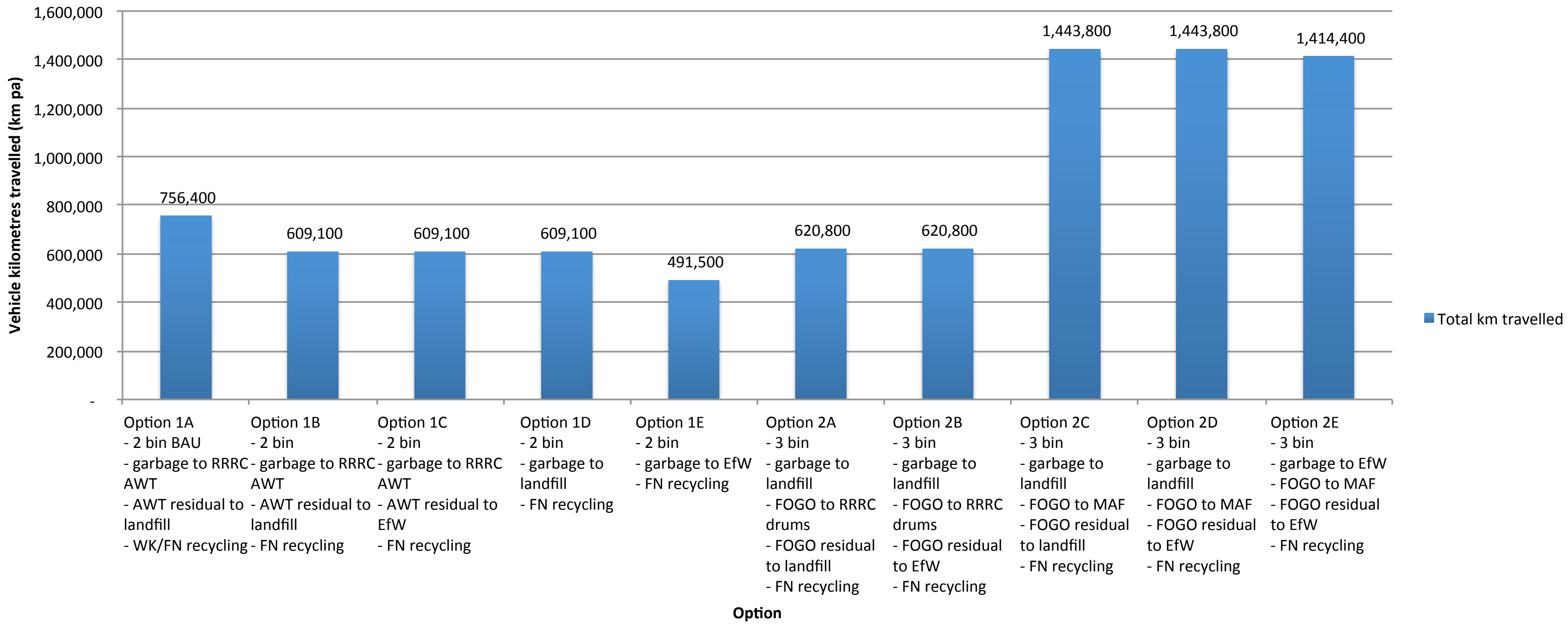
**Figure 8-9 System greenhouse gas emissions**



### 8.3.5 System vehicle kilometres travelled

The vehicle kilometres travelled for each option were calculated for collection and delivery to a processing/disposal facility (Figure 8-10). Options 2C through to 2E are significantly higher than all other options, as they assume that FOGO waste is processed in Bunbury at an existing FOGO processing facility to the south of SMRC. All other facilities are located within the SMRC region, significantly reducing the vehicle kilometres travelled. Options 1B through to 1D are less than Option 1A due to the reduction in recycling collection frequency. Option 1E is less again due to the close proximity of the Phoenix EfW facility in comparison to the WCF.

**Figure 8-10 System vehicle kilometres travelled**



## 8.4 Qualitative results

### 8.4.1 Political acceptability and compliance with state policy

Source separation of organics at the kerbside is consistent with the Waste Authority's Better Bins program and the Premier's letter which require use of a 3 bin system (with GO and/or FO) prior to EfW. While energy from waste is considered to be an important component of waste management, it should be considered with respect to the waste hierarchy (above landfill and below avoidance, re-use, reprocessing and recycling). It is understood that SMRC's political considerations align with these state directives and policies. The following criteria have thus been used to assess each option.

**Table 8-4 Political acceptability and compliance with state policy criteria**

| Political acceptability and compliance with state policy criteria | Code |
|---|---|
| Poor acceptability/compliance: source separation is limited and landfill is the primary method of residual disposal | 1 |
| Limited acceptability/compliance: source separation is limited and EfW/AWT is the primary method of residual disposal | 2 |
| Good acceptability/compliance: source separation is maximised and landfill is the primary method of residual disposal | 3 |
| Excellent acceptability/compliance: source separation is maximised and EfW/AWT is the primary method of residual disposal | 4 |

### 8.4.2 Community engagement and participation

Domestic waste services are inherently reliant on community effort and engagement to operate successfully, which in turn is influenced by simplicity, equity, and perceptions of benefit and behaviour change. This considers the level of community engagement necessary to achieve the desired program goals and recovery rates. The following criteria have thus been used to assess each option.

**Table 8-5 Community behaviour criteria**

| Community engagement and participation criteria | Code |
|---|---|
| Heightened engagement/participation: requires high community engagement level and a major change in behaviour (e.g. food separation) | 1 |
| Increased engagement/participation: requires moderate community engagement and a minor change in behaviour (e.g. modified collection frequencies) | 2 |
| No change in engagement/participation: requires minimal community engagement or no behavioural change | 3 |
| Reduced engagement/participation: requires minimal community engagement and increased convenience for residents | 4 |

### 8.4.3 Qualitative analysis

The results of the qualitative assessment of the ten full system options are presented in Table 8-6.

Each option was evaluated against the two criteria outlined in the tables below, and given a score from 4 (dark green: low risk/positive impact) to 1 (red: high risk/negative impact).

**Table 8-6 Qualitative analysis results for council**

| Scenario | | Options | | Political acceptability and compliance with state policy | Community engagement and participation |
|---|---|---|---|---|---|
| 1 | 2 Bin | Option 1A BAU | - MSW to WCF<br>- AWT residual to landfill<br>- WK/FN recycling | Limited acceptability due to higher price than alternates: source separation is limited (2 bin); WCF is the primary methods of residual disposal (Kwinana to EfW) | No change in engagement/participation: requires minimal community engagement; no behavioural change |
| | | Option 1B | - MSW to WCF<br>- AWT residual to landfill<br>- FN recycling | Limited acceptability/compliance: source separation is limited (2 bin); Phoenix Energy/WCF are the primary methods of residual disposal; change in recycling collection frequency has a marginal impact upon source separation practices | Increased engagement/participation: requires moderate community engagement; Cockburn, East Fremantle and Melville converted to a fortnightly recycling service |
| | | Option 1C | - MSW to WCF<br>- AWT residual to EfW<br>- FN recycling | Limited acceptability/compliance: source separation is limited (2 bin); Phoenix Energy/WCF are the primary methods of residual disposal; change in recycling collection frequency has a marginal impact upon source separation practices | Increased engagement/participation: requires moderate community engagement; Cockburn, East Fremantle and Melville converted to a fortnightly recycling service |
| | | Option 1D | - MSW to landfill<br>- FN recycling | Poor acceptability/compliance: source separation is limited (2 bin); landfill is the primary method of residual disposal; change in recycling collection frequency has a marginal impact upon source separation practices | Increased engagement/participation: requires moderate community engagement; Cockburn, East Fremantle and Melville converted to a fortnightly recycling service |
| | | Option 1E | - MSW to EfW<br>- FN recycling | Limited acceptability/compliance: source separation is limited (2 bin); Phoenix Energy is the primary method of residual disposal; change in recycling cling collection frequency has a marginal impact upon source separation practices | Increased engagement/participation: requires moderate community engagement; Cockburn, East Fremantle and Melville converted to a fortnightly recycling service |
| 2 | 3 Bin | Option 2A | - MSW to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to landfill<br>- FN recycling | Good acceptability/compliance: source separation is maximised (3 bin FOGO); landfill is the primary method of residual disposal; change in recycling collection frequency has a marginal impact upon source separation practices | Heightened engagement/participation: requires high community engagement; FOGO bin roll out and education program; Cockburn, East Fremantle and Melville converted to a fortnightly recycling service |

| Scenario | | Options | | Political acceptability and compliance with state policy | Community engagement and participation |
|---|---|---|---|---|---|
| | | Option 2B | - MSW to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to EfW<br>- FN recycling | Good acceptability/compliance: source separation is maximised (3 bin FOGO); landfill is the primary method of residual disposal; change in recycling collection frequency has a marginal impact upon source separation practices; FOGO residual to EfW comprises minimal tonnes | Heightened engagement/participation: requires high community engagement; FOGO bin roll out and education program; Cockburn, East Fremantle and Melville converted to a fortnightly recycling service |
| | | Option 2C | - MSW to landfill<br>- FOGO to MAF<br>- FOGO residual to landfill<br>- FN recycling | Good acceptability/compliance: source separation is maximised (3 bin FOGO); landfill is the primary method of residual disposal; change in recycling collection frequency has a marginal impact upon source separation practices | Heightened engagement/participation: requires high community engagement; FOGO bin roll out and education program; Cockburn, East Fremantle and Melville converted to a fortnightly recycling service |
| | | Option 2D | - MSW to landfill<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | Good acceptability/compliance: source separation is maximised (3 bin FOGO); landfill is the primary method of residual disposal; change in recycling collection frequency has a marginal impact upon source separation practices; FOGO residual to EfW comprises minimal tonnes | Heightened engagement/participation: requires high community engagement; FOGO bin roll out and education program; Cockburn, East Fremantle and Melville converted to a fortnightly recycling service |
| | | Option 2E | - MSW to EfW<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | Excellent acceptability/compliance: source separation is maximised (3 bin FOGO); Phoenix Energy is the primary method of residual disposal; change in recycling collection frequency has a marginal impact upon source separation practices; FOGO residual to EfW comprises minimal tonnes | Heightened engagement/participation: requires high community engagement; FOGO bin roll out and education program; Cockburn, East Fremantle and Melville converted to a fortnightly recycling service |

### 8.4.4 Summary of Quantitative and Qualitative Analysis

The outcomes of the above analysis are summarised in Table 8-7.

**Table 8-7 Full systems' options results summary**

| Scenario | | System Options | | System NPV ($m) | Recovery rate | MCA result | MCA rank |
|---|---|---|---|---|---|---|---|
| 1 | 2 Bin | Option 1A BAU | - MSW to WCF<br>- WCF residual to landfill<br>- WK/FN recycling | $715.49 | 70% | 49% | 10 |
| | | Option 1B | - MSW to WCF<br>- AWT residual to landfill<br>- FN recycling | $676.98 | 70% | 58% | 8 |
| | | Option 1C | - MSW to WCF<br>- AWT residual to EfW<br>- FN recycling | $668.09 | 90% | 65% | 5 |
| | | Option 1D | - MSW to landfill<br>- FN recycling | $469.92 | 33% | 54% | 9 |
| | | Option 1E | - MSW to EfW<br>- FN recycling | $462.26 | 85% | 83% | 2 |
| 2 | 3 Bin | Option 2A | - MSW to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to landfill<br>- FN recycling | $573.13 | 57% | 66% | 4 |
| | | Option 2B | - MSW to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to EfW<br>- FN recycling | $572.49 | 59% | 66% | 3 |
| | | Option 2C | - MSW to landfill<br>- FOGO to MAF<br>- FOGO residual to landfill<br>- FN recycling | $520.77 | 57% | 64% | 7 |
| | | Option 2D | - MSW to landfill<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | $519.76 | 59% | 64% | 6 |
| | | Option 2E | - MSW to EfW<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | $519.33 | 89% | 86% | 1 |

**Key**

Poorest performing option (red shading)

Best performing option (green shading)

The findings of the analysis include:

- Option 2E (3 bin FOGO (EfW)) ranks first. This delivers 89% diversion rate (higher than 1E at 85%);
- Option 1E (2 bin with EfW) is the cheapest option with one of the highest diversion rates and ranks second;
- Both assume fortnightly recycling is implemented and EfW is available at the advertised price;
- Option 2A (FOGO to RRRC drums and residual to landfill) is capable of being implemented from 2015 as it does not require EfW to be implemented; and
- Business as Usual (WCF and residual to landfill with weekly recycling) is ranked the lowest due to cost and relatively lower diversion outcomes (albeit at 70% this option achieves the State diversion targets).

# 9 System sensitivity testing

The full system analysis results are underpinned by several key assumptions that warrant further investigation and analysis. Five sensitivity analyses we conducted, focussing on the uncertainty of a future EfW facility gate fee. Additional sensitivity testing is provided in Appendix G System sensitivity testing. The justifications for each amended assumption are summarised below:

## 9.1 EfW operational risk

To date, no EfW facilities have been built in the region. SMRC's member councils (excluding Kwinana) thus have potentially two alternative technology providers to select from: Phoenix and New Energy. The gate fees for each differ considerably ($115/t and $170/t respectively). There is limited justification for the lower of these two gate fees and cannot be supported by international facility examples (see 0 for more information).

## 9.2 EfW capital risk

It is conservatively assumed that the capital cost of a 300,000tpa EfW facility is $100m and that this capital cost is amortised over 15 years. However, it is possible that only 100,000tpa is secured under contract in the region. The gate fee will need to increase under this scenario to ensure the facility remains viable when it is not operating at full capacity. The gate fee rise under this scenario is calculated to be $44/t.

## 9.3 EfW brick manufacturing risk

At present, there is no cost management apparent for ash residual generated by the EfW facility. The Brixx technology has not been proven and no international studies could be located to support the claim that Brixx could be used to recycle the residual ash generated by the proposed EfW facility. The parent company of the proposed technology was unavailable to confirm the use of Brixx when questioned regarding the technology. The primary concerns that arise from this uncertainty are:

- There is no legislation governing the use or disposal of ash in Australia; and
- The following tests have yet to be completed:
    - Brick quality tests (to confirm strength and adherence to building material standards); and
    - Leaching tests (to ensure that chemicals do not leach if the bricks break down).

In the European Union, the cost of ash management is high, while in the United Kingdom bottom ash from EfW facilities is typically recycled, but at a net cost to the operator.

These uncertainties could result in a higher than anticipated gate fee. Assuming that bottom ash can be recycled (comprising 78% of total ash according to technology provider HZI) and that the EfW facility achieves a recovery rate of 85%, an additional $12/t would be needed at the gate, assuming the cost to manufacture bricks from bottom ash is $100/t.

## 9.4 EfW ash disposal risk

It is uncertain if the bottom and fly ashes generated by an EfW facility in the region will be able to be recycled (technically and legally). It is therefore possible that bottom ash will be classified as a Class 3 waste (which can be disposed of at Millar Road Landfill) and that fly ash will be classified as a Class 4 waste (which will need to be disposed of at Red Hill Landfill). These disposal costs of $127/t and $211/t respectively are considerable, and may be passed on to waste generators (councils).

Assuming 78% of ash generated is bottom ash and 22% is fly ash, this corresponds to a weighted landfill price of $145/t for 15% of the total waste processed, or an increase in gate fee of $7/t.

## 9.5 EfW combined risks

As the proposed EfW technology is untested in the Australian market, it is possible that the risks identified above will occur simultaneously. The following was assumed to determine what the cumulative impact of these risks would be:

- Operational risk base gate fee: $170/t;
- Capital risk additional gate fee: $44/t;
- Bottom ash additional recycling fee: $12/t across all input tonnes; and
- Disposal of fly ash to a class 4 landfill: $7/t across all input tonnes.

This corresponds to a total gate fee of $233/t (102% increase from $115/t). This is still considerably lower than the gate fees charged by many eastern seaboard AWT facilities that utilise relatively simple mechanical and biological methods to process waste (in place of thermal treatment).

Detailed sensitivity test results are provided in Appendix G System sensitivity testing.

# 10 Analysis summary

## 10.1 Industry developments

SMRC has processed its residual bin into compost successfully over the last 15 years. While there have been operational issues associated with odour, the drums have met their primary task of diverting waste from landfill at a known cost. However, the situation has changed with a public policy expectation of government for the introduction of 3 bin systems (with or without food), the establishment of commercially competitive composting systems and the aspirations of the EfW sector for low cost thermal treatment.

Unlike most councils that are making the transition from 2 bin (recycling and landfill) to 3 bin (FOGO, recycling and landfill) or 2 bin (recycling and AWT), the situation is considerably more complicated for SMRC council members. By Australian standards, this is the first group of councils attempting to move away from 2 bin (recycling and AWT) to 3 bin (FOGO, recycling and landfill) or a hybrid model including EfW. This new and more complicated transition makes both the economics and the diversion from landfill outcomes counterintuitive for certain options. It thus makes the public policy choices of SMRC councils considerably more difficult.

## 10.2 MCA results

The highest ranking option in the MCA is Option 2E. This is a function of its cheaper price than business as usual and compliance with state directives.

However, EfW (in comparison to FOGO) is the cheapest option with the highest diversion potential. However in MRA's view, there are considerable risks associated with EfW, including:

- The gate fee of $115/t quoted by EfW developers while competitive with landfill, (and much cheaper than the RRRC WCF gate fee), is not able to be validated;
- Approval uncertainty;
- Throughput tonnage uncertainty;
- Inability to fully insulate Councils from gate fee increases in commercial contracts; and
- Existing operational/technology risk and the absence of reference plants operating in the Australian context.

However, these risks will no doubt be minimised over time.

While the current BAU system is expensive, it offers a waste management solution that is proven and achieves expected environmental outcomes.

The three bin options with landfill for MSW (Option 2B to Option 2D) do not achieve the equivalent recovery rate as BAU. It is only when the three bin system is combined with EfW for MSW and processing residuals that these options achieve higher diversion than BAU.

MRA independently compared the costs and resource recovery rates of FOGO and GO systems (Appendix I 3 bin GO options analysis). The results demonstrate that for comparable 3 bin organic systems, FOGO options deliver significantly better recovery results for approximately the same cost. The difference in cost is less than 1% over the full planning horizon, but the recovery rate is an additional 9%. This includes the costs of education, kitchen caddies and other one-off transition costs.

## 10.3 System recommendations

### 10.3.1 Bins

MRA recommends SMRC implement a hybrid model, which combines the resource recovery achievements of a three bin system (Option 2A initially) with the higher diversion rates of EfW when commercially viable and proven (Option 2E).

The Plan in summary, recommends:

1. SMRC consider reverting to a fortnightly recycling collection service;
2. Implementation of 3 bin FOGO collection and composting system as soon as is convenient; and
3. Consideration of EfW for the residual bin component only when and if, EfW is both operational and commercially proven in Western Australia.

The introduction of FOGO composting as a first stage, pre-prepares the MSW bin for EfW processing (as it removes the low calorific and “wet” materials (such as food) from the EfW stream).

The FOGO 3 bin system provides the opportunity to decommission the WCF drums, which are high maintenance and expensive to operate. It is recommended that a trial be undertaken to test the utility of a drum being used for pre-processed FOGO (albeit processing 32,000 tonnes rather than 73,000 tonnes of MSW).

### 10.3.2 FOGO

From an objective analysis, Option 2E (3 bin FOGO) assumes the following:

- 32,000tpa of FOGO availability from SMRC;
- $100/t cost base for FOGO ($10/t transfer; $20/t haulage; $70/t gate fee);
- Access to the existing WCF receival hall (3,000m$^2$); and
- Decommissioning of most or all of the drums.

This system relies on four of the member councils introducing FOGO systems as soon as possible or convenient. This option delivers high-grade compost to Western Australia’s nutrient depleted soils. In recovering FOGO it best complies with the waste hierarchy and state directives.

3 bin FOGO through a MAF is substantially cheaper than attempting to retrofit the drums (Option 2A). Note Option 2A also relies on 73,000tpa of available FOGO and is still more expensive per tonne even at this higher throughput. Clearly attempting to use the drums for a purpose beyond their specifications is both expensive and inefficient.

The trial of the drum(s) processing FOGO should particularly focus on the improved efficiency of the composting process (if any) vs. the high cost of maintenance and operation of the drum. These should be compared to the relatively low cost of current shredding and composting processes of a MAF. Undertaking this technical work is beyond the scope of this Plan.

## 10.4 Legacy overheads

The Plan recognises that these are not "greenfield" options. SMRC has existing operations with legacy contracts and costs. SMRC estimates that between $1-$2.5m of existing management, insurance and lease costs need to be recovered by the WCF operations under any configuration. There is no doubt that if SMRC proceeds with a 3 bin FOGO option, some or many of these overheads may be transferred or eliminated under new operational configurations. However, the reallocation of these costs is beyond the scope of this project.

To test whether these costs could impact on the options analysis, MRA allocated a per tonne premium to all options based on their throughput (excluding BAU which already incorporates these costs). $21 per tonne was conservatively allocated.

Table 10-1 shows that these fixed costs do not affect the ranking of options by cost. However, it is noted that these costs should be fully quantified and mitigated as part of the implementation plan for the 3 bin FOGO system.

**Table 10-1 Allocation of legacy overheads ($/t)**

| Facility | Option 1A (BAU) | Option 1E | Option 2A | Option 2E |
|---|---|---|---|---|
| Modelled cost | $307 | $213 | $297 | $276 |
| Legacy overheads | $0 (already included) | $21 | $21 | $21 |
| Total cost | $307 | $234 | $318 | $297 |

### 10.4.1 Implementation of 3 bin FOGO option – sub options

As an owner of existing infrastructure, SMRC is uniquely placed to extract economics of scale and efficiencies in existing assets, including:

- 3,000m$^2$ receival hall;
- 10,000m$^2$ composting hall;
- Weighbridge; and
- Operations management.

There are three primary alternatives to the location and technology type for processing FOGO. These are:

1. MAF technology in a remote location (e.g. Bunbury MAF – Option 2E);
2. MAF technology in a local region (new site); or
3. MAF technology in the RRRC site.

The assumptions for these are set out in Table 10-2.

**Table 10-2 Composting technology options**

| Location | Transfer Station | Transport | Gate Fee | Operational Summary | Opportunities |
|---|---|---|---|---|---|
| Remote MAF | $10/t | $20/t (25t payload) | $70/t gate fee | Utilises the 3,000m$^2$ receival hall as the transfer station | This leaves the 10,000m$^2$ vacant and potentially available for lease (estimated rental return: up to $900,000 per annum). |
| Local MAF | $0/t | $30/t (8t pay load) | $70/t gate fee | Direct haulage to Biowise or other facility | This leaves the 10,000m$^2$ and 3,000m$^2$ sheds vacant and potentially available for lease (estimated rental return: up to $1,200,000 per annum). |
| RRRC MAF | $0/t | $0/t | $70/t gate fee (assuming the drums are not used) | Establish a MAF processing facility in the 10,000m$^2$ shed | This leaves the 3,000m$^2$ vacant and potentially available for lease. Alternatively SMRC could close 3 of the 4 drums and utilise 1 drum to fast tract the compost system (this is the least efficient use of the shed infrastructure and should be trialled prior to a decision being made). |

Note: While MAF is one available technology and has been used for benchmarking purposes, there are a range of similar technologies and providers, which could and would meet the needs of SMRC. The selection of a specific processing technology should be resolved via a tender process.

Note: Unless there is a direct payback between the cost of the drum and the efficiency it provides in pre-preparing the composting process, it is advised that SMRC terminate all of the drums and shred the material within the shed using purpose built equipment. This should be determined by a trial.

## 10.5 Policy settings of state government

The Plan gives significant weighting to the public policy position of the State Government. That is, that the State Government expects:

- The waste hierarchy to be implemented;
- Councils should have a 3 bin system separating food and/or green, recycling and residual (Premier's letter and the Waste Hierarchy);
- EfW should only be used for the residual bin (which may still include food but must not include garden); and
- EfW contracts should not foreclose on future options for Councils to pursue diversion through higher value recovery methods.

The Plan therefore depends upon the State Government acting on and enforcing the principles outlined above. If 3 bin systems are not to be mandated by the State Government, then EfW becomes a much more likely scenario (particularly as EfW risks are managed downwards).

EfW systems are due to commence operation from 2018. SMRC member councils should consider EfW for processing residuals only if, EfW technology can satisfy the following general criteria:

1. It is operational at the same scale required;
2. It operates on the same waste stream; and
3. Has 3 years of profitable operating experience.

If all conditions are satisfied then SMRC should consider adopting EfW for its residual bin. This is consistent with the State policy and the waste hierarchy. Removing FOGO has the additional benefit of preparing the residual bin for thermal treatment.

# 11 Infrastructure and Assets

## 11.1 Existing SMRC waste infrastructure

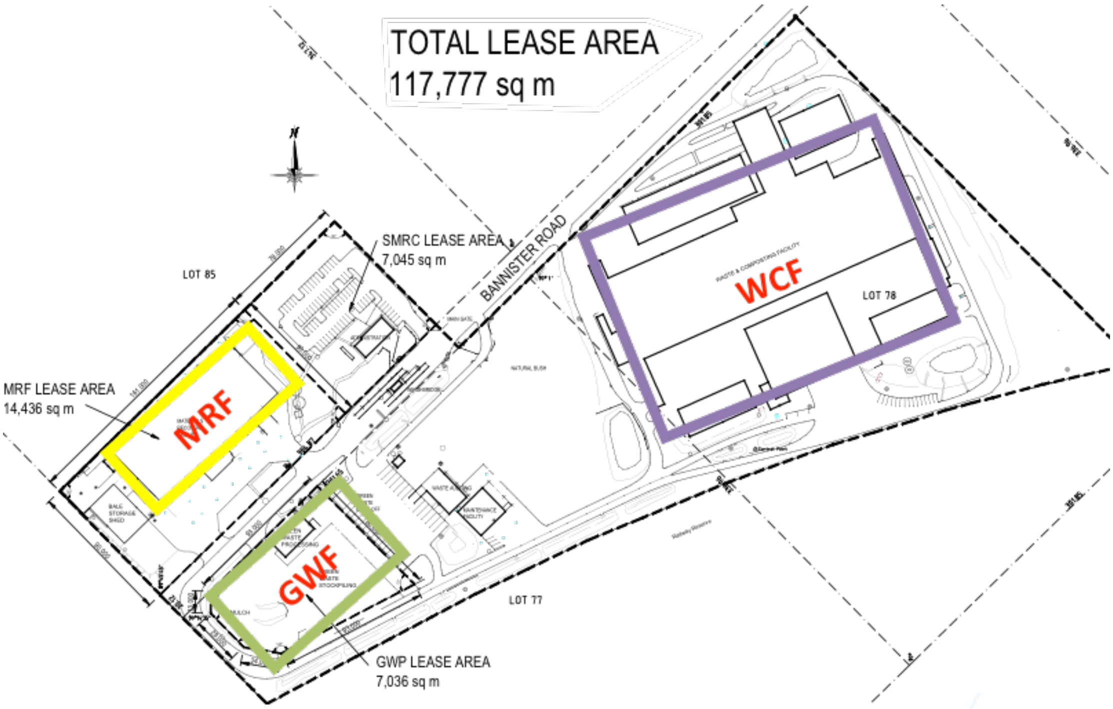
### 11.1.1 RRRC

Residents of the Cities of Melville, Cockburn, Fremantle and Town of East Fremantle have the same two-bin collection system. All household waste, once collected, is taken to the SMRC Regional Resource Recovery Centre (RRRC) for recovery and processing.

The RRRC is located at a 12-hectare site in 350 Bannister Road, Canning Vale. The site, owned by the City of Canning is on long term lease to the SMRC which operates the site. The RRRC, shown in Figure 11-1, is made up of three resource recovery facilities:

- The Waste Composting Facility (WCF) for processing of organic waste;
- The Materials Recovery Facility (MRF) for processing recyclables; and
- The Green Waste Facility (GWF) for processing green waste.

**Figure 11-1 RRRC site in Canning Vale showing the location of the three resource recovery facilities**




### 11.1.2 The Waste Composting Facility (WCF)

The WCF, an in-vessel (drum) composting facility based on Bedminster rotary digester technology processes all MSW material collected in the household MSW bin and turns the organic fraction into compost. Although the WCF has a design capacity of 109,000tpa and is licensed accordingly. It currently only processes 75,000 tonnes of MSW each year. This relatively low throughput is mainly a result of some of the SMRC councils pulling out of the RRRC. The recent removal of biosolids as a WCF input due to odour issues has had a much lower impact on throughput tonnages. Approximately 25,000 tonnes of compost are produced annually.

Diversion of MSW from the WCF may be required from time to time due to plant availability and seasonal variations in waste generation rates.

The amount of MSW received and residual composts produced each year can vary and is dependent upon a range of factors such as:

- Environmental licence requirements;
- material composition;
- plant performance;
- maintenance requirements;
- seasonal factors; and
- contractual arrangements with customers.

Once delivered to the WCF, the MSW undergoes a number of processes as illustrated in Figure 11-2 and outlined below.

**Receipt of waste**

Once MSW loads are deposited on the floor of the tipping building, they are visually assessed and large recyclable items, hazardous, contaminated, oversized and non-process materials are removed either manually or with a loader.

Removed items are either sent to general landfill, stored for further processing and recovery (pressure packs, gas cylinders, chemicals, oils and car batteries and large ferrous, aluminium and plastics) or, in the case of hazardous items, disposed of following appropriate procedures.

**Digestion**

The remaining MSW is loaded onto digester feeders which convey the material into the Eweson digester. At this stage the MSW is mixed with liquid wastes (when available) and process leachates. The material is digested over a period that can vary between one to three days and is converted to raw compost.

**Primary Screening**

The raw compost passes over a head magnet that removes some ferrous metals before passing through the primary trommel, which generally removes particles greater than 40mm in size. The bulk volume of this residual material largely consists of plastics and textiles but also includes other inert and general waste materials. There is likely to be some minus 40mm materials and partly decomposed waste attached to the surface of the residual waste fraction plus some ferrous and non-ferrous metals.

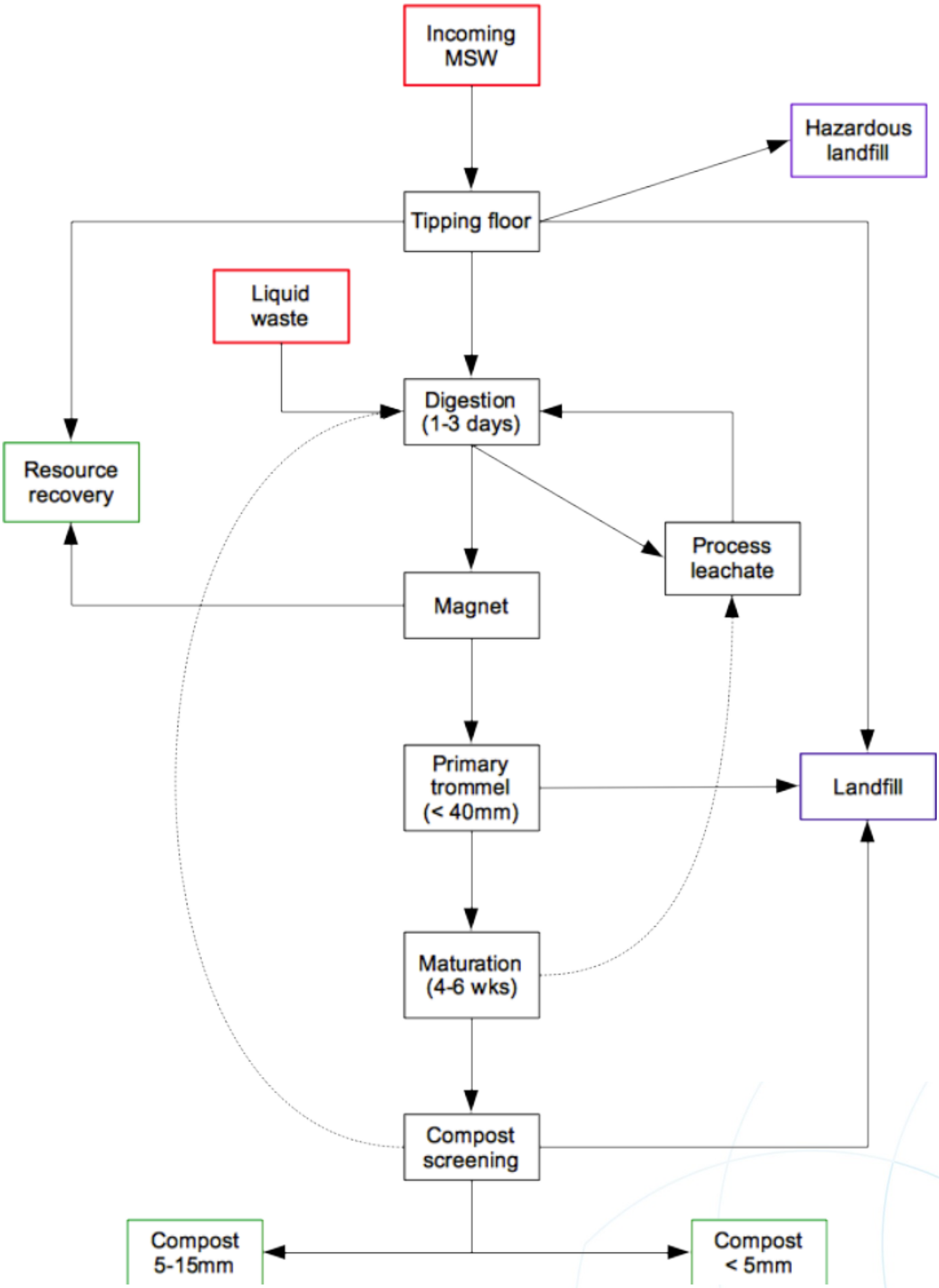
**Disposal of Primary Trommel Residuals**

Static compactors are used to pack these residuals into 30m$^3$ hook-lift compactor bins for transport to landfill.

**Maturation**

A front end loader is used to place the minus 40mm primary compost into indoor windrows. The composting process continuous within the facility for approximately 4 to 6 weeks. During this time windrows are turned and moisture is controlled as necessary.

**Figure 11-2 WCF process flows**



**Compost Screening**

Once mature, compost is screened producing a number of grades of compost, some materials that are placed back into the WCF process for further processing and some residual waste (final screen residuals) that is landfilled. Two screens are applied in sequence:

- A 15mm trommel; and
- A 4.76mm oscillating deck screen.

The two compost grades produced are:

- Screenings - 5mm to 15mm; and
- Compost - minus 5mm.

Final screen residuals not passing 15mm trommel screen and not required for further processing are placed into Contractor Bulk Bins for transport to landfill. This residual material largely consists of woody materials, glass and plastics, however, there are also a quantity of other inert, metal and general waste materials.

**WCF performance**

The exact properties and composition of the final products can vary between batches due to a number of factors that include but are not limited to:

- Variation in the composition of waste materials received for processing;
- Efficiency of removal of oversize materials prior to loading into digesters;
- Time period for waste processed in digesters (normally up to three days but can be as high as five days);
- Stage of digester discharge (the density and composition of raw compost can vary during any single digester discharge period due to variations in material composition and density along the length of the digester chamber); and
- Efficiency of primary trommels, compost turning operations and final compost screening affected by equipment, materials composition, moisture and processing rates.

However, over time, SMRC has optimised the composting process and has become very successful in managing it, constantly achieving the highest diversion rates of all Bedminster plants in Australia (Table 11-1).

**Table 11-1 Diversion performance of Australian Bedminster facilities**

| Facility | Overall diversion | Capacity (tpa) | Product use |
|---|---|---|---|
| RRRC (WA) | 60% | 109,200 | Land rehabilitation, broad acre agriculture |
| Raymond Terrace ARRT Facility (NSW) | 50% | 40,000 | Landscaping, land rehabilitation, turf growing and broad acre agricultural |
| Cairns ARRT Facility (NSW) | 50% | 125,000 | Farming |

Recently, output composts have been deemed unfit for application to non-agricultural land due to a high plastic content. Although the technology is capable of reducing plastic content, the cost for doing so is high. Therefore, although the facility is performing well and extensively utilises the capabilities of the technology, financial considerations affect its performance. The facility achieves its diversion target at the promised cost.

However, since the project's inception, the rest of the waste industry has changed in ways unforeseen at the time. Landfill gate fees did not increase at the then projected rate, while the various EfW technologies have developed significantly, promising the same or higher diversion at lower gate fees.

**WCF costs and income**

Overall in 2014/15, the shortfall of $676,811 from member tonnes processed is required to be funded from 10,700 tonnes of commercial waste at an average of $140 per tonne for the facility to break even (Table 11-2).

**Table 11-2 P&L summary for 2014/15**

| | Total ($) | Per member t received ($/t) | Per total t received ($/t) |
|---|---|---|---|
| **Income** | $18,822,573 | $233.10 | $221.45 |
| **Fixed costs** | -$12,121,304 | -$163.14 | -$142.60 |
| **Variable costs** | -$6,701,269 | -$90.19 | -$78.84 |
| **Total** | **$0** | **$0** | **$0** |

Table 11-3 details the income and key cost items for the WCF in 2014/15. All WCF income, amounting to over $18.8 million, raised through the per tonne gate fee paid by member councils and commercial operators when depositing waste.

**Table 11-3 WCF income and expenses for 2014/15**

| Income source | Tonnes | Gate fee ($/t) | Total income ($) |
|---|---|---|---|
| **Member** | 74,300 | $233 | $17,305,956 |
| **Other income** | 74,300 | $0.18 | $ 13,374 |
| **Non-member** | 10,700 | $140 | $1,501,317 |
| **Other income** | 10,700 | $0.18 | $1,926 |
| **Total** | **85,000** | **$221** | **$18,822,573** |
| **Fixed costs** | **Total expenses ($)** | **Expenses ($/member t)** | **Expenses ($/all t)** |
| Employment costs | $1,975,000 | $27 | $24 |
| Utility costs | $1,574,748 | $22 | $19 |
| Accommodation expenses | $440,812 | $6 | $5 |
| Maintenance expenses | $3,100,060 | $42 | $38 |
| Maintenance contingencies | $500,000 | $7 | $6 |
| Consultants | $355,000 | $5 | $4 |
| Insurance | $1,021,000 | $14 | $13 |
| Other Costs | $213,154 | $3 | $3 |
| Allocations (overheads) | $1,100,531 | $15 | $13 |
| Transfer to reserves | $1,841,000 | $25 | $23 |
| **Total fixed costs** | **$12,121,304** | **$163** | **$143** |
| **Variable costs** | **Total expenses ($)** | **Expenses ($/member t)** | **Expenses ($/all t)** |
| Landfill & transport | $4,182,614 | $57 | $51 |
| Compost transport | $1,472,173 | $20 | $18 |
| Process consumables | $183,500 | $3 | $2 |

| | | | |
|---|---|---|---|
| Quality assurance costs | $36,550 | $1 | $1 |
| Commercial volumes | $826,432 | $11 | $10 |
| **Total variable costs** | **$6,701,269** | **$90** | **$79** |

The maintenance and operation of the WCF requires approximately $12 million in fixed costs and a further $6.7 million in variable costs. The latter is directly linked to the amount of waste processed, the larger the amount of waste, the higher the variable costs. More than a fifth of the variable cost is made up of transport fees for the produced compost that is applied as soil conditioner for land rehabilitation. In the original design of this facility, the compost was foreseen as a source of income for the WCF through sales to farmers for use as a source of nutrients. However, as a result of the contamination issues discussed previously, it has proven more economic to transport it over long distances and deliver it to land rehabilitation projects for free instead of processing it further to achieve a saleable product.

**Technology flexibility – WCF**

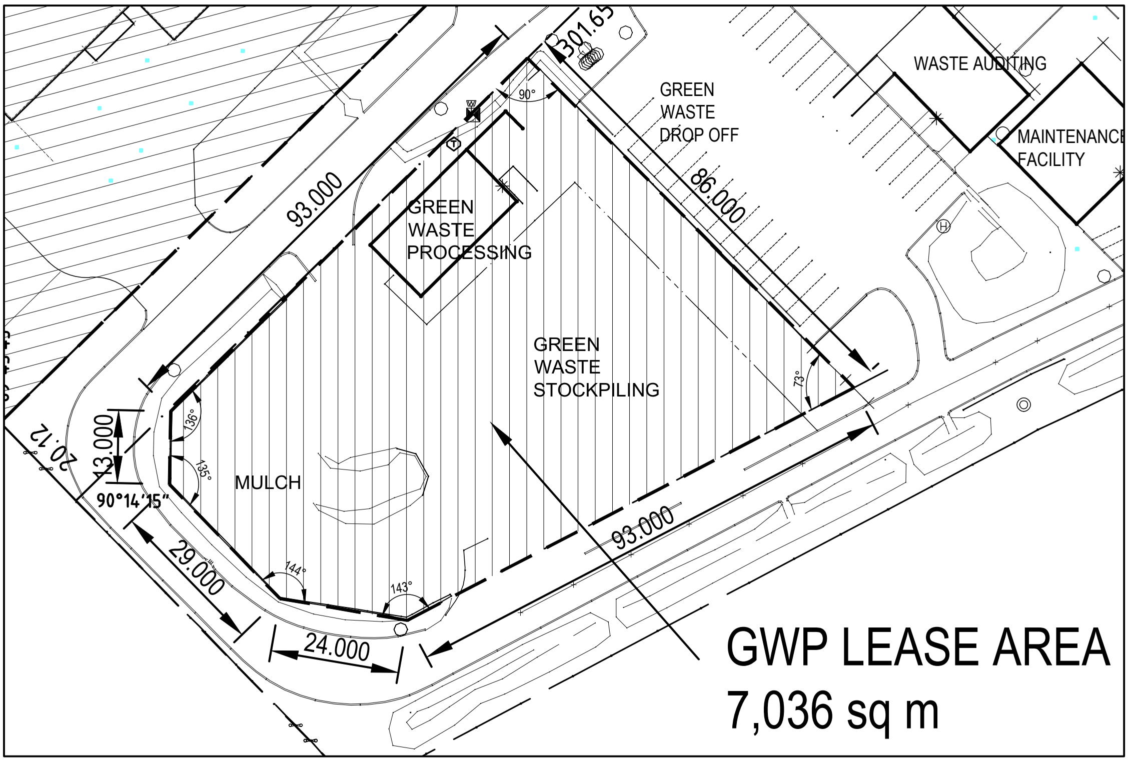
The quality of the composts produced by the WCF is directly dependent on the feedstock. The current input to the facility is mixed waste that includes organic compostables as well as inert contaminants. The facility operates on the premise that organics will break down and pass through the various post-composting screens while contaminants will undergo the process remaining large enough to be captured and removed by the screens. In practice many contaminants break during processing and therefore end up in the final compost. More contamination can be removed to increase the quality and value of the compost however this comes at the cost of diminishing quantities.

Therefore, the quality of the final product is inextricably linked to the inputs. If the incoming material is clean, the final product will be contaminant free. Given the facility's high composting efficiency, it could be used in processing source separated food and green organics should the SMRC region decide to implement 3 bin FOGO collections.

### 11.1.3 The Green Waste Facility

The GWF facility currently comprises a chipping and a mulching machine and processes approximately 8,600tpa of green waste generated by member councils and an additional 8,700tpa from other sources. In total, the facility currently processes approximately 17,300tpa. The area of the facility is 7,036m$^2$ (Figure 11-3).

**Figure 11-3 Green Waste Processing Facility lease area**




The profit and loss statement for the facility has been provided (The shortfall of $423,934 is required to be funded from 8,700 tonnes of commercial waste at an average of $74 per tonne.

Table 11-4). The shortfall of $423,934 is required to be funded from 8,700 tonnes of commercial waste at an average of $74 per tonne.

**Table 11-4 Green Waste Processing facility profit and loss (BAU)**

| Green Waste Processing Facility profit and loss statement | | Total | |
|---|---|---|---|
| Revenue | Member councils (8,600tpa x $80.83/t) | $695,138 | |
| | Other sources (8,700tpa x $73/t) | $643,278 | |
| | Mulch sales | $31,936 | |
| Total revenue | | | $1,370,352 |
| Variable costs | Employment | -$71,679 | |
| | Maintenance | -$144,540 | |
| | Processing | -$16,479 | |
| Fixed costs | Utilities | -$20,146 | |
| | Accommodation | -$83,755 | |
| | Insurance | -$29,000 | |
| | Other | -$245,281 | |
| | Allocations | -$522,472 | |
| | Transfer to reserves | -$237,000 | |
| Total costs | | | -$1,370,352 |
| Profit/loss (annual) | | | $0 |

| Profit/loss ($/t) | $0 |
| --- | --- |

Currently, it costs SMRC approximately $50/t to process green waste through the green waste facility. Should SMRC decide to pursue alternative collecting and processing options for FOGO either onsite or off, then it would be prudent to consider the following:

1. Conduct a full cost accounting breakdown for green waste processing costs to ensure that $50 is accurate; and
2. If the gate fee for composting at the chosen FOGO facility is less than $50/tonne then consider rolling the green waste into the process and distribute the cost savings to member councils.

### 11.1.4 The Materials Recycling Facility

The Materials Recovery Facility (MRF) at the RRRC is a single stream clean MRF that accepts recyclable comingled materials that have already been separated at the source from MSW generated by either residential or commercial sources. The current MRF was commissioned in July 2012 as the original was destroyed by fire in June 2009. All five member Councils deliver kerbside collected comingled recyclables to the MRF.

Material is sorted to specifications, then baled, crushed, compacted, or otherwise prepared for sale to buyers of recyclables. The major sorting categories are paper and cardboard and plastic, glass, steel and aluminium containers.

The design throughput for the MRF is at 47,424 tonnes per year under single shift Monday to Friday operation and double that, at 94,848 tonnes, under double shift operation (subject to space on tipping floor and storage capacity for processed recyclables). Currently the MRF is operating in single shift mode and in the 2014/15 financial year received 40,000 tonnes for processing.

The annual amount of comingled recyclables received can vary and is dependent upon a range of factors including but not limited to:

- Behaviour of residents;
- Material composition;
- Plant performance;
- Seasonal factors; and
- Contractual arrangements with MRF customers.

Comingled recyclables delivered to the MRF undergo a number of processes as outlined below.

#### 11.1.4.1 Comingled recycling processing

Once comingled recycling loads are deposited on the tip floor, non-processable materials such as hazardous, large and bulky items, wire and rope are removed by front end loader during stockpiling and handling. Subsequently sorting is performed with the following process:

1. Comingled recycling is placed by front end loader onto the primary feed conveyor and fed onto secondary inclined conveyor by feed drum;
2. At the primary sorting cabin, the following items are removed:

   a. Other hazardous waste such as car batteries, used engine oil, gas bottles, chemical containers; and
   b. any remaining non-processable items, bulky items, large metal objects and bulky plastics.
3. Cardboard screens remove cardboard which is sent to old corrugated cardboard bunker;
4. Glass breaker screen breaks all glass to minus 60mm and sends to glass screening area for further processing as follows:
   a. Ferrous metal removal by overhead magnet; and
   b. Two stage trommel splits glass into:
      i. 0 – 15mm >> vibratory feeder to air wash to remove lights before fine glass into product bunker 1;
      ii. 15 – 50mm >> vibratory feeder to air wash to remove lights before coarse glass into product bunker 2; and
      iii. over 50mm to waste.
5. Paper and containers fed to old newsprint and polishing screens;
6. Old newsprint is removed and sent to old newsprint bunker via QA station 1;
7. Mixed paper is removed and sent to mixed paper bunker via QA station 2;
8. Container streams from old newsprint and polishing screens are sent to container area and processed as follows:
   - Ferrous metal removal by overhead magnet;
   - Heavy items removal by cyclone and recirculated to tip floor for removal of liquids from plastic bottles;
   - Optical sort 1 removes paper and recirculates to polishing screens;
   - Eddy current removes aluminium;
   - Optical sort 2 removes mixed plastic; and
   - Optical sort 3 removes PET and HDPE.
9. Old corrugated cardboard, mixed paper and old newsprint are baled through baler 1 and removed from site in sea containers via product storage areas;
10. All containers and bulky plastics are baled through baler 2 and removed from site in sea containers and flat-bed trailers via product storage areas;
11. Glass is loaded by front end loader into bulk bins for removal by hook lift truck;
12. Bulky and heavy metals and metals from glass plant are removed in bulk bins;
13. Tip floor waste is removed in bulk bins; and
14. Process waste is sent to waste packers and compacted into 30m$^3$ hook lift containers.

#### 11.1.4.2 MRF performance

The recovery rate achieved by MRFs can vary over time as a result of a number of factors that include but are not limited to:

- Variation in the composition of comingled recyclables received for processing;
- Contamination rate of the incoming comingled recyclables;
- Type of contaminants;
- Efficiency of removal of contaminants;
- Efficiency of primary trommels, compost turning operations and final compost screening affected by equipment, materials composition, moisture and processing rates; and

- Market demand for recyclables.

In 2014/15, the facility processed 40,000t of comingled recyclables of which 83%, or 33,200t, were recovered (Table 11-5). Paper and cardboard made up close to half (45.5%) of all incoming material while glass accounted for another 30%.

**Table 11-5 MRF recovery performance**

| Output material | % of incoming comingled stream | Tonnes |
|---|---|---|
| **Aluminium** | 0.4 | 160 |
| **Steel** | 2.9 | 1,160 |
| **Plastic -PET** | 0.7 | 280 |
| **Plastic -HDPE** | 0.9 | 360 |
| **Plastic -Mixed** | 2.7 | 1,080 |
| **Old newsprint 6+8** | 18.9 | 7,560 |
| **Paper -Mixed** | 19.6 | 7,840 |
| **Cardboard** | 6.8 | 2,720 |
| **Glass Inert** | 25 | 10,000 |
| **Glass Mixed** | 5 | 2,000 |
| **Residual to landfill** | 15.5 | 6,200 |
| **Moisture Losses** | 1.5 | 600 |
| Total | 100 | 40,000 |
| **Total recovered** | 83 | 33,200 |
| **Total disposed and evaporated** | 17 | 6,800 |

### 11.1.4.3 MRF costs and income

Overall in 2014/15, the shortfall of $593,827 was required to be funded from 5,600 tonnes of commercial waste at an average of $53 per tonne million (Table 11-6).

**Table 11-6 MRF P&L summary for 2014/15**

| | Total ($) | Per member t received ($/t) |
|---|---|---|
| **Income** | $6,806,788 | $170.17 |
| **Fixed costs** | -$5,194,526 | -$151.00 |
| **Variable costs** | -$1,625,857 | -$47.26 |
| **Total** | **$0** | **$0** |

Table 11-7 details the income and key cost items for the MRF in 2014/15. All MRF income, amounting to $6.8 million, is through the per tonne gate fee paid by member councils and commercial operators when delivering comingled recyclables, as well as sales of processed materials.

MRF maintenance, salaries and annual allocations each add more than $1 million in fixed costs while disposal of residuals is the only significant variable cost. The latter is directly linked to the amount of waste processed, the larger the amount of waste, the higher the variable costs. Reducing the cost of disposal, for example through ensuring better separation at the source, can have a significant impact on the MRF's costs.

**Table 11-7 MRF income and expenses for 2014/15**

| Income source | Tonnes | Gate fee ($/t) | Total income ($) |
|---|---|---|---|
| Member gate fees (total) | 34,400 | $80.63 | $2,773,720 |
| Sales | 34,000 | $93.36 | $3,211,601 |
| Commercial gate fees | 5,600 | $53.33 | $298,648 |
| Sales | 5,600 | $93.36 | $522,819 |
| Total | 40,000 | $170.17 | $6,806,788 |
| **Fixed costs** | **Total expenses ($)** | **Expenses ($/member t)** | **Expenses ($/all t)** |
| Employment Costs | $1,322,802 | $38.45 | $33.40 |
| Utility Costs | $118,214 | $3.44 | $2.99 |
| Accommodation Expenses | $220,665 | $6.41 | $5.57 |
| Maintenance Expenses | $1,102,000 | $32.03 | $27.83 |
| Consultants | $17,000 | $0.49 | $0.43 |
| Insurance | $283,000 | $8.23 | $7.15 |
| Other Costs | $117,505 | $3.42 | $2.97 |
| Allocations | $1,027,699 | $29.87 | $25.95 |
| Interest & Loan Repayments | $985,641 | $28.65 | $24.89 |
| **Total fixed costs** | $5,194,526 | $151.00 | $131.17 |
| **Variable costs** | **Total expenses ($)** | **Expenses ($/member t)** | **Expenses ($/all t)** |
| Disposal Costs | $1,314,740 | $38.22 | $32.87 |
| Process Consumables | $83,477 | $2.43 | $2.09 |
| Other variable | $227,640 | $6.62 | $5.69 |
| **Total variable costs** | $1,625,857 | $47.26 | $40.65 |

### 11.1.5 Weighbridge

SMRC currently owns and operate, as part of the RRRC site, a dual-weighbridge that records and categorises all waste entering and exiting the RRRC.

SMRC currently provides the labour and administrative overheads to operate the weighbridge. SMRC could consider contracting the operation and administration of the weighbridge to an external contractor, however, there would be potentially many disadvantages as outlined in Table 11-8.

**Table 11-8 Strengths and weaknesses of contracting weighbridge to private provider**

| Strengths | Weaknesses |
|---|---|
| Reduced administration overhead costs | Lack of transparency if codes for waste change into the future |
| | Lack of quality control and quality assurance |
| | Waste is owned by Council and Council is responsible for levy payments |
| | Transitional issues |

It is unclear what advantage might be achieved by tendering out operations but the risk to Council revenues and governance are known. Experience elsewhere indicates weight-based operations on behalf of Council operating are best kept in-house.

### 11.1.6 Summary and future use of RRRC

Relative to other MRFs, the gate fee for the SMRC MRF is high. SMRC is currently preparing to invite tenders for the ownership/lease and operation of the MRF which is the appropriate response to establish private sector interest.

Currently, there are no options considered as part of the collection and processing options which would require expansion of the current footprint of the site.

Therefore, the recommended actions for the future use of the site are;

- Tender the MRF to a commercial operator;
- Trial RRRC drums for FOGO;
- Tender WCF site for FOGO (with GW option);
- Based on tender price review GW processing (If < $50 (current cost) then roll GW into FOGO processing; retain gate revenues);
- Retain the weighbridge; and
- Lease vacant sheds as appropriate (based on collection model going forward).

## 11.2 Regional infrastructure and assets

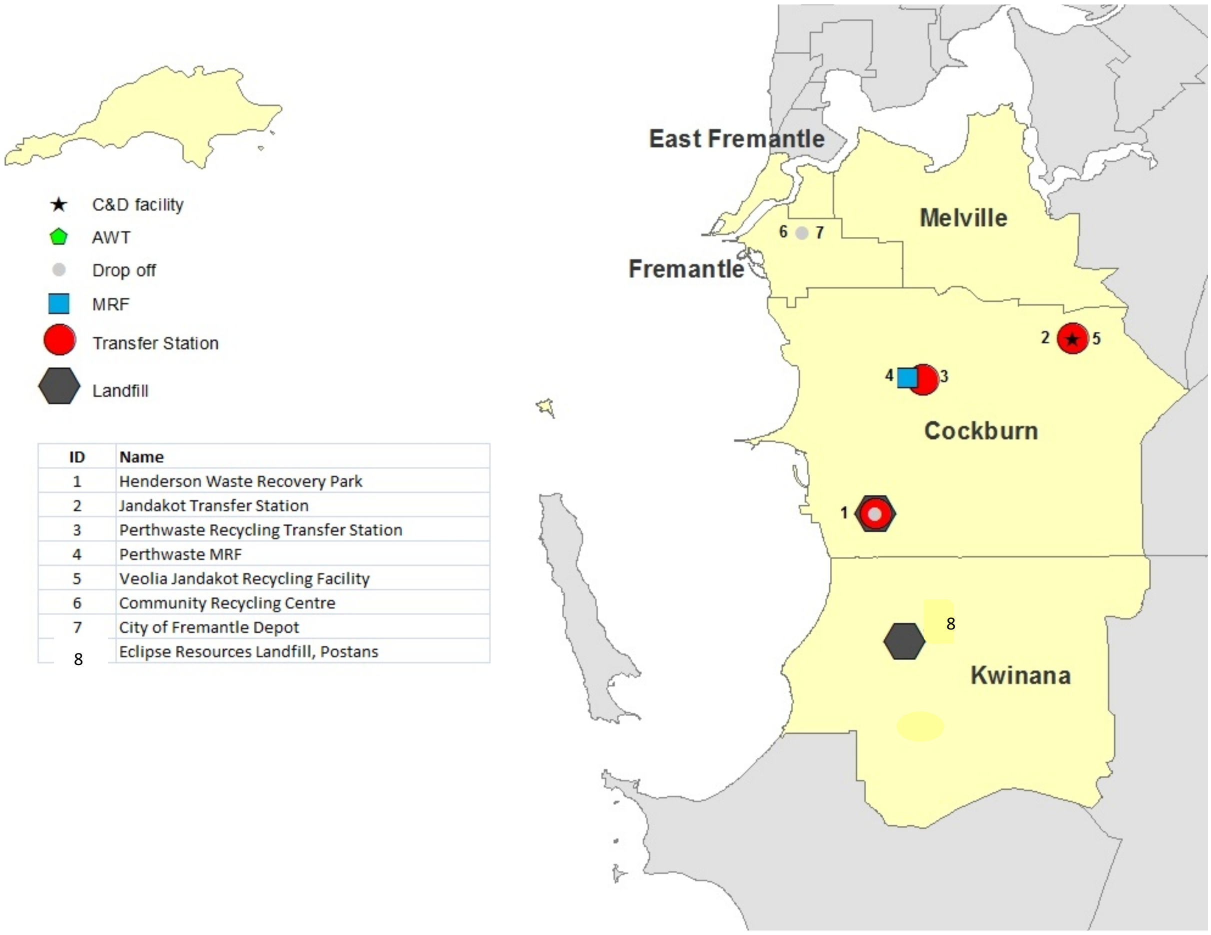
### 11.2.1 Introduction

There are a number additional of waste facilities within Southern Perth including landfills, AWT facilities, and MRFs. Commercial operators manage the majority of these facilities, but there are also a number of Council owned landfills, transfer stations, and MRFs in operation within SMRC member council's boundaries (Figure 11-4).

## 11.2.2 The Henderson Waste Recovery Park

The Henderson Waste Recovery Park is a Class II landfill, located in Henderson in Cockburn. The facility accepts a range of materials, including MSW as well as hazardous/problem wastes such as paints, oils and asbestos. The ultimate capacity of the site is 3,500,000m$^3$. A third generator was recently added to increase its methane capture capacity by 33%. The waste recovery park commenced operations in 2010 and has a design life of 25 years.

**Figure 11-4 Waste infrastructure located within SMRC boundaries**

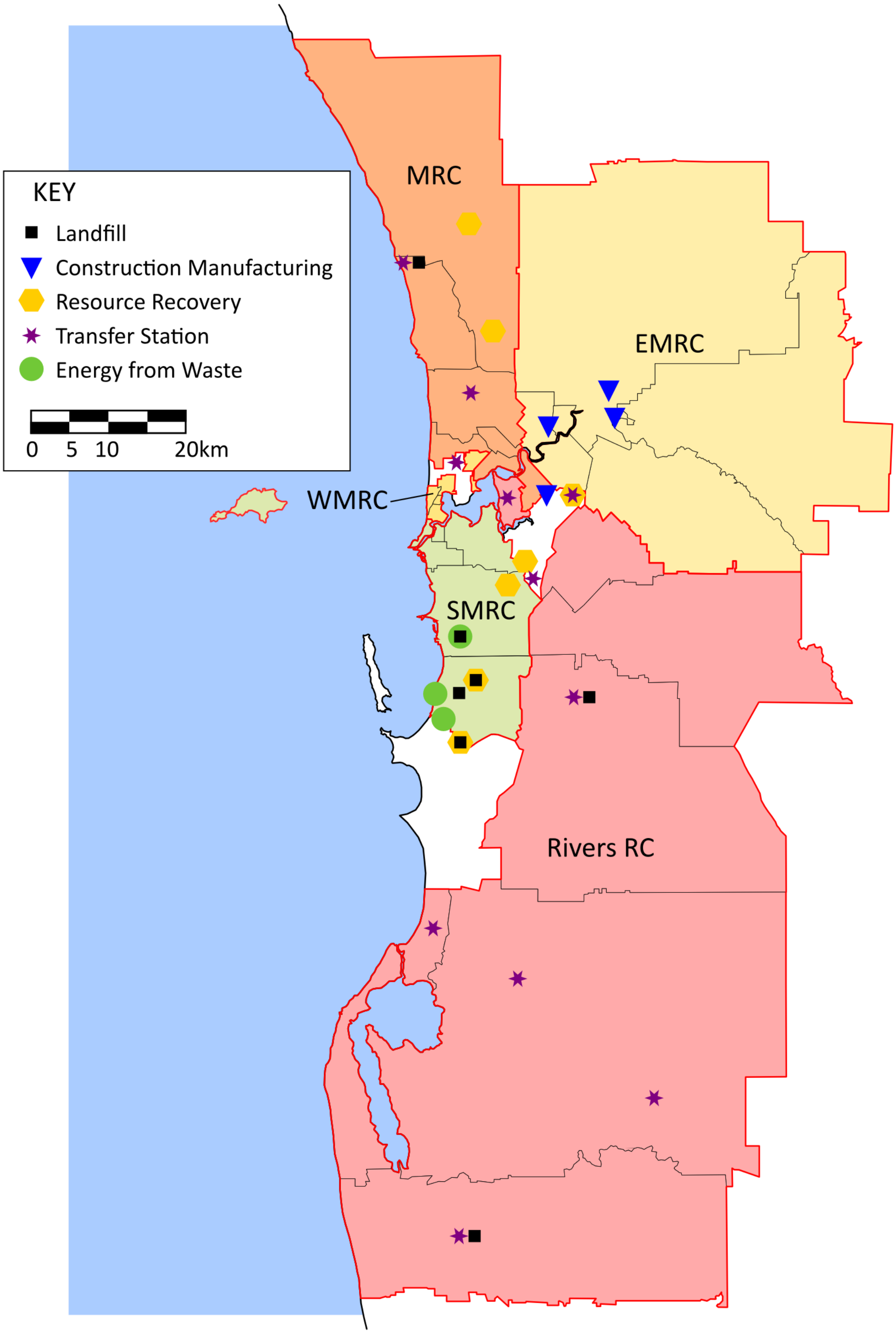



| ID | Name |
|---|---|
| 1 | Henderson Waste Recovery Park |
| 2 | Jandakot Transfer Station |
| 3 | Perthwaste Recycling Transfer Station |
| 4 | Perthwaste MRF |
| 5 | Veolia Jandakot Recycling Facility |
| 6 | Community Recycling Centre |
| 7 | City of Fremantle Depot |
| 8 | Eclipse Resources Landfill, Postans |

## 11.2.3 Neighbouring infrastructure

There are also a number of waste facilities within the neighbouring boundaries of Rivers Regional Council (RRC), Eastern Metropolitan Regional Council (EMRC) and Mindarie Regional Council (MRC) and Western Metropolitan Regional Council as well in neighbouring councils, City of Canning and City of Rockingham. All current facilities, as well as future planned facilities (such as EfW facilities), within the surrounding Regional Council areas, are shown in Figure 11-5.

**Figure 11-5 Waste infrastructure in relation to regional council boundaries**




### 11.2.4 Rivers Regional Council (RRC)

Rivers Regional Council (RRC) represents the member councils of:

- City of Armadale;

- City of Gosnells;
- City of Mandurah;
- City of South Perth;
- Shire of Murray;
- Shire of Serpentine Jarrahdale; and
- Shire of Waroona.

All seven member councils have signed up to a processing contract with Phoenix Energy for processing household MSW, once the facility is operational. The contract stipulates 'Committed' and 'Optional' tonnes for each member council in order to make provision should the State Government mandate a three bin policy in the future.

Currently, six member councils have contracts with Cleanaway for collection and processing of kerbside comingled recycling, one with Perth Waste.

The RRC member councils are serviced by three landfills, located at:

- Cardup;
- Armadale; and
- Waroona.

Six transfer stations are within the boundaries of RRC;

- South Perth;
- Mandurah;
- Pinjarra;
- Dwellingup;
- Waroona; and
- Armadale.

Two of the landfills within RRC are owned and operated by member councils; Armadale Landfill, owned and operated by City of Armadale Council and Buller Road Refuse Site, owned and operated by the Shire of Waroona Council. There are an additional 5 transfer stations in the Regional Council which are owned and operated by member councils and are listed in Table 11-9.

**Table 11-9 Facilities and assets owned and operated by RRC Member councils.**

| Landfill | Operated by | Materials accepted |
|---|---|---|
| Armadale Landfill | City of Armadale Council | Paper and cardboard, glass bottles, aluminium cans, scrap metal, vehicle batteries, green waste, sawn timber, logs, sand/soil/clay, brick rubble, concrete, furniture, whitegoods, e waste, tyres, car bodies, low level hazardous waste, household chemicals, asbestos, general waste |
| Buller Road Refuse Site | Shire of Waroona Council | Green waste, car bodies, general waste, general recyclables, green waste, sewage, animal remains, asbestos, waste oil |
| **Transfer Station** | **Operated by** | **Materials accepted** |
| Collier Park Waste Transfer Station | City of South Perth Council | E-waste, paper and cardboard, Motor oil, Scrap metal, fluorescent tubes, household and vehicle batteries, Car tyres, Mattresses, green waste, asbestos |
| Mandurah Waste Management Centre | City of Mandurah Council | General waste and junk, C+D waste, green waste, recyclable metal, car batteries, tyres, asbestos, household hazardous chemicals, general recyclables, compact fluorescent tubes, plastic garden pots, mobile phones and accessories |
| Corio Rd Waste Transfer Station | Shire of Murray Council | Whitegoods, scrap metals, cooking oil, bricks, concrete, terracotta pipes, vehicle batteries, sump oil, tyres, polystyrene, glass bottles and jars, aluminium cans and foil, paper and cardboard, steel cans, green waste, car bodies, mixed plastics |
| Dwellingup Waste Transfer Station | Shire of Murray Council | Whitegoods, scrap metals, cooking oil, bricks, concrete, terracotta pipes, vehicle batteries, sump oil, tyres, polystyrene, glass bottles and jars, aluminium cans and foil, paper and cardboard, steel cans, green waste, car bodies, mixed plastics |

RRC indicated during the stakeholder consultation process that during the 15/16 financial year they will conduct a feasibility study for processing hubs focussed on recycling in small streams, including but not limited to the following:

- Mattresses;
- HHW;
- Batteries;
- C&D materials;
- Whitegoods;
- E waste;
- Tyres;
- Cars;
- Asbestos; and
- Motor oil.

This study will look at developing up to 2 regional 'hubs' for recycling of the above materials. RRC has expressed an interest in considering SMRC's green waste processing facility and MRF in this study and would like to consider involving SMRC in the development of these options, in order to provide up to 4 regional processing 'hubs', 'South of the River', i.e. within SMRC and RRC servicing councils accordingly.

RRC do not own or operate any facilities, so employ just three staff members and one part-time accountant. RRC has expressed an interest in looking at the potential to rationalise overheads and administrative expenditure through sharing assets, such as the SMRC head office.

RRC has also expressed an interest in combining/partnering for the use and development of educational resources, such as the Recycle Right brand and App.

If SMRC consider regionalising these assets then this may help reduce some administrative overheads.

***Potential options for regionalisation of services:***

- Consider working with RRC to develop a regional 'hub' for green waste processing at GWF;
- Tender for processing RRC comingled recycling when contracts are tendered in the future;
- Consider input into/partnering with RRC to develop the feasibility study for 4 regional processing 'hubs' for mattresses, HHW, batteries, C&D materials, whitegoods, e waste, tyres, cars, asbestos and motor oil;
- Further discussions with RRC to set up a shared office/administrative support agreement with RRC;
- Further discussions with RRC for partnering and use of educational resources such as the Recycle Right brand; and
- Consider tendering for any food and/or garden waste tonnes which may become commercially available, should RRC (and all local government) be mandated to move to a third bin system (prior to EfW processing) in the future, should SMRC decide to continue running the WCF.

### 11.2.5 City of Canning Council

The City of Canning is not currently a member of any Regional Council. However, City of Canning has also signed a contract with Phoenix Energy for processing a stipulated number of 'Committed' and 'Optional' tonnes with Phoenix Energy, when the facility is operational.

#### 11.2.5.1 Ranford Rd Transfer Station

The Ranford Road Transfer Station is located within the City of Canning (Canning), in proximity to the northern SMRC member councils. The facility was opened in 2004 to cater for Canning's resident's need to dispose of inert materials, in excess of the annual hard waste collections, as well as for community works programs.

The facility accepts metals, building construction materials such as rubble, bricks, concrete and sand, as well as hazardous waste such as motor oil and batteries. The transfer station cannot accept putrescible wastes, however this license is currently under review, to include acceptance and initial processing (grinding) of green waste. The facility is licenced to receive 40,000 tonnes of waste per annum and receives waste from multiple sources on a fee for service basis. The building has a 50-year design life with the option for extensions to be made, therefore, there is capacity to receive additional wastes.

**Table 11-10 Materials accepted at Ranford Road Transfer Station**

| Material accepted | Recycled/disposed |
|---|---|
| Building construction material (rubble, bricks, concrete and sand) | Recycled |
| Metals | Recycled |
| Hazardous chemicals | Disposed |
| Batteries | Recycled |
| Motor oils | Recycled |
| Asbestos (limited access) | Disposed |
| Green waste | Recycled (ground and on-processed) |

The City of Canning was due to be disbanded and split between four surrounding member councils under Local Government reform, which saw the proposal for the Ranford Road Transfer Station to become a regional recycling facility put on hold. However, due to the turnaround in Local Government Reform, City of Canning still exists and indicated during the stakeholder consultation process that it is willing to expand its transfer station operations to work with SMRC member councils for regional processing options.

Though City of Canning expressed its desire to use the site to mainly service those residents and businesses with small trailers, it would consider expanding operations such as regionalisation of its green waste grinding and processing operations. City of Canning are likely to partner with RRC in the development of a feasibility study for regional processing hubs as described in Section 11.2.4.

***Potential options for regionalisation of services***:

- Consider working with City of Canning to develop a regional green waste processing site for member council's green waste either at the current GWF or at Ranford Road Transfer Station;
- Work with City of Canning and RRC to develop 4 regional hubs for household hazardous waste, batteries, motor oil, e-waste and building and construction permanent drop off site; and
- Tender for City of Canning's comingled recycling tonnes when they become commercially available.

### 11.2.6 Eastern Metropolitan Regional Council (EMRC)

Eastern Metropolitan Regional Council (EMRC) represents the following six member councils:

- City of Belmont;
- City of Bayswater;
- City of Swan;
- Town of Bassendean;
- Shire of Mundaring; and
- Shire of Kalamunda.

The member councils are serviced by three transfer stations, one at the Red Hill Waste Management Centre, which is owned and operated by EMRC, and the Coppin Road and Mathieson Road transfer stations which are owned and operated by the Shire of Mundaring.

Member councils are also serviced by the waste and recycling facilities available by the EMRC owned and operated Red Hill Waste Management Centre.

**Table 11-11 Facilities and assets owned and operated by EMRC Member councils**

| Landfill | Operated by | Materials accepted |
|---|---|---|
| Red Hill Waste Management Centre | EMRC | Paper and cardboard, glass bottles, aluminium cans, scrap metal, vehicle batteries, green waste, sawn timber, logs, sand/soil/clay, brick rubble, concrete, furniture, whitegoods, e waste, tyres, car bodies, low level hazardous waste, household chemicals, asbestos, general waste, controlled waste and clothing. |
| Hazelmere Resource Recovery Park | EMRC | **Timber recycling** - with processed wood fines and woodchip sold to industry for use as animal bedding or in landscaping.<br>**Mattress recycling** - with the springs sold as scrap metal, the wood components are processed into woodchip and wood fines, and the foam is baled and sent off site to be manufactured as carpet underlay. |
| **Transfer Station** | **Operated by** | **Materials accepted** |
| Coppin Road | Shire of Mundaring | General waste, green waste, motor oil, white goods, batteries, tyres (max. five, fees payable). Recyclables: clothing & blankets, cardboard (flattened, without plastic packaging, fluorescent lights, glass bottles, paper and plastic. |
| Mathieson Road | Shire of Mundaring | General waste, green waste, motor oil, white goods, batteries, tyres (max. five, fees payable). Recyclables: clothing & blankets, cardboard (flattened, without plastic packaging, fluorescent lights, glass bottles, paper and plastic. |

#### 11.2.6.1 Red Hill Waste Management Facility

The Red Hill Waste Management Facility (Red Hill) is operated by the Eastern Metropolitan Regional Council (EMRC) and located at Toodyay Rd, Red Hill.

The facility processes MSW, commercial, contaminated and hazardous wastes and comprises Class 1, 2, 3 & 4 landfills. The Class 4 cell was constructed in 2007, with a capacity of 300,000 cubic metres of low hazard contaminated soil. In addition, a new compactor purchased in 2009 can process more than 1,200 tonnes of waste for landfilling per day.

The site has an estimated design life of approximately 50 years based on current waste volumes and assuming a Resource Recovery Facility (an Anaerobic Digester) is built and operational in the next few years. Red Hill has previously received waste from two other regional councils and the facility would have the capacity to receive further waste.

**Table 11-12 Materials accepted at Red Hill**

| Material accepted | Recycled/disposed |
|---|---|
| Car bodies | Recycled |
| General household waste | Disposed |
| Household Hazardous Waste | Disposed |
| Tyres (limited to member councils and four tyres) | Recycled |
| Comingled recycling | Recycled |
| Clothing | Recycled |
| E-waste | Recycled |
| Steel | Recycled |
| Ceramics | Disposed |
| Cubicle glass | Disposed |
| Green waste | Recycled (composted into mulch) |
| Mattresses | Recycled at Hazelmere Resource Recovery Park |
| Contaminated waste | Disposed |
| Controlled waste | Disposed |
| Asbestos and asbestos contaminated soil and sand | Disposed |
| Class 1, Class II and Class III and Class IV waste | Disposed |

#### 11.2.6.2 EMRC Hazelmere Resource Recovery Park

The Hazelmere Resource Recovery Park is located on Lakes Road, Hazelmere. The site currently accepts timber for recycling into wood fines and woodchip and mattresses for recycling into wood fines, carpet underlay and scrap metal.

Development consent has been given to develop the site to include;

- A wood waste to energy plant;
- A green waste processing facility;
- A receival and sorting area for C&I waste; and
- A MRF.

Community members will also be able to use the site for:

- Household hazardous waste drop off;
- Reusable household goods drop off (tip shop);
- To visit the education centre; and
- Drop-off of household waste to be transferred to a landfill.

***Potential options for regionalisation of services:***

- SMRC could work with EMRC, as well as RRC and City of Canning to establish Hazelmere as a regional collection point for separated wood waste from verge side collections to the Pyrolysis plant, when operational; and
- SMRC to tender for EMRC kerbside comingled tonnes should they become commercially available again.

### 11.2.7 Mindarie Regional Council (MRC)

Mindarie Regional Council encompasses the member councils of:

- City of Wanneroo;
- City of Stirling;
- City of Perth;
- City of Joondalup;
- Town of Cambridge;
- Town of Vincent; and
- Town of Victoria Park.

There are a number of recycling facilities, transfer stations and landfills owned and operated by MRC member councils and MRC itself (Table 11-13). There is one Household Hazardous Waste Recycling Centre in Balcatta, which is owned and operated by City of South Perth, which accepts resident's waste and recyclable materials, as well as Household Hazardous Waste.

**Table 11-13 Facilities and assets owned and operated by MRC Member councils.**

| Landfill | Operated by | Materials accepted |
|---|---|---|
| Tamala Park (landfill and transfer station) | Mindarie Regional Council | General waste, Household Hazardous Waste, asbestos, mattresses, animals, controlled waste, special burial waste, tip shop materials. |
| **Transfer Station/ Recovery Facility** | **Operated by** | **Materials accepted** |
| Recycling Centre Balcatta | City of Stirling Council | Household junk, mattresses, green waste, sand/bricks/concrete, scrap metals, steel cans, aluminium cans, mixed plastics, paper and cardboard, glass bottles and jars, clothing, household goods, furniture, appliances, bicycles, landscaping items, household chemicals. |
| Greens Recycling Facility | City of Wanneroo Council | Green waste only |
| Resource Recovery Facility (Biovision 2020) | Mindarie Regional Council (BioVision 2020) | Mixed MSW, FOGO and GO |

#### 11.2.7.1 Tamala Park

The Tamala Park landfill waste disposal facility is operated by MRC after the Cities of Perth, Stirling and Wanneroo jointly acquired it in 1981. The site comprises an area of 250 hectares. Tamala Park is licensed as a Class 2 Waste Disposal facility.

Landfilling in Stage I ceased in November 2004. Waste disposal was moved to Stage II, Phase I and then closed in 2009 and capped in 2010. Landfilling in Stage II, Phase II commenced late 2009 and was completed in early 2012, with capping of Phase II expected to be completed later in 2012. While Phase II was being landfilled, cell development was occurring in Phase III. Landfilling of Phase III commenced immediately after Phase II was completed. Phase III of Stage II is the final stage of landfill development at Tamala Park and based on current waste quantities being received, the landfilling operations should cease by 2025.

Completed areas of the landfill are progressively covered and rehabilitated to return the area to its natural habitat. Rehabilitation includes planting the covered areas with native species most of which are grown from seeds collected on site, or in the local area.

To date, some 6 million tonnes of waste have even received since operations began in February 1991. The Tamala Park facility currently services a population of some 500,000 people.

#### 11.2.7.2 Resource Recovery Facility – (BioVision 2020, Neerabup)

In line with its vision and mission, the MRC began work in the early 2000's on a major project to reduce the mount of waste sent to landfill, in support of the State Government's Waste 2020 vision of "Towards Zero Waste". This has been achieved through the establishment of a Resources Recovery Facility, which is operated under contract to the MRC by BioVision 2020 Pty Ltd, based at Neerabup.

This waste treatment plant will process 100,000 tonnes of household waste to create products such as compost. The Resource Recovery Facility commenced operations in July 2009. Due to equipment related problems, the facility only processed 68,500 tonnes of waste in the first year. In the second year, the facility operated at near 100% capacity and processed 97,300 tonnes. It has an estimated gate fee of $235/t and not dissimilar to the RRRC.

***Potential options for regionalisation of services***

- SMRC could work with MRC to establish a regional mattress recycling and asbestos disposal point at Balcatta Recycling Centre;
- SMRC could potentially approach MRC to establish an MSW processing contract for the WCF after the contract expiry in 2020; and
- SMRC to consider tendering for MRC comingled recycling tonnes once commercially available.

### 11.2.8 Western Metropolitan Regional Council (WMRC)

Western Metropolitan Regional Council services the member councils of:

- Town of Claremont;
- Town of Cottesloe;
- Town of Mosman Park;
- Shire of Peppermint Grove; and
- City of Subiaco.

The Resource Recovery Facility services the residents of WMRC. Residents can deposit general waste, green waste, comingled recyclables and Household Hazardous Waste.

General waste is compacted and transported to landfill. Green waste is processed into mulch by RICHGRO and comingled recyclables are baled and transported to a MRF.

Household Hazardous Waste is also accepted at the site as is asbestos (under strict conditions).

***Potential options for regionalisation of services:***

- Consider tendering for WMRC comingled recycling tonnes once commercially available.

### 11.2.9 City of Rockingham Council

#### 11.2.9.1 Millar Road Landfill

The City of Rockingham operates the Millar Road Landfill facility at Millar Rd West, Baldivis. The facility incorporates a landfill, transfer station, recycling centre and a waste education centre. The facility accepts Class I Inert Waste, Class II MSW and Commercial Waste and Class III asbestos, quarry and contaminated soil waste. The facility is licensed to receive up to 20,000 tonnes per year of solid waste, up to 50,000 tonnes per year of Class I inert waste and up to 400,000 tonnes per year of Class II and III putrescible waste. The facility currently receives waste from SMRC, RRC and other local authorities within the region, receiving between 200,000 and 250,000 tonnes of waste per annum. At the current rate, the facility has an expected lifespan of over 30 year and has the capacity to accept additional wastes.

## 11.3 Potential regionalisation options identified

Regional options identified through stakeholder consultation for consideration by SMRC member councils are summarised in Table 11-14.

**Table 11-14 Summary of regionalisation actions identified**

| Regional Council | Action |
|---|---|
| **Rivers Regional Council** | 1. SMRC to consider working with RRC to develop a regional 'hub' for green waste processing at GWF (RRRC).<br>2. SMRC to tender for processing RRC comingled recycling when their services are tendered in the future.<br>3. SMRC to consider input into/partnering with RRC to develop the feasibility study for 4 regional processing 'hubs' for mattresses, HHW, batteries, C&D materials, whitegoods, e waste, tyres, cars, asbestos and motor oil.<br>4. SMRC to further discussions with RRC to set up a shared office/administrative support agreement with RRC.<br>5. SMRC to further discussions with RRC for partnering and use of educational resources such as the Recycle Right brand.<br>6. SMRC to consider tendering for any food and/or garden waste tonnes which may become commercially available, should RRC (and all local government) be mandated to move to a third bin system (prior to EfW processing) in the future, should SMRC decide to continue running the WCF. |
| **City of Canning** | 7. SMRC to consider working with City of Canning to develop a regional green waste processing site for member council's green waste either at the current GWF or at Ranford Road Transfer Station.<br>8. SMRC to work with City of Canning and RRC to develop 4 regional hubs for household hazardous waste, batteries, motor oil, e-waste and building and construction permanent drop off site. |

| | |
|---|---|
| | 9. SMRC to tender for City of Canning's comingled recycling tonnes when they become commercially available. |
| **Eastern Metropolitan Council** | 10. SMRC to consider working with EMRC, (as well as RRC and City of Canning) to establish Hazelmere as a regional collection point for separated wood waste from verge side collections to the Pyrolysis plant, when operational.<br>11. SMRC to tender for EMRC kerbside comingled tonnes should they become commercially available again. |
| **Mindarie Regional Council** | 12. SMRC to consider working with MRC to establish a regional mattress recycling and asbestos disposal point at Balcatta Recycling Centre.<br>13. SMRC (or its MRF operator) to consider tendering for MRC comingled recycling tonnes when tendered. |
| **Western Metropolitan Regional Council** | 14. SMRC (or its MRF operator) to consider tendering for WMRC comingled recycling tonnes when tendered. |

### 11.3.1 Commercial sites

In addition, there are a number of commercially owned and operated facilities within Southern Perth. There are also two EfW facilities in development, Phoenix Energy and New Energy East Rockingham facility.

### 11.3.2 Landfill

There are a number of Class I, Class II, Class III and Class IV landfill sites within SMRC member councils and the region, accepting both MSW and commercial waste. A number of these facilities are described below.

#### 11.3.2.1 Eclipse Resources

Eclipse Resources also operates a Class I Landfill and green waste recycling facility in Postans, which is within Kwinana. The facility commenced operations in 2002 and accepts both inert wastes for landfill and source separated green waste for recycling.

#### 11.3.2.2 Banksia Road Landfill, Dardanup

Transpacific Industries (TPI) Cleanaway operate a Class II & III putrescible and contaminated landfill facility at Banksia Rd, Dardanup. The Banksia Rd landfill accepts Class II MSW and commercial (including farming) waste, as well as green waste and other recyclable materials, such as steel and mattresses. Contaminated soils are the largest stream of hazardous wastes entering the Class III facility, with other industrial waste including asbestos also accepted. The site receives approximately 300,000 tonnes per annum and with continuation of current operations has an expected lifespan of 30 years. The Banksia Rd landfill has the capacity to receive additional waste and has previously tendered for waste contracts with SMRC.

#### 11.3.2.3 Thomas Road Landfill

Wastestream Management operates a landfill facility at Thomas Road, Kwinana Beach, which is leased from the City of Kwinana. The facility accepts solid waste (500 tonnes or more per year) and Class I inert waste

(500,000 tonnes or more per year). The current life of site is estimated to be 2024, however, the site license expires in July 2015.

### 11.3.3 Materials Recovery Facility/ Recycling Facilities

In addition to the abovementioned landfill facilities, there are a number of recycling facilities for organics and other recyclable material.

#### 11.3.3.1 Perthwaste MRF

Perthwaste MRF is located in Bibra Lake. The facility accepts co-mingled recyclable materials and processes approximately 30,000 tonnes of recyclables per annum[9]. No further information could be obtained from the facility at this time.

#### 11.3.3.2 SITA Welshpool Facility

Suez Environment (formerly SITA) operates a resource recovery park in Welshpool. The facility operates a resource recovery and treatment facility; transfer station, e-waste recovery facility, Suez 'Need-a-bin' services as well as hosting the Suez WA Head office and administration.

#### 11.3.3.3 Construction and Demolition Waste

In addition to the landfills and recycling facilities, which accept construction and demolition as well as other commercial waste, there is a number of additional facilities accepting construction and demolition waste such as bricks, clay and roof tiles.

#### 11.3.3.4 Midland Brick

Midland Brick is a subsidiary of Boral Bricks and is a brick and paver recycler operating across several locations in Perth. Midland operates 4 recycling yards, which accept clean clay bricks, clay pavers and clay roof tiles that are recycled and made into new construction products. The facility processes approximately 85,000 tonnes per annum of building materials[10]. There is capacity to expand this service, with the company trialling collection of building site waste and initiating partnerships with demolition companies.

#### 11.3.3.5 Veolia Jandakot Recycling Facility

Veolia Jandakot Recycling Facility is a resource recovery facility located in Jandakot that accepts construction and demolition waste for recycling/reprocessing.

#### 11.3.3.6 Wastestream Management

Wastestream Management accepts inert civil construction and demolition waste products including concrete, timber, bricks, steel, other construction materials and contaminated waste (1,000 tonnes or more per year) as well as solid waste (500 tonnes or more per year) and Class I inert landfill (500,000 tonnes or more per year). The current life of site is estimated to be 2024, however, the site license expires in July 2015. There are no logistical barriers that would prevent disposal of additional inert material.

[9] 2010 data
[10] 2005 data

## 11.4 Proposed Energy from Waste infrastructure in the region

The increasing gate fees at Australia's and WA's landfills, along with a demand for higher resource recovery, are key drivers for the increasing pursuit of EfW facilities (Table 11-15).

**Table 11-15 EfW market drivers and barriers**

| Drivers | Barriers |
|---|---|
| • Increasing landfill prices, including through the landfill levy, provide incentives for waste generators and collectors to divert waste to resource recovery facilities and energy recovery facilities;<br>• Decreasing availability of landfill space in the Perth region puts pressure on government and waste asset owners to reduce waste to landfill;<br>• Improving state policies and commitment to resource recovery by state and federal bodies; and<br>• National and state funding opportunities. | • Technology is relatively new and untested in the Australian context;<br>• Negotiating with existing waste service providers;<br>• Securing long term waste supply contracts that are of appropriate composition;<br>• A lot of the combustible material is made up of recyclables whose diversion take precedence under the waste hierarchy;<br>• Planning and approvals processes are relatively long and costly if unable to find an existing licensed site;<br>• Negative public perception due to past failures;<br>• Uncertain demand for heating and cooling outputs; and<br>• Current EfW policy limitations. |

No EfW facilities are currently operating in Australia on mixed residual waste streams but a number of proposals have been submitted, with a number of facilities having already received approval. As shown in Table 11-5, a number of suppliers are active in Australia including Martin GmbH and Entech, the companies that are proposing technology for the treatment of MSW in WA.

**Table 11-16 Summary of proposed EfW facilities in Australia**

| Company | Proposed Location | Cost | Waste feedstock (type/ tpa) | Energy Outputs (MW) | Technology Type |
|---|---|---|---|---|---|
| **New Energy** | Port Hedland (WA) | $180 million | MSW/ 70,000 – 130,000 | 15 | Entech gasification |
| **New Energy** | East Rockingham (WA) | $160 million | MSW/ 225,000 | 18.5 | Entech gasification |
| **Phoenix Energy** | Kwinana (WA) | $380 million | MSW/ 400,000 | 32 | Martin GmbH reverse-acting stoker grate |

| Company | Proposed Location | Cost | Waste feedstock (type/ tpa) | Energy Outputs (MW) | Technology Type |
|---|---|---|---|---|---|
| **Eastern Metropolitan Regional Council** | Hazelmere (WA) | $25 million | Wood waste | 3 | Pyrolysis |
| **Visy Group** | Tumut (NSW) | $300 million | Pulp and paper waste | 75 | Unknown |
| **Dial-a-Dump, The Next Generation** | Eastern Creek (NSW) | $700 million | C&I and C&D residues 1,200,000 | 140 | Moving grate thermal treatment |
| **City of Sydney** | Sydney (NSW) | Unknown | MSW/ 42,000 (minimum) | N/A | High temperature gasifier |

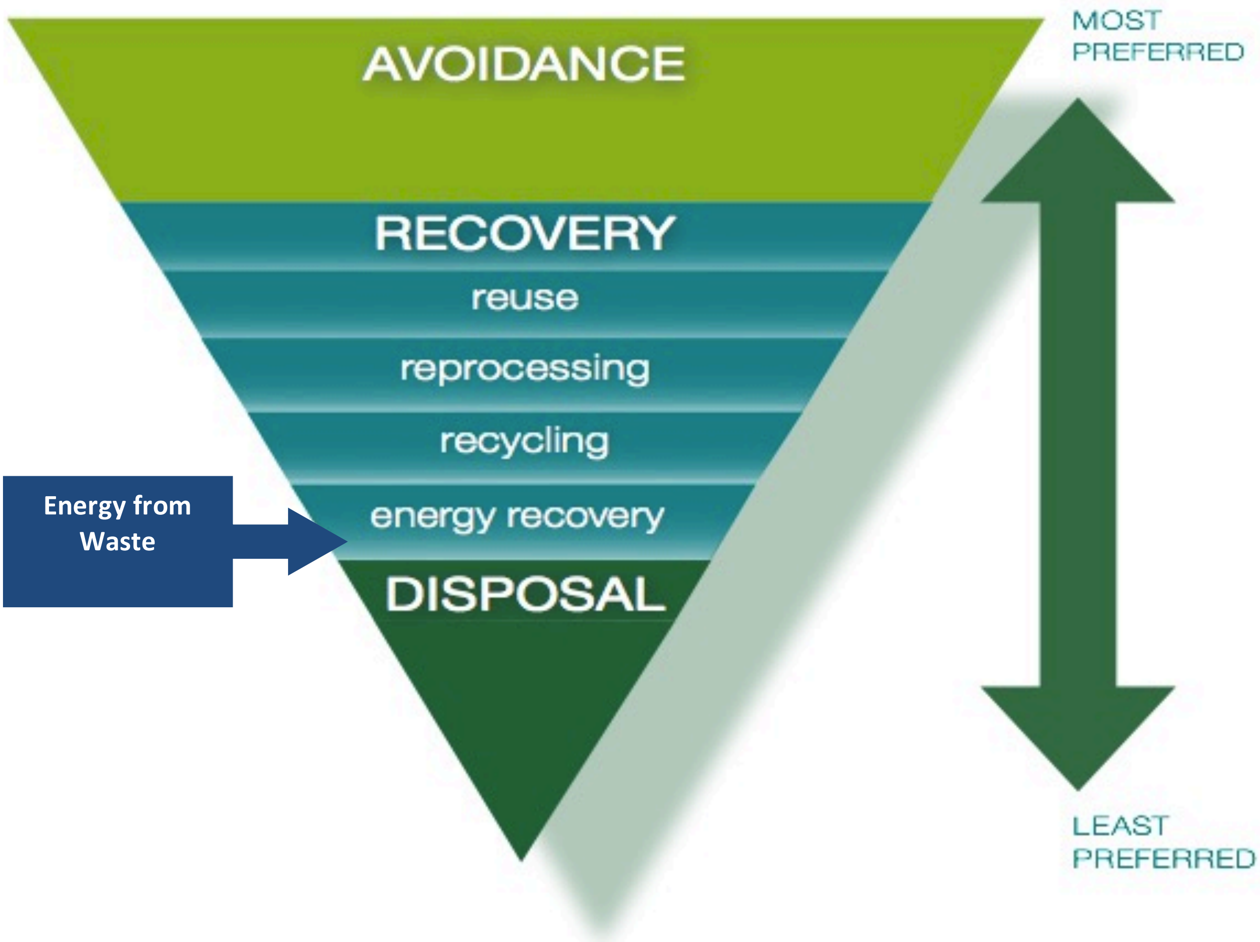
### 11.4.1 EfW and the WA waste hierarchy

The WA waste hierarchy, established under the Waste Avoidance and Resource Recovery Act 2007 (WARR Act), is one that ensures that resource management options are considered against the following priorities:

1. Avoidance including action to reduce the amount of waste generated by households, industry and all levels of government;
2. Resource recovery including reuse, recycling, reprocessing and energy recovery, consistent with the most efficient use of the recovered resources; and
3. Disposal including management of all disposal options in the most environmentally responsible manner.

The waste hierarchy lists in order of preference, the approaches needed to achieve efficient resource use with disposal being the least preferred method and waste avoidance the most preferred (Figure 11-6). EfW is not a lower priority option as it falls under the 'recover energy' approach.

**Figure 11-6 Position of EfW in the WARR Act waste hierarchy [11]**




The WA Energy from Waste Policy was summarised earlier. It essentially requires a 3 bin (GO) system as a minimum (Premier's Letter) but has been softened or confused somewhat by the letter of the Waste Authority, which allows 2 bin EfW subject to it not foreclosing on putrescible 3 bin solutions to delivery higher resource recovery (refer to section 10.5).

Energy from waste (EfW) or waste to energy (WtE) is the process of generating electrical and/or heat energy from the incineration of waste. Incineration, the oldest and most widely used EfW process produces energy through direct combustion. The electric efficiencies of incinerators ranges from 14% to 28% while it is also possible to harvest a significant percentage of the remaining energy via cogeneration e.g. district heating. Total efficiencies of cogeneration incinerators can be as high as 80%. New and emerging thermal EfW technologies such as pyrolysis and gasification produce a combustible fuel, including synthetic fuels.

### 11.4.2 Martin GmbH

Martin GmbH für Umwelt-und Energietechnik (Martin) is a German company that has been designing and constructing EfW incinerators since 1925. The company owns the core technology, the grate while it also

[11] **Source: Waste Authority Communication on the Waste Hierarchy, 2013**

supplies turnkey, delivers grate, grate/boiler lots consultation, maintenance and engineering services for new and existing installations.

With approximately 780 incineration lines equipped with its technology worldwide, Martin is the biggest thermal treatment technology provider worldwide. Four grate technology options are currently available.

**Martin Horizontal Grate (H-type):**

- Uses water-cooled grate bars to dissipate heat rather than under-fire air; and
- Good burnout of bottom ash and flue gas is dependent on furnace geometry, arrangement of over-fire air nozzles and choice of refractory materials.

**Mitsubishi-Martin Reverse Acting Stoker and Furnace (R-type):**

- Over 550 lines worldwide;
- Achieves more effective and complete combustion that the forward-acting stoker;
- Maintains performance even with waste containing high moisture and low calorific value;
- Sequential drying, combustion and post-combustion stages;
- Burning waste is constantly stirred and rotated. Heated waste is pushed upwards underneath waste that has just been fed in so it is ignited quickly and efficiently;
- Automatic combustion controls to maintain high temperature;
- Long service life – delivery records show Taiwan plant operational since 1994;
- Strict emissions control; and
- No waste water treatment required due to dry filtering system.

**Martin Reverse Acting Grate SITY 2000 (S-type):**

- Implemented in almost 40 plants, mainly in Asia;
- Best suited to waste with relatively high moisture content and low heating value; and
- Can be designed to treat biomass and sewage.

**Martin Reverse Acting Grate Vario (V-type):**

- Can be adjusted to varying requirements of fuels by changing speed of waste feed and combustion conditions;
- Not necessary to cool the Vario with high heating values as a constant covering on the grate is maintained protecting the equipment from excessive thermal loads;
- Modular construction – can install additional consecutive grates up to maximum of 20m; and
- New technology with fewer than five operational facilities worldwide.

### 11.4.3 Phoenix Energy

Recently, Phoenix Energy (Phoenix) secured WA EPA approval for developing an EfW facility in the Kwinana Industrial Area, south of Perth. Phoenix is a project development company that partners with established companies to deliver its projects. The Kwinana Waste to Energy Project will utilise Martin's R-type technology which is licensed through Mitsubishi Heavy Industries Environmental & Chemical Engineering (MHIEC), Martin GmbH's exclusive partner for large parts of the Asia-Pacific region. Other partners involved in the Kwinana project include John Holland and Covanta Energy Corporation.

In selecting the Mitsubishi-Martin Reverse Acting Stoker and Furnace (R-type) technology, Phoenix has sought to ensure that the technology it deploys has been tried and tested. The following factors were considered to be the main advantages of the R-type technology:

- Martin grate technology has been in commercial operation since 1959;
- Of the approximately 1,000 incinerator facilities operating worldwide, Martin GmbH has the largest market share, with its moving grate (stoker) furnace technology;
- Facilities operating in 33 countries, serving over 100 councils;
- Of the 4 grate models offered by Martin GmbH, the R-type grate has the largest installation base;
- The stoker grate technology has been demonstrated to be the most flexible of all of the available options for management of a change of composition of the feedstock;
- The Martin grate stoker technology is inherently robust and flexible in efficiently recovering the embodied energy in the feedstock, even as the feedstock composition varies season to season and over time; and
- Excellent environmental performance adhering to European Union's (EU) Waste Incineration Directive.

The processing capacity of the Kwinana WtE Facility is proposed as follows:

- Initial - 300,000t/yr;
- Aim - 200-300,000t of MSW annually;
- Up to 400,000t/yr of residual (post recycling) MSW;
- Up to 100,000T of C&I; and
- Generating an estimated 32MW of base load electricity to the grid.

The only confirmed source of MSW at the moment is from the City of Kwinana which has agreed to enter into a 20-year Waste Supply Agreement for the supply of all its residential MSW at a gate fee of $115/t. In 2014/15, Kwinana City generated approximately 13,000t of MSW. Phoenix is also the preferred tenderer for the Rivers Regional Council's tender for the 'Receipt and Processing of Waste for Resource Recovery'. The seven Rivers Councils generated just over 108,000t of waste in 2012/13[12].

The Kwinana WtE Facility is promising zero waste to landfill by reusing the ash produced in the combustion process to make by-products such as bricks and pavers.

Phoenix proposes to use the Brixx Technology developed by USA-based Pittsburgh Mineral & Environmental Technology (PMET). The Brixx process produces building products by combining lime with fly and bottom ash from coal combustion by-products. A 2005 trial demonstrated the technology by combining lime with fly and bottom ash from coal combustion by-products to produce building products. The trial did not involve fly or bottom ash from waste incinerators.

Online research has not revealed any instances of the Brixx technology being used commercially, while PMET has not responded to MRA's inquiries.

[12] RRC website, 2015. Waste education facts and figures www.rrc.wa.gov.au/Waste-Education/Facts-and-Figures

### 11.4.4 Martin Biopower

Martin is also offering a modified version of the tried and proven R- type grate called the Vario grate. The modifications allow the speed of the separate zones of the standard grate to be controlled independently. To market this technology, Martin has formed Martin Biopower, a joint venture with professionals in Australia, which has the right to market the MARTIN reverse-acting grate Vario (V-type) in Australia and New Zealand on an exclusive basis and is offering Original Equipment Manufacturer (OEM) and Engineering Procurement Construction (EPC) services to potential partners with the capability to operate an EfW facility in addition to answering tenders issued by the private or public sector.

### 11.4.5 Entech

ENTECH-Renewable Energy Solutions (Entech) has developed a low temperature gasification technology (WtGas) that converts solid waste to a gaseous form called syngas (a methane like gas). Syngas can subsequently be combusted to generate energy. Entech's business model involves forming joint ventures (in Build-Own-Operate investment) with companies that have a substantive presence in local regions and who have a firm strategy in place to invest in waste utilisation, renewable energy or carbon trading.

### 11.4.6 Entech project examples

Entech projects outside of Australia have served smaller, private clients, such as hospitals, airports and universities. The Genting Group have employed the use of an Entech WtGAS pyrolytic gasification system to manage municipal solid waste generated by the Genting Highlands Complex, a tourist attraction in Malaysia. The facility has the capacity to process 60t/day of waste (equivalent to 21,900t/yr), with a thermal capacity of 7.2MWt.

A recent project in Poland was designed to manage medical and bio-hazardous waste from the Gorzow Medical Institute. The facility uses the Entech WtGAS renewable energy system and processed 15t/day of waste (equivalent to 5,475t/yr), with a thermal capacity of 0.3MWt. The heat generated from this process is used to provide heat to the hospital.

### 11.4.7 New Energy in WA

New Energy Corporation (New Energy) has partnered with Entech to supply low temperature gasification technology to two EfW facilities in WA. Compared to previous Entech projects, the Australian facilities will have much larger capacity and power outputs.

The Boodarie Industrial Estate facility in Port Hedland has already been approved and development is underway. This facility will use Entech gasification technology with the capacity to process 70,000 to 130,000 tonnes of waste per annum. It is estimated that the plant will have a capacity to produce up to 18MW of power per annum, providing electricity for 21,000 households in the Pilbara region. The project will also assist with the closure of the South Hedland landfill as the majority of waste produced by the Port Hedland and Karratha regions will be able to be processed at the facility.

New Energy is also seeking approval for an EfW facility to be located at 26 Office Road, East Rockingham. If approved, the facility will process up to 225,000 tonnes per annum of Class 1, 2 & 3 MSW for energy recovery and is scheduled to be commissioned in December 2017. The facility is close to transport, 2.5km from residential areas and is close to a planned wastewater treatment facility.

### 11.4.8 EfW gate fee pricing

EfW is mainly implemented in four regions in the world (ISWA, 2013):

1. Europe- mainly Germany, Scandinavian Countries (Norway, Sweden, Denmark), France, Netherlands, Italy, United Kingdom (around 500 installations);
2. United States (around 75 installations);
3. Japan (more than 1,000 installations); and
4. China and South Korea (around 120 installations, growing fast).

The boundary conditions for EfW are quite different in these regions, therefore, what is successful and feasible in one region may not be feasible in another region. Gate fees are also dependent upon local conditions including environmental regulations and local legislation.

The City of Kwinana has agreed with the Kwinana WtE Facility to a highly competitive gate of $115 per incoming tonne, a significant discount on both landfill and the RRRC. No comparable EfW facilities exist in Australia to compare this gate fee against. However, a 2001 report to Directorate General Environment of the European Commission has reviewed EfW costs in European Union countries that operate incineration facilities (Eunomia, 2001).

The costs presented in Table 11-17 are converted 2001 Euros and as a result of inflation, they would probably be higher. Conversely, as the technology develops and becomes more available leading to higher competition, costs might reduce. Moreover, the figures provided by Eunomia refer to pre-tax costs excluding profit and therefore they can be quite different than facility gate fees. Therefore, the figures below can only server as guidance. Nevertheless, a pattern emerges indicating that smaller facilities are costlier to operate than larger ones.

**Table 11-17 Comparative 2015 costs (2001 EUR - AUD) of incineration in EU members[13]**

| | Pre-tax costs net of revenues ($/t) | Waste throughput (ktpa) | Bottom ash ($/tonne ash) | Fly ash ($/tonne ash) |
|---|---|---|---|---|
| **Austria** | $472 | 60 | $91 | $526 |
| | $230 | 150 | | |
| | $140 | 300 | | |
| **Belgium** | $103 | 150 | | |
| | $109 | | | |
| **Denmark** | $43 | | $49 | $194 |
| | $65 | | | |
| **France** | $171 | 18.7 | $125 | |
| | $187 | | | |
| | $125 | 37.5 | | |

[13] modified from Table 14: Eunomia, 2001

| | Pre-tax costs net of revenues ($/t) | Waste throughput (ktpa) | Bottom ash ($/tonne ash) | Fly ash ($/tonne ash) |
|---|---|---|---|---|
| | $132 | | | |
| | $146 | | | |
| | $116 | 75 | | |
| | $130 | | | |
| | $97 | 150 | | |
| | $116 | | | |
| **Germany** | $362 | 50 | $41 | $370 |
| | $152 | 200 | | |
| | $94 | 600 | | |
| **Ireland** | $67 | 200 | | |
| **Italy** | $60 | 350 | $109 | $187 |
| | $135 | | | |
| **Luxemburg** | $140 | 120 | $129 | $232 |
| **Netherlands** | $103 | | | |
| | $159 | (The Netherlands figures are gate fees, not costs) | | |
| | $101 | | | |
| | $194 | | | |
| **Poland** | $67 | | | |
| | $110 | | | |
| **Spain** | $49 | | | |
| | $81 | | | |
| **Sweden** | $30 | | | |
| | $77 | | | |
| **United Kingdom** | $100 | 100 | $130 | Recycled (net cost to operator) |
| | $68 | 200 | | |

A 2014 report on UK waste facility gate fees also contradicts the ISWA data as it identifies costs in the UK of up to $221/t, significantly higher than the maximum $145/t identified for Europe by ISWA. Past WRAP reports have recorded even higher EfW gate fees in the UK with the 2012 report showing a maximum gate fee of $258/t for facilities under 200,000t.

**Table 11-18 EfW gate fees (2014 GBP - AUD) in the UK (adapted from WRAP, 2014)**

| Facility age | Median ($/t) | Minimum ($/t) | Maximum ($/t) | Sample |
|---|---|---|---|---|
| **All** | $132 | $69 | $221 | 31 |
| **Pre-year 2000** | $116 | $69 | $197 | 22 |
| **Post-2000** | $185 | $122 | $221 | 9 |

The overall pattern that emerges from these reports is that newer facilities have higher gate fees than older ones. Similarly, small facilities have higher gate fees than larger ones which presumably achieve economies of scale. Given the wide range of gate fees charged around the world and the unknown factors that determine them (including government subsidies), it is difficult to estimate an independent, reliable gate fee. There are a large number of uncertainties.

To arrive at a gate fee price, the costs for ash management, insurance and licensing, operating cost, depreciation, emission control, electricity generation, amongst other things need to be qualified within the Australian/WA regulatory environment.

Tenders are the only reliable method of determining a gate fee and only if that gate fee can be relied upon.

While many councils draft legal contracts in an attempt to fix the price and limit council's exposure to unexpected cost increased and gate fee rises, the experience to date in Australia is that when faced with facility closure councils generally pay any premiums required to maintain services.

In other words, it is very difficult to insulate council from technology and commercial risk. Councils should be acutely aware that legal contracts may not bind operators to fixed prices. The next section outlines some of the known commercial risks.

### 11.4.9 Gate fee uncertainties

#### 11.4.9.1 Waste throughput

The proposed throughput of one EfW plant is 400,000t pa. However, the operator has only secured about 120,000t at present. In the unlikely event of not securing further tonnes, the costs for capital amortisation alone would rise to almost $160/t. Even at a throughput of 300,000 capital amortisation costs could be over $60/t.

#### 11.4.9.2 Ash management

Reuse of ash is widespread worldwide including in Europe and the USA. The EfW facility is proposing to do the same and therefore achieve cost neutral ash management or even generate some income through the sale of bricks and pavers.

However, currently in WA there is no legislation governing ash management and no regulatory pathway exists for re-use. The default management approach would be disposal to landfill and then proving up beneficial re-use. The operator will be required to prepare and implement an Ash Reuse Management Plan which will ensure that by-products meet all the necessary environmental criteria and are fit for use on an on-going basis.

This situation leaves EfW facilities in WA exposed to two risks. First that they have to be able to prove, that their ash-based products (such as bricks and pavers) consistently meet the environmental criteria through leach tests to confirm that the material is non-hazardous and would not be classed as a controlled waste in WA. More tests would need to be devised depending on the end-use material standards as defined in a Material Guideline to be developed in consultation with the DER, participating councils and the construction industry.

If the ash-based products fail these tests, alternative management methods will be required. Landfill will be the fall-back option in which case the products would need to undergo a TCLP (Toxicity characteristic leaching procedure) to determine if they should be characterised as hazardous waste. The cost of disposal at Millar Road landfill is $114.22 (including the levy). At a generation rate of 230-280kg of bottom and fly ash per tonne of incinerated material (ISWA, 2006), it would cost between $10.5 and $12.8/t to landfill.

This cost may be much higher if the products fail the TCLP and therefore require landfilling in a hazardous landfill. To cover the extra costs, the EfW facility would need to raise gate fees by $26-$32/t.

Another possible reason for ash products being sent to landfill would be the introduction of regulations or controls under environmental protection legislation in WA that categorises incinerator ash (either all or just fly ash) as either not safe for use or as hazardous waste. If such were introduced it would effectively mandate the landfill disposal of ash and therefore increase the facility's operating costs. In such a case however, the facility operator would most likely be able to raise its gate fees and pass on the additional costs to its clients as it would trigger the "change in law" clause (included in most contracts). In other words, actions by the Department of Environment could drive up gate fees under legitimate change in law provisions (though contrary to the spirit of the contract). There is not enough information in the public arena for MRA to quantify or validate this risk.

# 12 Governance

## 12.1 Existing business models and contracts

While SMRC fully owns and operates the RRRC, which processes most of the Member's waste and recyclables, the collection and transportation of waste is commonly contracted out by both SMRC and individual member Councils.

The Cities of Melville, Cockburn and Fremantle have opted for a business model under which they collect and transport their waste to RRRC via a council operated truck fleet, while the City of Kwinana and the Town of East Fremantle both outsource collections under contract (Table 12-1). All current contracts have already expired or are set to expire within the next few years. Procedures for renewal are underway. Collection contracts can be readily modified should the destination of waste change in the future. This is expected with Kwinana's waste which will be diverted to the Phoenix facility when it becomes operational.

**Table 12-1 Individual council's waste collection contracts**

| Contract area | Council involved | SMRC facility involved | Service provider | Term |
|---|---|---|---|---|
| **Waste collection - all streams** | City of Melville | RRRC | in-house | |
| **Waste collection - all streams** | City of Cockburn | RRRC | in-house | |
| **Waste collection - MSW** | City of Fremantle | RRRC | in-house | |
| **Waste collection - Recycling** | City of Fremantle | RRRC | Perth Waste | |
| **Bulk verge and Green waste** | City of Fremantle | RRRC | Western Maze | |
| **Waste collection - Recycling, MSW and parks & litter** | Town of East Fremantle | RRRC | Cleanaway | Sep 2015 plus 2 years |
| **Bulk Verge** | Town of East Fremantle | - | Steann | Expired |
| **Waste collection - Recycling and MSW** | City of Kwinana | - | Perth Waste | 2 October 2015 |
| **Bulk Verge** | City of Kwinana | - | Recycling WA | 2017 |

Contracts for the processing, recovery and disposal of waste are different in that they are inextricably linked to a waste facility. Although SMRC processes its own waste, it relies on external parties for transportation, disposal and final recovery of its outputs. All of these contracts are either being extended on an annual basis at the discretion of SMRC or are expiring in the near future (Table 12-2). Given that SMRC is exploring significant changes to its business model, it should strive to expand the flexibility that accompanies its current contracts. This could be achieved by either entering into short-term contracts that can be unilaterally extended or, in longer-term contracts, via building in clauses that allow the SMRC to unilaterally withdraw under specific circumstances (such as ceasing of RRRC operations). The downside of such contracts is that they will be viewed as high risk by service providers and therefore will likely attract additional costs for SMRC (either through higher gate fees or a monetary penalty in the event that SMRC exercises its opt-out option).

As three councils currently collect through in house labour SMRC should consider acting as a regional body for contract procurement to coordinate collection contracts and ensure economies of scale in future waste contracting.

**Table 12-2 SMRC contracts for the management of MSW and recyclables**

| Contract area | SMRC facility involved | Other party | Term | Notes |
|---|---|---|---|---|
| **Landfill of MSWs** | WCF and MRF | City of Rockingham (CoR) | 16 July 2014 to 15 July 2017 (annual extensions with CPI adjustment at SMRC discretion) | |
| **Transport of MSWs** | WCF and MRF | Perth Bin Hire | 30 June 2014 to 29 June 2017 (annual extensions with CPI adjustment at SMRC discretion) | To CoR Baldivis landfill |
| **Compost removal** | WCF | Nutrarich | Expired Jan 2015 | New 5 + 1 + 1 = 7 year contract under negotiation |
| **Compost screenings removal** | WCF | Nutrarich | July 2015 | Final 12 month extension may be granted to July 2016 |
| **Glass removal and recovery** | MRF | Perth Bin Hire | December 2016 | 2 x1 year extensions to 2018 |

## 12.2 Governance options

The SMRC is a statutory local government authority aiming to deliver innovative and sustainable waste management solutions for the benefit of the community and the environment.

As a regional local government under the WA Local Government Act 1995, SMRC has all the general, legislative and executive functions provided for under the Act. A key executive function is the provision of services and facilities. However, as a regional local government, SMRC can only do things for the regional purpose specified under its Establishment Agreement. Therefore, the application of the Local Government Act 1995 or any other applicable Act is limited accordingly.

SMRC's role, regional purpose and objectives governing its functions are detailed in its Establishment Agreement and outlined in Table 12-3.

**Table 12-3 SMRC functions as per its Establishment Agreement**

| Role |
|---|
| SMRC has an operational role in the planning and coordination of the removal, processing, treatment and disposal of waste for the benefit of communities within its regional boundaries. |
| **Regional purpose** |
| Plan, coordinate and implement the removal, processing, treatment and disposal of waste for the benefit of the communities of the member councils. |
| Influence Local, State and Federal Governments in the development of regional waste management policies and legislation. |
| Prepare, facilitate and implement programmes, measures and strategies for the reduction of greenhouse gases. |
| **Objectives** |
| Without loss being incurred by the Regional Local Government to carry out the Regional Purposes so that services and facilities are provided to the consumer at a reasonable cost and with due regard for community needs. |
| Reduce the quantity of waste disposed of at landfill sites in accordance with targets set by the Regional Local Government. |

SMRC's setup and powers allow for program, infrastructure and ownership functions to be carried out. The authority can:

- Enter into contracts;
- Acquire, hold, dispose of property;
- Sue and be sued in its corporate name; and
- Has perpetual succession and a common seal.

In addition to the above functions, SMRC is also responsible for waste management operations, including the day to day running of the RRRC, weighbridge, transfer station, in-vessel composting facility MRF and green waste processing facility.

### 12.2.1 Best practice governance for regional authorities

The Victorian Waste Sector Ministerial Advisory Committee Report (MAC) on Waste Governance 2013 sets out a Best Practice approach for the management and governance arrangements of regional waste management groups.

The MAC report finds that the seven major roles (or best practice functions) of regional waste coordination bodies are:

1. Policy development and oversight;
2. Administration and expenditure of levy funds;
3. Planning for infrastructure and services;

4. Procurement of waste infrastructure and services;
5. Market development;
6. Education; and
7. Reporting, data and accountability.

As evident in Table 12-3, the SMRC has committed to meeting the overall scope of these roles upon its inception. SMRC's Annual Reports detail how these goals have been met so far and outline the strategies for continuing to do so.

In an attempt to identify cost saving opportunities, the following sections review the current SMRC governance situation and a number of possible alternative models. The review identifies potential change in governance and management issues only since all the current operations and functions of the SMRC will remain due to the fact that they are fundamental requirements for efficient waste management in the region and part of the SMRC's Establishment Agreement 2000. Therefore, what can potentially be modified is the allocation of these functions to different entities.

Consequently, management overhead is the only area where cost savings could potentially occur as a change in governance arrangements. SMRC's current operational budget would not be affected by any such changes. More detailed financial and workforce implications, preliminary cost/benefit and risk management analysis should be further investigated if SMRC decides to modify its governance model.

### 12.2.2 Self standing SMRC (BAU)

As shown in the diagram below, SMRC currently fully owns, manages and operates all of the RRRC assets while it is also responsible for all policy and planning matters.

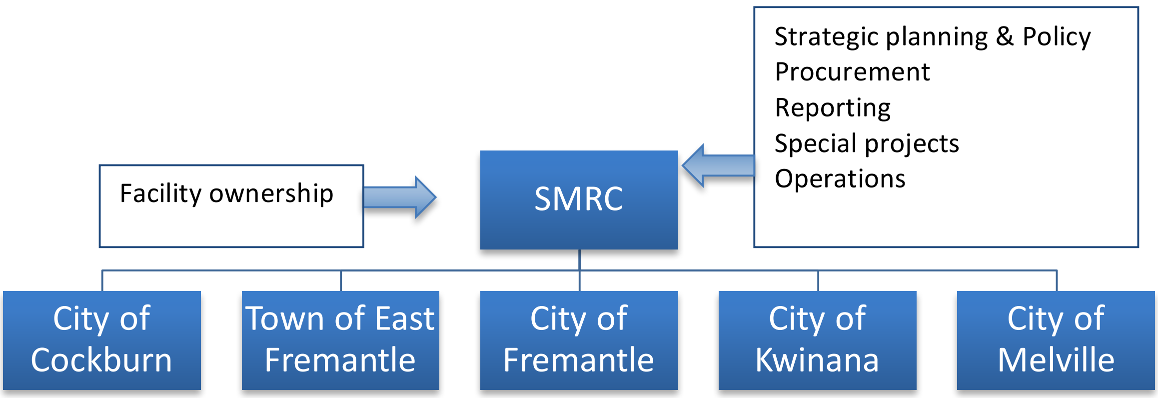


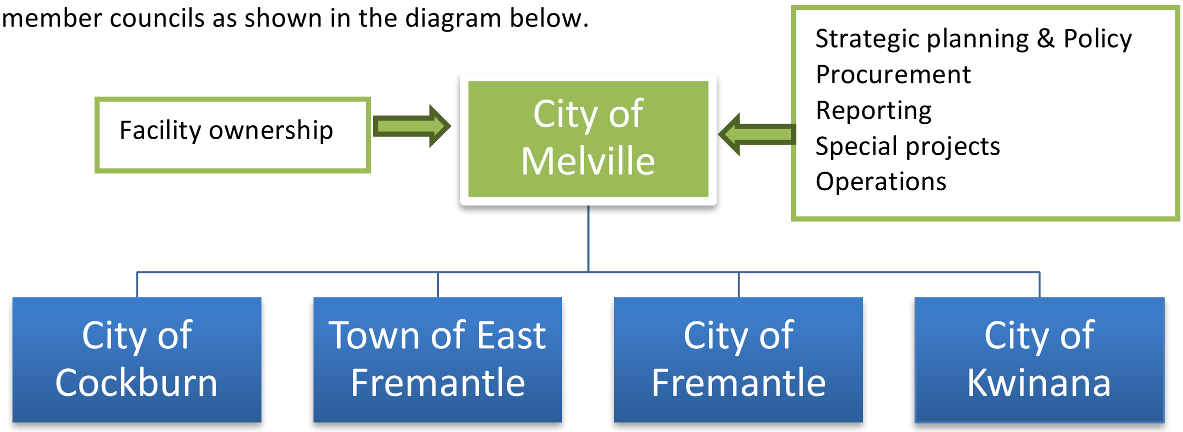

Table 12-4 presents the actual 2013/14 annual expenses for the self standing SMRC. Current and non-current liabilities amount to $12.4 and $23.2 million respectively, the majority of which is a result of long-term borrowing.

**Table 12-4 Annual expenses in the self standing SMRC model (2013/14 actual expenses)**

| Expense | BAU $ | Notes |
|---|---|---|
| Employee Costs | $7,034,639 | Staff: 54 operational, 21 administrative |
| Materials and Contracts | $11,368,554 | |
| Utility Charges | $2,673,703 | |
| Depreciation on Non-current Assets | $5,799,197 | |
| Interest Expenses | $1,756,189 | |
| Insurance Expenses | $2,018,822 | |
| Rent | Included | RRRC site on long term lease (50 years), own offices. |
| Total for 2013/14 | $30,651,104 | |

### 12.2.3 SMRC replaced by a single council owner

One of the simplest governance structures to potentially manage the region's waste would be the dismantling of the SMRC and the transfer of all its assets, liabilities, roles and responsibilities to one of the member councils as shown in the diagram below.




Although any council can potentially take on this role, for the purposes of this report it was assumed that the City of Melville could become the facility owner. The City of Melville would effectively become a waste service provider for the region, taking on all benefits, risks, assets and liabilities associated with the SMRC business while the remaining councils would become clients.

However, for this transition to happen, a number of complex contractual and practical issues would need to be resolved. Initially, the SMRC Establishment Agreement would need to be amended. Councils would also need to decide who would be the one taking over along with the role of the other councils, in particular how they would be represented under this scenario. Key issues that would have to be resolved include:

- Financial arrangements for the transfer of assets;

- Lack of knowledge and skill in the management of a complex industrial facility;
- Transfer of Environment Protection Licence to a new owner;
- Dismantling of the SMRC;
- Potential reluctance of councils to become the owner and liable entity;
- Reluctance of councils to give up and seemingly lose control of their strategic and policy roles; and
- The overall difficulties in reaching necessary decisions (possibly due to conflicting interests).

In addition to these complex practical arrangements, the ultimate benefits of such a decision are uncertain. As evident in Table 12-5, the expected cost savings are only marginal. The RRRC operational expenses, along with annual, total liabilities, assets, other expenses and the capital expenditure budget remain the same irrespective of the governance structure. Some overhead costs could potentially be reduced if the council owner brings some secretarial and managerial activities in house and utilise council employees. However, given that most SMRC related work would be additional to normal council operations and that RRRC-specific expertise would be necessary, it is unlikely that more than 25% of the 21 current administrative jobs could be cut. Therefore, the overall annual cost savings by such a move is unlikely to exceed $500,000, which results in a marginal 1.6% overall saving in operating costs.

**Table 12-5 Annual expenses in the self standing SMRC model (2013/14 actual expenses)**

| Expense | BAU $ | Council owner $ | Notes |
|---|---|---|---|
| Employee Costs | $7,034,639 | $6,542,214 | Maximum savings of 25% of administrative employee costs |
| Materials and Contracts | $11,368,554 | $11,368,554 | |
| Utility Charges | $2,673,703 | $2,673,703 | |
| Depreciation on Non-current Assets | $5,799,197 | $5,799,197 | |
| Interest Expenses | $1,756,189 | $1,756,189 | |
| Insurance Expenses | $2,018,822 | $2,018,822 | |
| Rent | Included | Included | Possible revenue if head office leased out |
| Total for 2013/14 | $30,651,104 | $30,158,679 | |

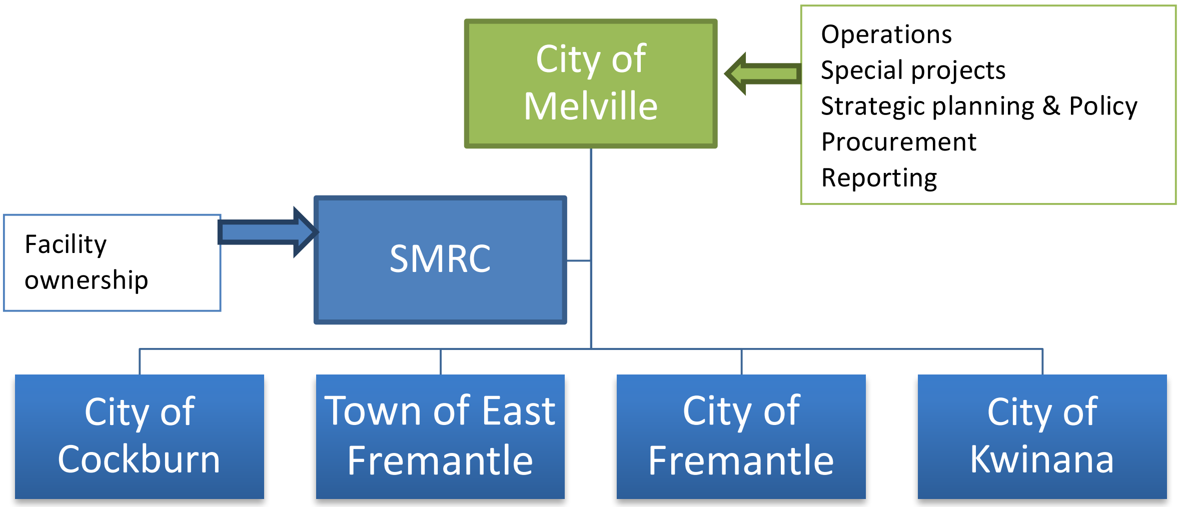
The only other potential cost saving opportunity would be through savings in head office expenses should the owner council decided to house SMRC staff in its offices. This presupposed that there is sufficient space available and that SMRC's current Head Office can be sold to pay-off the outstanding debt.

At the same time, the costs for actually implementing the change are expected to be considerable, while the political and practical viability of such a setup is dubious at best.

### 12.2.4 Single council to assume all functions, SMRC to retain ownership

Appointing one of the councils as the main manager of the RRRC and all SMRC activities as shown below, could result to the staff related savings identified in Table 12-5 without the need to transfer asset ownership. SMRC would retain ownership of all facilities while one council, for example the City of Melville which is the biggest waste generator, would undertake all functions, including operations and policy.

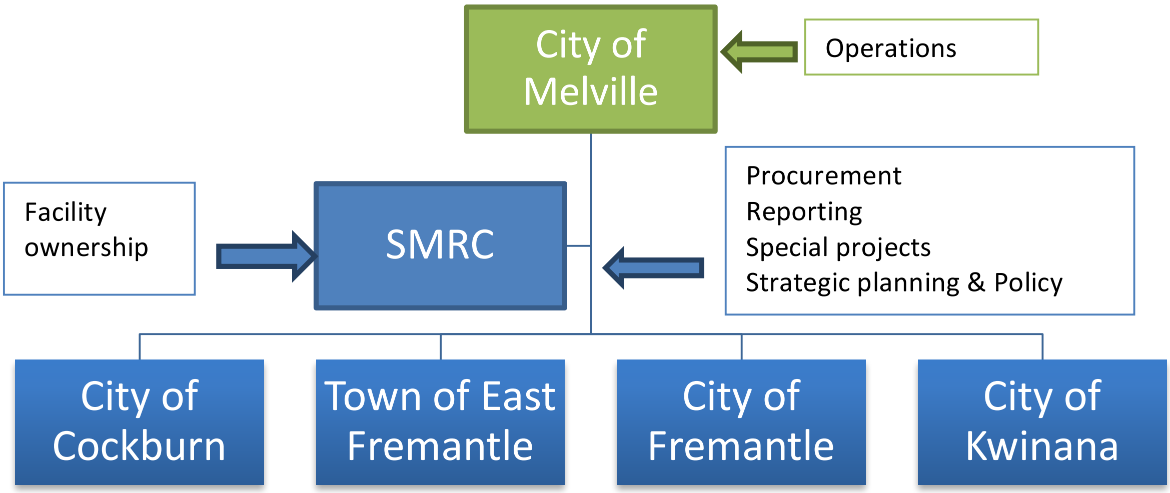
However, all issues related to council roles and loss of waste management strategy and policy control by the four non-managing councils, remain as per the previous section.




### 12.2.5 Single council to assume operations, SMRC to retain ownership and other functions

Under a similar option, the managing council (for example the City of Melville) might only take up the operating aspect of the facility as shown below. SMRC would maintain all other functions and therefore all councils would have a say in policy development, procurement and generally all the usual functions of a regional waste coordination body. Although this would address the representation issues identified previously and City of Kwinana's status would remain unaffected, staff related cost savings would not be achieved.

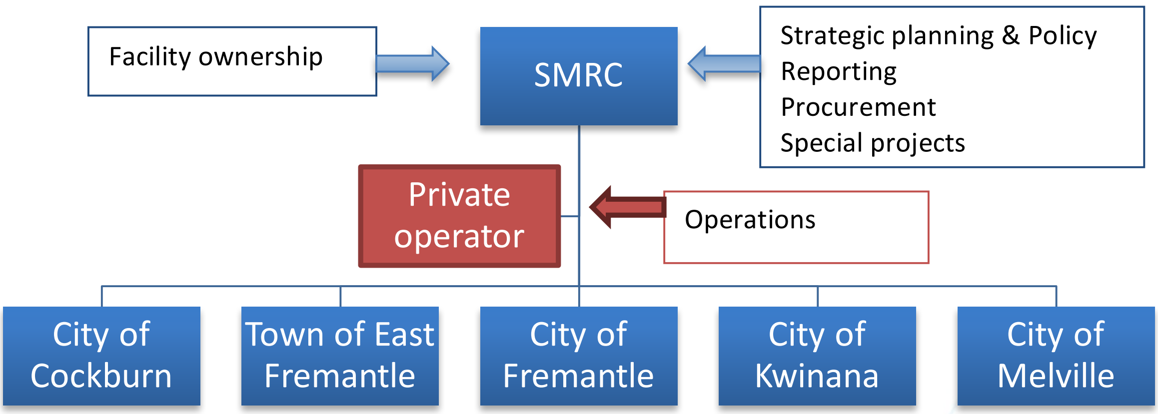
The operational aspect of SMRC has inflexible staffing requirement, while there are very limited potential synergies between the workload of SMRC operating staff and existing managing council staff, Moreover, SMRC operations positions rely on a full time workload. Therefore, the managing council would have to retain all operations staff. The workload overlap identified in section 12.2.3 only applies to office staff, however since SMRC will retain all non-operations functions, there can be no staff reductions. Therefore, under this governance approach, expenses are likely to remain as under the current arrangement (refer to Table 12-4).




### 12.2.6 Private operator

#### 12.2.6.1 Tender out SMRC operations

Under this model, SMRC would maintain the non-operational part of the RRRC while one or more private operators would be responsible for the operation of all the RRRC assets. SMRC is already preparing to follow this mode of operation with its MRF. If that proves successful, the arrangement could be applied to all RRRC assets, including the weighbridge and the in-vessel composting operation. Under these arrangements, SMRC would remain responsible for all other functions as shown in the diagram below.




Such a model of governance would align more closely with the usual waste management arrangement employed around Australia, however the ultimate cost saving of the approach are uncertain at this stage. SMRC would retain its current administrative and managerial staff. The current operations staff would either continue being employed by the operator or would become redundant. The operator would most likely be contracted on a simple gate fee per incoming tonne arrangement and therefore no inferences in regard to cost savings can be made at this point.

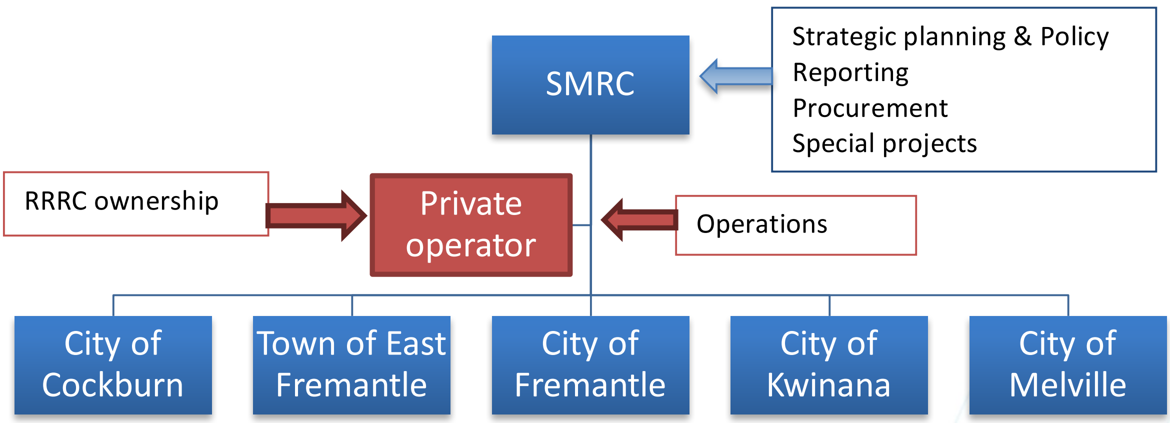
A key uncertainty in that respect is the capabilities of the selected operator in running the in-vessel composting facility. While there are many MRF facilities in Australia and therefore there are a number of operators with experience in running them, there are only two Bedminster AWTs and both are run by SUEZ environment (ex. SITA Australia). This means that SUEZ is the only experienced operator in Australia that might tender for the taking on the composting operation and as such, their pricing offer might not be competitive with current costs. It is however likely that other local or international operators will also bid for the operations component in which case the SMRC might have to choose between Australian but inexperienced operators, international Bedminster operators with no local experience and SUEZ.

Given SMRC's long-term success in running the Bedminster drums, transitioning to a private operator could be a risky move. Whether that would be a worthwhile risk depends entirely on the fee on offer. Unfortunately, the only way to determine what potential operators are prepared to offer is to test the market through a tendering process.

Finally, under such an arrangement councils should expect to have to contractually commit to providing significant quantities of waste to the operator on an annual basis to at least 2023, when the Bedminster facility is scheduled for retirement. This binding commitment would impact on the current ability of the SMRC and its Members to transition to new waste management methods.

#### 12.2.6.2 Tender out SMRC operations and sell assets

A variation to the above arrangement would be to sell all SMRC assets as shown below. A private operator would own and operate the RRRC. Again, under this arrangement councils would need to commit to supply waste in the long term while the operator could also investigate attracting more waste if there is excess capacity.



### 12.2.7 Governance models summary

The following table (Table 12-6) summarises the strengths and weaknesses of each of the alternative governance models in comparison to the current self standing SMRC model (BAU).

**Table 12-6 Strengths and weaknesses of alternative governance models against BAU**

| Governance model | Strengths | Weaknesses |
|---|---|---|
| SMRC replaced by a single council owner. | Savings of up to 1.6% in operating expenses.<br>Potential savings in head office expenses. | Cost to implement changes.<br>Overall savings uncertain.<br>Tight timeframe likely insufficient for savings to be realised. |
| Single council to assume all functions, SMRC to retain ownership. | Savings of up to 1.6% in operating expenses<br>Potential savings in head office expenses. | Cost to implement changes.<br>Overall savings uncertain.<br>Tight timeframe likely insufficient for savings to be realised.<br>Loss of role for member councils.<br>Member councils have no say in strategy and policy development. |
| Single council to assume operations, SMRC to retain ownership and other functions. | None. | Cost to implement changes.<br>No cost savings. |
| Private operator. | If savings are confirmed via a market test, they will be immediate.<br>Tendering out operations can benefit from MRF tender experience. | Only one experienced commercial Bedminster operator in Australia.<br>SMRC is an experienced and tested operator. Risk in bringing in a commercial operator not familiar with the facility.<br>Councils will need to commit tonnes to the RRRC until 2023.<br>MRF and WCF (MSW or FOGO) could be tendered under SMRC control. |

### 12.2.8 Governance recommendation

For any changes in governance to be worthwhile, it is important to ensure that the long term operating savings will outweigh the expected transaction costs. Moreover, timeframe is a key parameter as councils' commitment to the WCF runs out in 2023 and therefore any savings would need to be realised relatively soon to make the transition process worthwhile.

Transitioning to an arrangement where one of the member councils becomes the owner or managing party is a complicated and potentially costly endeavour with minimal or at best uncertain, cost saving prospects.

Given that the commitment to the WCF runs out in 2023, 7 years is not enough to justify such a wholesale restructure for unclear benefit. The transition itself will incur transaction costs that are expected to outweigh the limited cost savings that could arise through the managing council's consolidation of some overheads with those of the SMRC. The procedural and financial issues associated with the transition of councils from a partnership type relationship to that of a business and clients one, make this proposition even less appealing.

Having a commercial operator take over the operations aspect of the SMRC could provide an acceptable alternative governance model and lead to immediate short-term benefits. However, the issues associated with the fact that there is only one operator in Australia that has experience in managing rotating drum composting make it a risky proposition. Given the SMRC's long and successful experience the current modus operandi appears to be the safest option. Nevertheless, if councils are prepared to commit waste input tonnes and bear the cost of going out to tender, MRA also recommends that SMRC tests the market for an operator for both the MRF and the WCF. Using its recent MRF tendering experience, SMRC can prepare specifications for a private operator to run the WCF until they are scheduled to close in 2023. If the bids received are not financially attractive, SMRC should retain its current governance arrangements until it ceases operating.

Finally, if the recommendations of the report are accepted then, the tender of the WCF would be focused on 32,000tpa of FOGO processing (not 73,000tpa of MSW). There are many commercial compost operators and the provision of a composting site (10,000m$^2$ shed) or a transfer station (3,000m$^2$ shed) at commercial rent would be attractive to the market.

MRA recommends SMRC also invite off site composting options in accordance with the earlier options analysis.

Legacy, contractual and overhead costs will need to be fully accounted for in this process. Consequently, MRA also recommends a full cost accounting study of existing overheads, splitting expenditure into:

- SMRC coordination function costs (in its role as regional coordinator doing Policy, Planning and Procurement etc.);
- Operating overheads for SMRC, WCF, GWF, MRF and weighbridge (including management allocation); and
- Other direct overhead costs.

The operational overheads should be reduced with the tendering and outsourcing to private sector operators. This will require a robust and considered approach.

# 13 Actions list

Below is a summary of the recommended actions (developed through stakeholder consultation and development of the Plan) for consideration by SMRC (Table 13-1).

**Table 13-1 Summary of actions**

| Collection Actions |
|---|
| 1. Conduct a 3 bin FOGO trial through the RRRC drums (the WCF) – retain or mothball the drums dependent on the outcome. |
| 2. Implement a 3 bin FOGO collection and composting system. |
| 3. Seek urgent clarification on government policy 3 bin v 2 bin EfW – Waste Authority v Premier. |
| 4. Conduct a weekly to fortnightly recycling bin fullness study. |
| 5. Consider reverting to a fortnightly recycling collection service across all councils. |
| Processing Actions |
| 6. Go to tender for FOGO processing and/or provision of composting technology. |
| 7. Optimise the use and revenue obtained from the RRRC by either leasing or converting vacant sheds into an alternative use (e.g. FOGO processing if implemented). |
| 8. Analyse the existing "operational management overheads" based on the existing 73,000tpa MSW to the WCF compared to 32,000tpa of FOGO through the RRRC drums (WCF). Identify options to eliminate or mitigate these overheads. |
| 9. Consider EfW for the MSW bin and processing residuals only if, a proven EfW technology (which can be internationally proven) satisfies the following criteria:<br>o It is operational at the same scale required;<br>o On the same waste stream; and<br>o Has 3 years of profitable operation. |
| **Facility Actions** |
| 10. Tender MRF |
| 11. Trial RRRC drums for FOGO |
| 12. Tender WCF site for FOGO (with GW option) |
| 13. Review Green Waste processing (if >50,000 then roll the green waste into FOGO processing and retain commercial gate fees |
| 14. Retain the operation and ownership of the weighbridge |
| 15. Lease the vacant sheds as appropriate |
| **Regionalisation Actions** |
| 16. Consider working with Rivers Regional Council (RRC) to develop a regional 'hub' for green waste processing at the GWF. |

| | |
|---|---|
| 17. Submit a tender for MRF processing of RRC, City of Canning, WMRC, MRC and EMRC's comingled recycling (when services are tendered). | |
| 18. Consider input into/partnering with RRC to develop the feasibility study for four regional processing 'hubs' for mattresses, HHW, batteries, C&D materials, whitegoods, e-waste, tyres, cars, asbestos and motor oil. | |
| 19. Work with City of Canning and RRC to develop four regional hubs for household hazardous waste, batteries, motor oil, e-waste and building and construction permanent drop off sites (if the feasibility study demonstrates that the model is viable). | |
| 20. Further discussions with RRC to set up a shared office/administrative support agreement. | |
| 21. Further discussions with RRC for partnering and use of educational resources such as the Recycle Right brand. | |
| 22. Consider tendering for FOGO processing should RRC (or any local government) move to 3 bin collection of organics (if SMRC becomes a FOGO processor). | |
| 23. Work with City of Canning to develop a regional green waste processing site for member councils' green waste either at the current GWF or at Ranford Road Transfer Station. | |
| 24. Work with EMRC, RRC and City of Canning to establish Hazelmere as a regional collection point for separated wood waste from verge side collections for processing in the Pyrolysis plant (when operational). | |
| 25. Work with EMRC to develop a protocol for any future EfW contracts in order to minimise risk. | |
| 26. Work with MRC to establish a regional mattress recycling and asbestos disposal point at Balcatta Recycling Centre. | |
| 27. Continue inter-council cooperation through meetings of the Regional Executive Group. | |
| **Education/Engagement Actions** | |
| 28. Develop a comprehensive resident behaviour change program for 3 bin FOGO through development of Recycle Right or similar model. | |
| 29. Continue Recycle Right or similar model campaign. | |
| 30. Continue community advisory group. | |
| 31. Continue to actively promote RRRC and SMRC activities via traditional educational channels such as TV, brochures, radio, tours, apps and social media. | |
| 32. Continue to offer RRRC community based recycling services for HHW, batteries, polystyrene etc. | |
| **Governance actions** | |
| 33. Conduct a full cost accounting study to differentiate SMRC governance and coordination overhead functions and costs from those as a waste and recycling service provider. | |
| 34. If the FOGO bin collection system is adopted, explore cost reduction initiatives such as commercial rental of vacant shed space and reduction of any unnecessary management overhead expenses arising from the revised service delivery model. | |

| |
|---|
| 35. Advocate for the implementation of State policies and in particular for the government to clarify how the EfW policy will operate in regards to 2 bin and 3 bin systems. |
| 36. Continue to work with the Waste Authority. |
| 37. Continue to participate in Australian and International waste management groups. |
| 38. Conduct a full review of waste management contracts |

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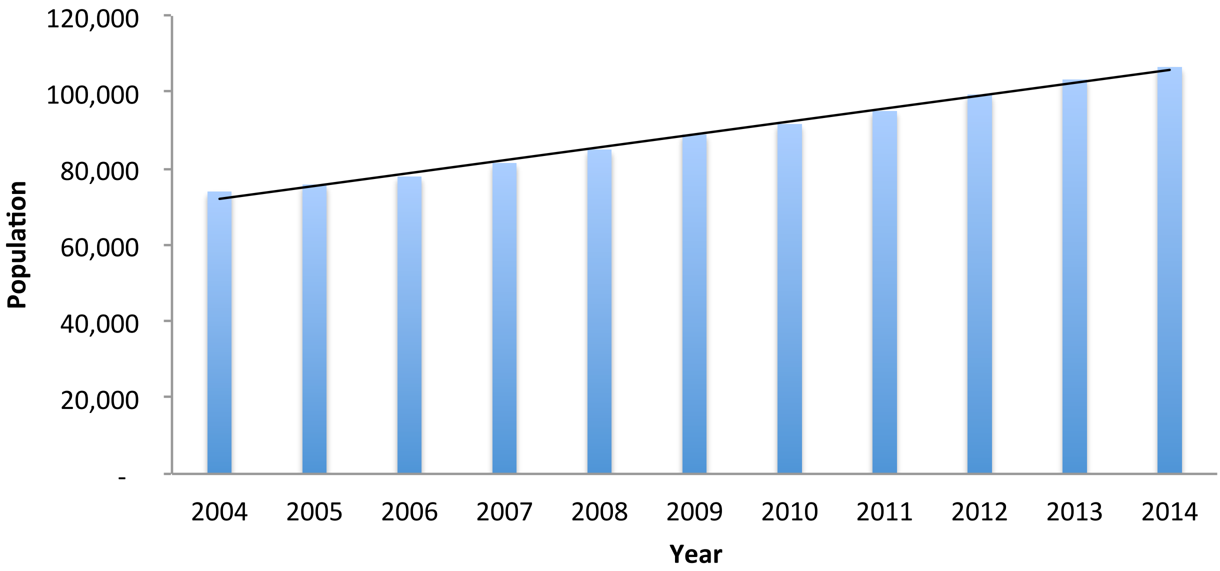
# Appendix A SMRC member council demographics

## A.1 City of Cockburn

The City of Cockburn had an estimated resident population of 106,540 in 2014 (ABS 2015). The 2011 Australian census indicated that there were 31,840 households in the City of Cockburn, the great majority of which are family households. Assuming the number of households has increased along with population growth, the estimated number of households in 2014 is 35,507.

**Figure A-1 City of Cockburn population trend based on estimated resident population (ABS 2015)**




There is a skew towards younger demographics, with the highest percentage of people aged 0-14 years (20.3%). The percentage of the population between the ages of 15-24, 25-34, 35-44 & 45-54 is relatively evenly spread at around 13-16% for each age bracket (ABS 2012).

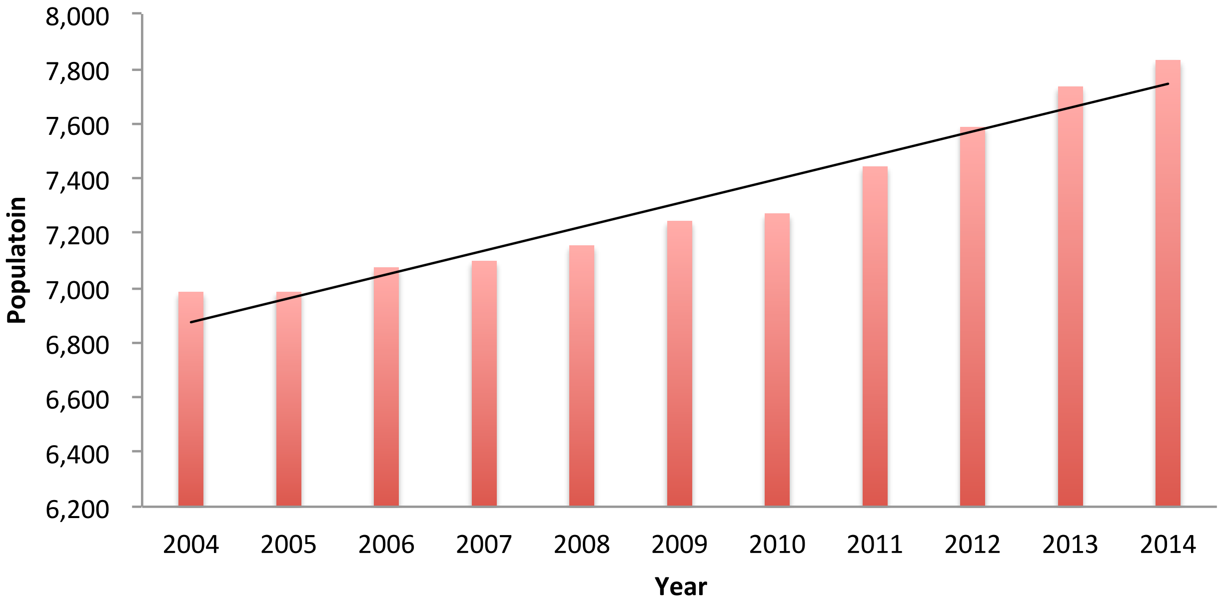
Based on 2011 ABS Census data, the main employing industry is manufacturing (11.2%). Technicians and trade workers make up the biggest group of employees (18.6%), closely followed by professionals (18.1%). In terms of employment by age, wage and salary earners aged between 25-34 years make up the majority of the workforce (25.6%), with wage and salary earners aged 35-44 years making up 23.2%.

## A.2 Town of East Fremantle

The Town of East Fremantle has an estimated resident population of 7,832 in 2014 (ABS 2015).

The 2011 Australian census indicated that there were 2,613 households in the Town of East Fremantle, the majority of which are family households. Assuming the number of households has increased along with population growth, the estimated number of households in 2014 is 2,708.

**Figure A-2 East Fremantle population trend (ABS 2015)**




The highest percentage of residents are aged 0-14 years (18.1%), followed by persons aged 45-54 years (17.4%). The percentage of the population ages between 15-24, 35-44 and 55-64 is relatively evenly spread at around 12-14% for each age bracket (ABS 2012).

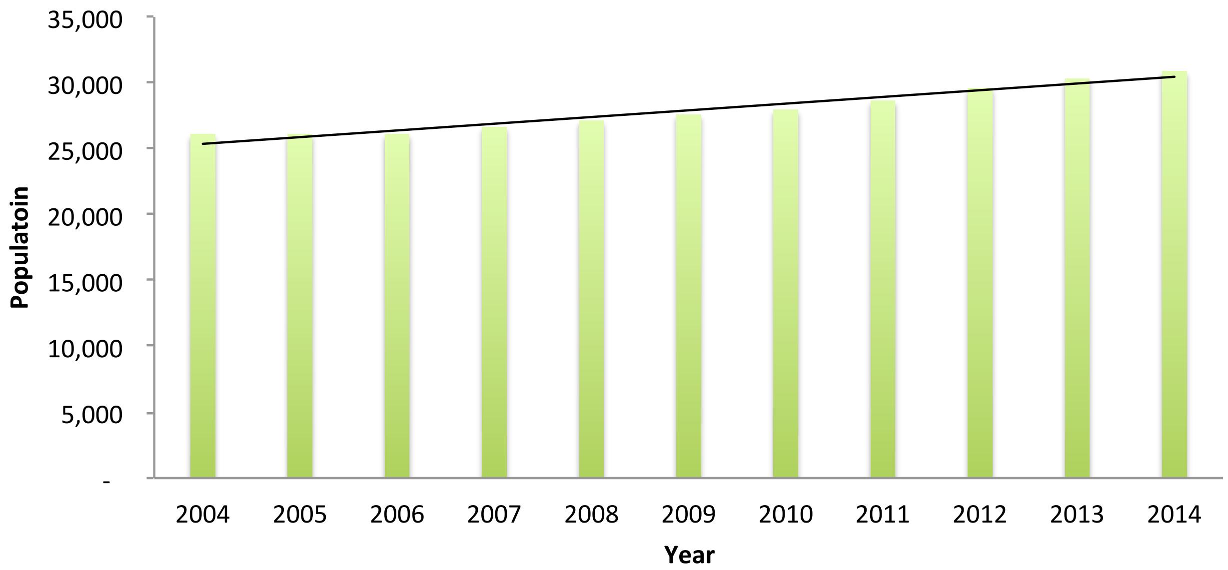
Based on 2011 ABS Census data, the main employing industry is education & training (14.3%). Professionals make up the biggest group of employees (34.5%), while 14.4% of residents are employed as clerical and administrative workers and 13.9% as managers. In terms of employment by age, wage and salary earners aged between 45-54 years make up the majority of the workforce (24.8%), with wage and salary earners aged 35-44 years making up 20.5%.

## A.3 City of Fremantle

The City of Fremantle has an estimated resident population of 30,883 in 2014 (ABS 2015).

The 2011 Australian census indicated that there were 11,025 households in the City of Fremantle, the majority of which are family households. Assuming the number of households has increased along with population growth, the estimated number of households in 2014 is 11,794.

Figure A-3 City of Fremantle population trend based on estimated resident population (ABS 2015)




The highest percentage of residents are aged 25-34 years (16.2%). The percentage of population between the ages of 0-14, 15-24, 35-44, 45-54 & 55-64 is relatively evenly spread at around 11-14% for each age bracket (ABS 2012).

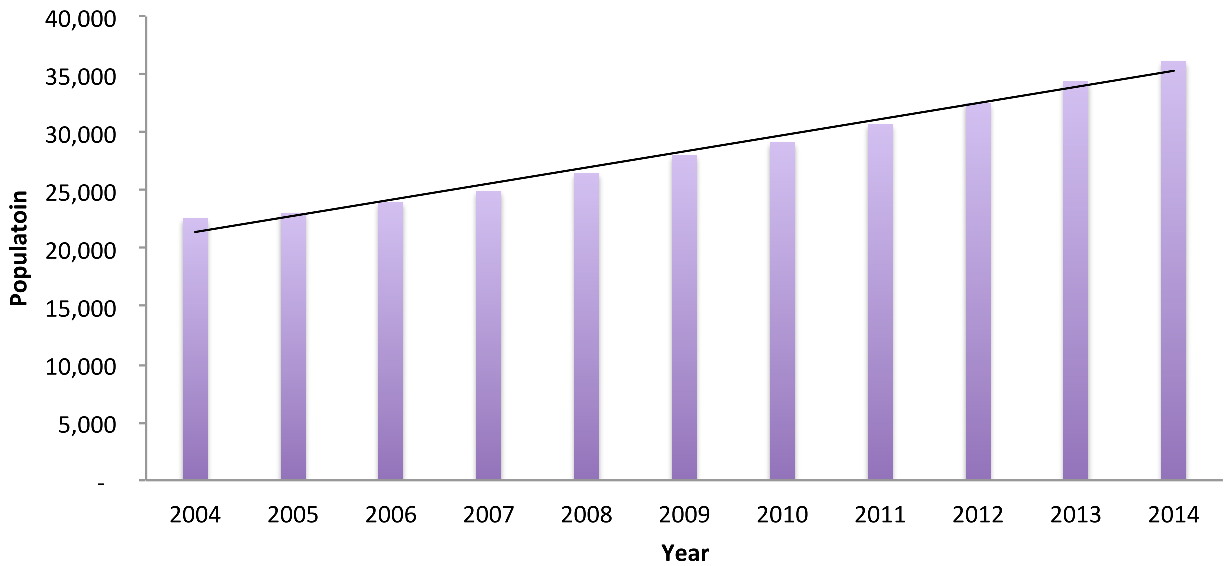
Based on 2011 ABS Census data, the main employing industry is healthcare and social assistance (14%). Professionals make up the largest group of employees (28.4%), with 13.2% of residents employed as clerical and administrative workers. In terms of employment by age, wage and salary earners aged between 25-34 years make up the majority of the workforce (26.1%), with wage and salary earners aged 35-44 years making up 21.1%.

## A.4 City of Kwinana

The City of Kwinana has an estimated resident population of 36,145 in 2014 (ABS 2015).

The 2011 Australian census indicated that there were 9,987 households in the City of Kwinana, the majority of which are family households. Assuming the number of households has increased along with population growth, the estimated number of households in 2014 is 12,047.

Figure A-4 City of Kwinana population trend based on estimated resident population (ABS 2015)




The highest percentage of residents are aged 0-14 years (22.5%) followed by residents aged 25-34 years (18.6%). The percentage of population between the ages of 15-24, 35-44 & 45-54 is relatively evenly spread at around 11-15% for each age bracket (ABS 2012).

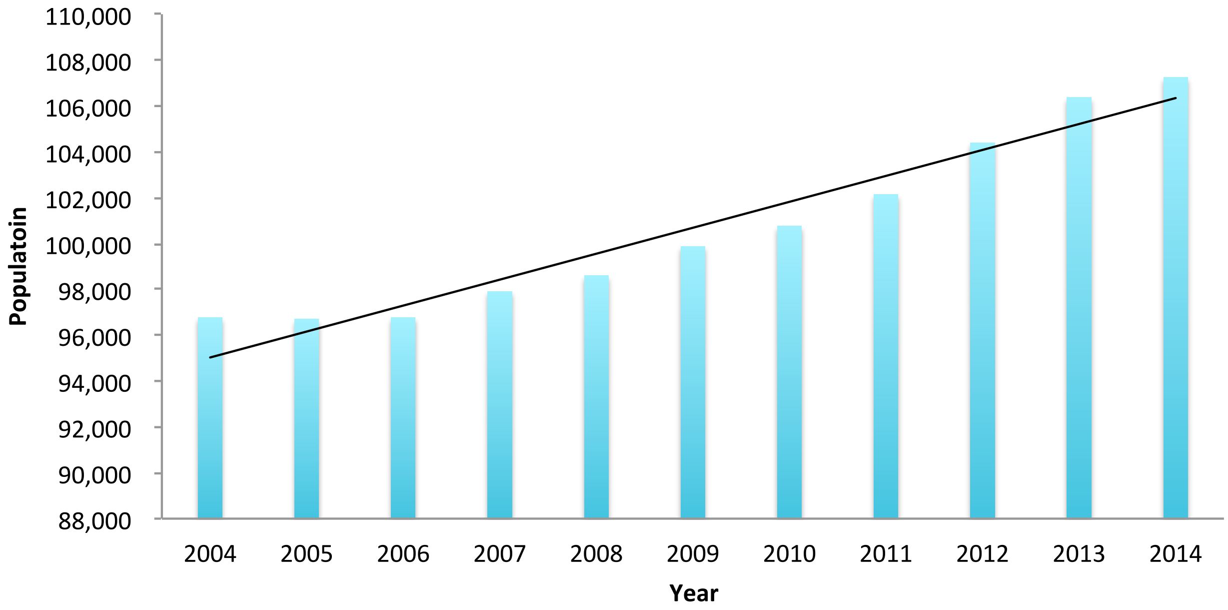
Based on 2011 ABS Census data, the main employing industry is manufacturing (13.4%). Technicians and trade workers make up the biggest group of employees (17.1%), while 15.3% are employed as labourers and 13.2% as clerical and administrative workers. In terms of employment by age, wage and salary earners aged between 25-34 make up the majority of the workforce (29%), with wage and salary earners aged between 35-44 years making up 23.1%.

## A.5 City of Melville

The City of Melville has an estimated resident population of 107,239 in 2014 (ABS 2015).

The 2011 Australian census indicated that there were 35,587 households in the City of Melville, the majority of which are family households. Assuming the number of households has increased along with population growth, the estimated number of households in 2014 is 36,665.

Figure A-5 City of Melville population trend based on estimated resident population (ABS 2015)




The highest percentage of residents are aged 0-14 years (16.4%). The percentage of population between the ages of 15-24, 25-34, 35-44, 45-54 & 55-64 is relatively evenly spread at around 11-15% for each age bracket (ABS 2012).

Based on 2011 ABS Census data, the main employing industry is healthcare and social assistance (12.3%). Professionals make up the biggest group of employees (28.3%), while 16.1% of residents are employed as clerical and administrative workers. In terms of employment by age, wage and salary earners aged between 45-54 years make up the majority of the workforce (21.9%), closely followed by residents aged 25-34 years (20%) and residents aged 35-44 years (19.3%).

# Appendix B 'Recycle Right'

## B.1 Introduction

The SMRC's Recycle Right ™ program was established in 2012 and provides a central point of information to educate the community about waste and recycling.

Recycle Right, in partnership with its member local governments, seeks to educate and influence households and business in its region about responsible waste management and waste reduction measures. Recycle Right was proud to be Highly Commended in the Waste Authority's Infinity Awards in 2013 and 2014.

Recycle Right has significant intellectual property and has developed in-house a smart phone app, website and educational and marketing material for use by member councils and as a fee for service basis to external local governments and the Waste Authority.

## B.2 Strategic objectives

The purpose of Recycle Right is collaboration to maintain and improve waste management across the communities in the south metropolitan region.

There are five key objectives/outcomes:

**Outcome 1: Informing the Recycle Right strategy with a strong evidence base**

Strategies:

- 1.1 Maximise benefit from community perception surveys;
- 1.2 Sharing learning from individual and collective research; and
- 1.3 Monitor progress of Recycle Right Plan.

**Outcome 2: Delivering a consistent recycling message**

Strategies:

- 2.1 Ensure regionally consistent waste education messaging across councils and all waste types;
- 2.2 Support member councils to integrate Recycle Right into their existing activities; and
- 2.3 Identify potential for joint education campaigns.

**Outcome 3: Provide options for non-green and yellow bin materials**

Strategies:

- 3.1 Raise awareness of domestic and standard business options;
- 3.2 Improve accuracy of bulk verge collection disposal;
- 3.3 Improve accuracy of hazardous waste disposal;
- 3.4 Improve accuracy of E-waste disposal (mobiles, TVs, computer monitors);
- 3.5 Improve accuracy of resource recovery disposal; and
- 3.6 Improve accuracy of construction waste disposal.

**Outcome 4: Maximise effectiveness through collaboration and partnership**

Strategies:

- 4.1 Maintain governance of the Recycle Right Strategy;

- 4.2 Optimising waste education activities across council; and
- 4.3 Creating community and business partnerships to bolster recycling.

**Outcome 5: Monitoring outcomes and improve effectiveness**

Strategies:

- 5.1 Monitor improvements in accuracy of recycling behaviour;
- 5.2 Reporting on outcomes from Recycle Right initiatives; and
- 5.3 Modelling financial impacts of recycling of verge, junk, bulk and hazardous waste.

For further information on the Recycle Right strategic objectives, please refer to the Recycle Right Plan 2014-2017.

## B.3 Funding

Recycle Right is funded by member local government contributions. The 2014-15 operating budget is $413,000.

Recycle Right is also supported by the Waste Authority of Western Australia. In the past three years it has successfully received $500,000 in funding for some of the following projects:

- Updating education materials at the Regional Resource Recovery Centre's Education Centre;
- Recycle Right marketing and education – public transport bus and waste truck branding, animated waste video, virtual tour video and projector for education centre;
- Digital marketing to support implementation of three bins across the state;
- Greenfingers TV segments on Channel 9;
- Educational displays at the Perth Royal Show; and
- Improving recycling attitudes in the Avon Valley.

## B.4 Recycle Right and the Waste Authority

The SMRC is currently in discussions with the Waste Authority of Western Australia to license Recycle Right for implementation beyond its member councils. This would ultimately see Recycle Right as a universally recognisable brand and program across the Perth metropolitan region, providing a central point of information relevant to each local government authority.

This initiative is already underway in some areas and organisations. Some examples include:

- Use of Recycle Right branding by WALGA for the "That's Rubbish!" and bin tagging campaigns across the Perth metropolitan region;
- Use of Recycle Right branding by local governments in the Avon Valley region, including Northam and Toodyay; and
- Use of Recycle Right branding to support implementation of the Waste Authority's "Better Bins" project where some local governments will be financially supported to upgrade to a three bin collection system.

## B.5 Community engagement

Recycle Right community engagement activities are implemented as follows:

- Tours of the Regional Resource Recovery Centre (RRRC) in Canning Vale;

- A modern education centre at the RRRC's Materials Recovery Facility;
- Visits to schools, childcare centres and community groups;
- Information displays at public events and shopping centres;
- Community group and school holiday workshops;
- Public speaking engagements; and
- Developing key partnerships and networks to expand Recycle Right awareness.

## B.6 Communications

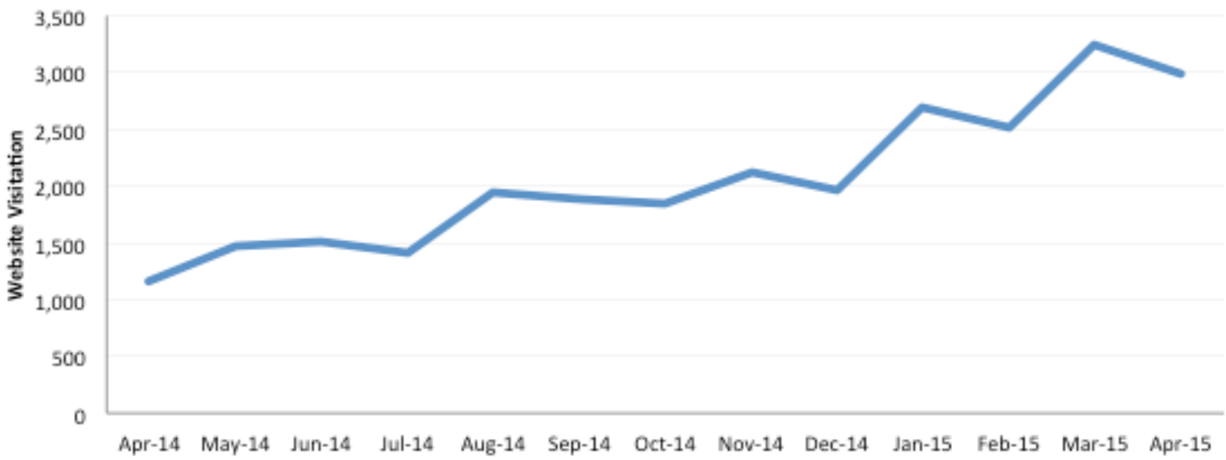
Recycle Right is supported by the following communication tools:

- Website recycleright.wa.gov.au;
- Mobile website m.recycleright.wa.gov.au;
- App available to download from the iTunes and Google Play stores;
- Monthly E-news distributed via email;
- Positive media stories, including newspaper, television, radio and online;
- Signage and information panels to educate tour visitors;
- Fact sheets, posters and brochures;
- Waste collection calendars; and
- Merchandise such as bin stickers, fridge magnets, shopping bags and water bottles.

## B.7 Statistics

Figure B-1 below details the number of visitors per month to the Recycle Right website www.recycleright.wa.gov.au. Website visitation has steadily increased since the website's inception.

**Figure B-1 Recycle Right website visits**



# Appendix C Historical and future waste projections

**Table C-1 Total waste per member council 2014/15**

| COUNCIL | Collected/landfill | MSW | REC | Green Waste Verge | Bulk Verge (incl Ferrous) | Totals |
|---|---|---|---|---|---|---|
| All Member Councils | **Collected** | **83,707** | **33,547** | **8,798** | **8,585** | **134,637** |
| | **Landfill** | **12,415** | **-** | **-** | **8,247** | **20,662** |
| | **% to Landfill** | **14.8%** | **0.0%** | **0.0%** | **96.1%** | **15.3%** |
| | | | | | | |
| Cockburn | **Collected** | **28,934** | **13,156** | **1,874** | **3,106** | **47,071** |
| | **Landfill** | **-** | **-** | **-** | **3,106** | **3,106** |
| | | | | | | **6.6%** |
| East Fremantle | **Collected** | **2,553** | **1,071** | **335** | **165** | **4,124** |
| | **Landfill** | **-** | **-** | **-** | **165** | **165** |
| | | | | | | **4.0%** |
| Fremantle | **Collected** | **7,913** | **3,539** | **903** | **1,204** | **13,559** |
| | **Landfill** | **-** | **-** | **-** | **1,204** | **1,204** |
| | | | | | | **8.9%** |
| Melville | **Collected** | **31,891** | **12,580** | **4,363** | **2,426** | **51,260** |
| | **Landfill** | **-** | **-** | **-** | **2,089** | **2,089** |
| | | | | | | **4.1%** |
| Kwinana | **Collected** | **12,415** | **3,201** | **1,324** | **1,684** | **18,623** |
| | **Landfill** | **12,415** | **-** | **-** | **1,684** | **14,098** |
| | | | | | | **75.7%** |

**Table C-2 Total Waste per member council 2013/14**

| COUNCIL | MSW | REC | Green Waste Verge | Bulk Verge (incl Ferrous) | Totals |
|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| All Member Councils | **Collected** | **80,055** | **33,861** | **9,570** | **8,246** | **131,732** |
| | **Landfill** | **40,734** | **5,728** | **-** | **7,388** | **53,849** |
| | **% to Landfill** | **50.9%** | **16.9%** | **0.0%** | **89.6%** | **40.9%** |
| | | | | | | |
| Cockburn | **Collected** | **26,914** | **13,138** | **2,002** | **2,373** | **44,427** |
| | **Landfill** | **11,367** | **2,222** | **-** | **2,254** | **15,844** |
| | | | | | | **35.7%** |
| East Fremantle | **Collected** | **2,383** | **1,087** | **236** | **215** | **3,920** |
| | **Landfill** | **1,006** | **184** | **-** | **180** | **1,370** |
| | | | | | | **35.0%** |
| Fremantle | **Collected** | **7,942** | **3,607** | **998** | **1,484** | **14,031** |
| | **Landfill** | **3,354** | **610** | **-** | **1,266** | **5,231** |
| | | | | | | **37.3%** |
| Melville | **Collected** | **30,832** | **12,827** | **4,826** | **2,542** | **51,027** |
| | **Landfill** | **13,022** | **2,170** | **-** | **2,243** | **17,435** |
| | | | | | | **34.2%** |
| Kwinana | **Collected** | **11,984** | **3,202** | **1,509** | **1,632** | **18,327** |
| | **Landfill** | **11,984** | **542** | **-** | **1,444** | **13,970** |
| | | | | | | **76.2%** |

**Table C-3 Total Waste 2010 - 2014**

| | | Forecast scenario 1: Household led forecast based on 2013/2014 t/hhld remaining the same | Forecast scenario 2: Household forecast with SMRC weighted average 1.28%/yr growth/hhd from 2012 - 2014 | Forecast scenario 3: Population forcast with 0.5%/yr reduction/capita from 2013/14 | Forecast scenario 4: 2009-2014 trends persist, waste generation increases by the average growth |
|---|---|---|---|---|---|
| 2010/11 | 81,602 | | | | |
| 2011/12 | 81,308 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 2012/13 | 85,297 | | | | |
| 2013/14 | 135,023 | 135,023 | 135,023 | 135,023 | 135,023 |
| 2014/15 | | 137,979.52 | 140,169.70 | 137706.2135 | 139,551.40 |
| 2015/16 | | 141,429.01 | 145,512.97 | 140443.1245 | 144,080.17 |
| 2016/17 | | 144,964.73 | 151,059.92 | 143234.4316 | 148,608.93 |
| 2018/19 | | 148,588.85 | 156,818.33 | 146081.2159 | 153,137.70 |
| 2019/20 | | 152,303.57 | 162,796.24 | 148984.5801 | 157,666.46 |
| 2020/21 | | 156,111.16 | 169,002.04 | 151945.6486 | 162,195.23 |
| 2021/22 | | 160,013.94 | 175,444.39 | 154965.5684 | 166,723.99 |
| 2022/23 | | 164,014.29 | 182,132.33 | 158045.509 | 171,252.76 |

**Table C-4 Recycling**

| | | Forecast scenario 1: Household led forecast based on 2013/2014 t/hhld remaining the same | Forecast scenario 2: Household forecast with SMRC weighted average 1.28%/yr growth/hhd from 2012 - 2014 | Forecast scenario 3: Population forcast with 0.5%/yr reduction/capita from 2013/14 | Forecast scenario 4: 2009-2014 trends persist, waste generation increases by the average growth |
|---|---|---|---|---|---|
| 2010/11 | 15,573 | | | | |
| 2011/12 | 23,022 | | | | |
| 2012/13 | 25,161 | | | | |
| 2013/14 | 33,861 | 33,861 | 33,861 | 33,861 | 33,861 |
| 2014/15 | | 34,494.88 | 35,151.78 | 34533.99 | 34,533.99 |
| 2015/16 | | 35,357.25 | 36,491.77 | 35220.35 | 35,220.35 |
| 2016/17 | | 36,241.18 | 37,882.83 | 35920.35 | 35,920.35 |
| 2018/19 | | 37,147.21 | 39,326.93 | 36634.27 | 36,634.27 |
| 2019/20 | | 38,075.89 | 40,826.07 | 37362.38 | 37,362.38 |
| 2020/21 | | 39,027.79 | 42,382.36 | 38104.96 | 38,104.96 |
| 2021/22 | | 40,003.49 | 43,997.97 | 38862.29 | 38,862.29 |
| 2022/23 | | 41,003.57 | 45,675.18 | 39634.68 | 39,634.68 |

**Table C-5 Garden organics**

| | | Forecast scenario 1: Household led forecast based on 2013/2014 t/hhld remaining the same | Forecast scenario 2: Household forecast with SMRC weighted average 1.28%/yr growth/hhd from 2012 - 2014 | Forecast scenario 3: Population forcast with 0.5%/yr reduction/capita from 2013/14 | Forecast scenario 4: 2009-2014 trends persist, waste generation increases by the average growth |
|---|---|---|---|---|---|
| **2010/11** | 7,876 | | | | |
| **2011/12** | 9,548 | | | | |
| **2012/13** | 9,914 | | | | |
| **2013/14** | 9,733 | 9,733 | 9,733 | 9,733 | 9,733 |
| **2014/15** | | 10,613.81 | 10,104.02 | 9926.443 | 10,122.32 |

| | | | | |
|---|---|---|---|---|
| **2015/16** | 10,879.15 | 10,489.19 | 10123.73 | 10,527.21 |
| **2016/17** | 11,151.13 | 10,889.04 | 10324.94 | 10,948.30 |
| **2018/19** | 11,429.91 | 11,304.13 | 10530.15 | 11,386.23 |
| **2019/20** | 11,715.66 | 11,735.04 | 10739.44 | 11,841.68 |
| **2020/21** | 12,008.55 | 12,182.38 | 10952.88 | 12,315.35 |
| **2021/22** | 12,308.76 | 12,646.77 | 11170.57 | 12,807.96 |
| **2022/23** | 12,616.48 | 13,128.87 | 11392.59 | 13,320.28 |

**Table C-6 MSW**

| | | Forecast scenario 1: Household led forecast based on 2013/2014 t/hhld remaining the same | Forecast scenario 2: Household forecast with SMRC weighted average 1.28%/yr growth/hhd from 2012 - 2014 | Forecast scenario 3: Population forcast with 0.5%/yr reduction/capita from 2013/14 | Forecast scenario 4: 2009-2014 trends persist, waste generation increases by the average growth |
|---|---|---|---|---|---|
| **2010/11** | 79,312 | | | | |
| **2011/12** | 78,509 | | | | |
| **2012/13** | 61,985 | | | | |
| **2013/14** | 82,636 | 82,636 | 82,636 | 82,636 | 82,636.00 |
| **2014/15** | | 86,237.20 | 87,198.97 | 85666.44 | 85,941.44 |
| **2015/16** | | 88,393.13 | 90,522.99 | 87369.06 | 89,379.10 |
| **2016/17** | | 90,602.96 | 93,973.73 | 89105.52 | 92,954.26 |
| **2018/19** | | 92,868.03 | 97,556.01 | 90876.49 | 96,672.43 |
| **2019/20** | | 95,189.73 | 101,274.84 | 92682.66 | 100,539.33 |
| **2020/21** | | 97,569.48 | 105,135.44 | 94524.73 | 104,560.90 |
| **2021/22** | | 100,008.71 | 109,143.20 | 96403.41 | 108,743.34 |
| **2022/23** | | 102,508.93 | 113,303.74 | 98319.43 | 113,093.07 |

# Appendix D System option modelling assumptions

## D.1 General assumptions

General assumptions applied throughout the model are listed in Table D-1 .

**Table D-1 General assumptions**

| Parameter | Value | | Comments | Source |
|---|---|---|---|---|
| **Number of dwellings/households (2014)** | Cockburn | 33,114 | Estimated for 2014 using 2011 census data | ABS 2011 |
| | East Fremantle | 2,639 | | |
| | Fremantle | 11,264 | | |
| | Kwinana | 10,486 | | |
| | Melville | 35,943 | | |
| | **Total** | **93,446** | | |
| **Population (2014)** | Cockburn | 106,549 | Estimated resident population for 2014 | ABS 2014 |
| | East Fremantle | 7,832 | | |
| | Fremantle | 30,883 | | |
| | Kwinana | 36,145 | | |
| | Melville | 107,239 | | |
| | **Total** | **288,648** | | |
| **Annual population increase (%)** | 3.3% | | Applied across the region | Weighted ABS Data |
| **Annual waste generation per capita growth rate** | 1.3% | | Applied across the region | Historical trends from SMRC data |
| **Consumer Price Index (%)** | 2.5% | | Applied across the region | MRA assumption |
| **Discount rate (%)** | 7% | | Applied across the region | MRA assumption |

## D.2 Specific assumptions

Other scenario specific assumptions include are listed in Table D-2.

**Table D-2 Scenario assumptions**

| | Scenario Assumptions | Source |
|---|---|---|
| 1 | All MSW generated by City of Kwinana will be processed by Phoenix Energy Australia Pty Ltd in an EfW facility that will be operational by 2018. | SMRC |
| 2 | There is no distinction between MUD and SUD services due to the relatively small number of MUD swellings in the region.[14] | SMRC |
| 3 | Under all FOGO scenarios, 90% of otherwise available garden organics in the MSW bin, and 60% of available food organics is assumed to be captured by the FOGO bin. From the audit data provided, it has been assumed that 29% of the MSW bin currently comprises garden organics and 28% comprises food organics. | MRA |
| 4 | 20% of current garden organics recovered from the verge service will be collected in the FOGO bin. | MRA |

[14] MRA expects that as the percentage of MUDs is very low, it is unlikely that bin storage will pose any significant challenges with the introduction of a three bin system

## D.3 Material quantities assumptions

The scenarios modelled are based on region-specific waste stream combinations. All material quantities are projected to increase at the annual waste generation rate (population and consumption growth rates), and maintain the same composition. Table D-3 presents the tonnages for each waste stream for each option. The total tonnes **do not** remain consistent across the scenarios, as it is assumed that 20% of garden organics current collected via the verge service will transition to the kerbside bin service under a three bins scenario. All calculations and forecasts are based upon the 2014 domestic waste tonnage data provided by SMRC.

**Table D-3 Material quantities for SMRC**

| Waste Stream | Councils | Scenario 1 | | | | | Scenario 2 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Option 1A | Option 1B | Option 1C | Option 1D | Option 1E | Option 2A | Option 2B | Option 2C | Option 2D |
| | | 2 bin BAU MSW to WCF; residual to landfill | 2 bin BAU with improved screening | 2 bin MSW to WCF; residual to EfW | 2 bin MSW to landfill | 2 bin MSW to EfW | 3 bin FOGO to RRRC drums; FOGO residual to landfill | 3 bin FOGO to RRRC drums; FOGO residual to EfW | 3 bin FOGO to a composting facility; FOGO residual to landfill | 3 bin FOGO to composting facility; FOGO residual to EfW |
| MSW | - Kwinana | 13,149 | 13,149 | 13,149 | 13,149 | 13,149 | 13,149 | 13,149 | 13,149 | 13,149 |
| MSW | - Cockburn<br>- East Fremantle<br>- Fremantle<br>- Melville | 73,182 | 73,182 | 73,182 | 73,182 | 73,182 | | | | |
| FOGO depleted MSW | - Cockburn<br>- East Fremantle<br>- Fremantle<br>- Melville | | | | | | 41,787 | 41,787 | 41,787 | 41,787 |
| Comingled recycling | - Cockburn<br>- East Fremantle<br>- Fremantle<br>- Kwinana<br>- Melville | 33,968 | 33,968 | 33,968 | 33,968 | 33,968 | 33,968 | 33,968 | 33,968 | 33,968 |
| Food and garden organics | - Cockburn<br>- East Fremantle<br>- Fremantle<br>- Melville | | | | | | 32,623 | 32,623 | 32,623 | 32,623 |
| **TOTAL** | | **120,299** | **120,299** | **120,299** | **120,299** | **120,299** | **121,527** | **121,527** | **121,527** | **121,527** |

## D.4 Collection and haulage assumptions

Table D-4 lists assumptions for collection vehicles. Lift/service costs have been provided by SMRC for current services.

**Table D-4 Collection assumptions**

| Description | Capacity (t) | Fuel | Lift/service cost (market average) | Metres travelled per lift |
|---|---|---|---|---|
| MSW collection vehicle | 8t | Diesel | $1.34 | 30 |
| Comingled collection vehicle – WK/FN | 5t | Diesel | $1.20 | 30 |
| Comingled collection vehicle – FN | 5t | Diesel | $1.35 | 30 |
| Food and garden collection vehicle | 8t | Diesel | $1.29 | 30 |

**Table D-5 Haulage distance assumptions to facilities**

| Facility | Conservative distance from regional centre (km) |
|---|---|
| RRRC | 20 |
| Millar Road Landfill | 20 |
| Red Hill Landfill | 60 |
| Phoenix EfW | 10 |
| Bunbury MAF | 160 |

**Table D-6 Fuel emission assumptions**

| Item | Value | Source |
|---|---|---|
| Average rate of diesel consumption for rigid and articulated trucks in Australia | 40L per 100km | Australian Bureau of Statistics, 2010 |
| Diesel emissions | 2.68 t $CO_2$-e per kL of diesel | Department of Climate Change and Energy Efficiency, 2012 |

## D.5 Facilities

Facility gate fees (expressed as *cost per tonne processed/landfilled/transferred*) and recovery rates are presented in Table D-7. **The combination of recovery rates for specific waste streams - when weighted against the composition of the waste stream - corresponds to a total resource recovery rate consistent with SMRC's data or market experience**.

**Table D-7 Facility costs and recovery rates**

| Facility name | Facility Type | Existing/ Hypothetical | Base Gate Fee | Levy | Full Gate Fee | Gas capture if landfill % | Levy | Weighted Average Recovery | Residual | Garden | Food | Other organic | Metal | Paper/ Card | Plastic | Glass | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WCF** | AWT | Existing | $242.37 | (base inclusive of levy on residuals) | $242.37 | - | Metro Putrescible | **60%**[15] | - | 90% | 85% | 85% | 95% | 50% | 30% | 50% | - |
| **Millar Road Landfill** | Landfill | Existing | $59.22 | $55.00 | $114.22 | 50% | Metro Putrescible | **0%** | - | - | - | - | - | - | - | - | - |
| **Millar Road Landfill - Class 3** | Landfill | Existing | $71.75[16] | $55.00 | $126.75 | 50% | Metro Putrescible | **0%** | - | - | - | - | - | - | - | - | - |
| **Red Hill Landfill - Class 4** | Landfill | Existing | $156.36[17] | $55.00 | $211.36 | 50% | Metro Putrescible | **0%** | - | - | - | - | - | - | - | - | - |
| **Phoenix EfW** | EfW | Hypothetical | $115.00 | (base inclusive of all disposal and transport costs) | $115.00 | - | Metro Putrescible | **85%** | 80% | 90% | 90% | 95% | 95% | 95% | 95% | - | 85% |
| **FOGO Drums** | Enclosed composting | Existing | $185.00 | (base inclusive of all disposal and transport costs) | $185.00 | - | Metro Putrescible | **90%** | - | 90% | 90% | - | - | - | - | - | - |
| **Bunbury MAF** | Enclosed composting | Existing | $100.00[18] | (base inclusive of all disposal and transport costs) | $100.00 | - | Metro Putrescible | **90%** | - | 90% | 85% | - | - | - | - | - | - |
| **RRRC MRF**[19] | MRF | Existing | $80.00 | (base inclusive of all disposal and transport costs) | $80.00 | - | Metro Putrescible | **85%** | - | - | - | - | 95% | 95% | 95% | 95% | - |

[15] MRA understands from historical data that the recovery rate of the AWT has increased significantly over the past 5 years. 60% has been selected as a conservative recovery rate for analyses purposes.

[16] Assuming bottom ash is classified as low contaminated soil Class 3, the gate fee at Millar Road Landfill is $147.90 (inclusive of levy and GST). By extracting GST from the base fee and assuming a $12.70 reduction on the base fee (assuming 15% of the 300,000tpa facility is ash, and 78% of this is bottom ash), the equivalent gate fee becomes $126.75 (ex GST inclusive of the levy). This is the discount rate for generators disposing of between 30,000 and 50,000tpa.

[17] Assuming fly ash is classified as Class 4 contaminated waste, the gate fee at Red Hill Landfill is $222.70/t + $129.00 per consignment (inclusive of levy and GST). Assuming each consignment comprises 30 tonnes and GST is extracted from the base fee, the equivalent gate fee becomes $211.36 (ex GST inclusive of the levy). No discount is assumed as the tonnes generated will not exceed 20,000tpa.

[18] This gate fee was provided as an estimate from C-Wise. A sensitivity analysis will be conducted to determine the impacts of increasing a FOGO gate fee to $150/t. It is possible that the Bunbury facility may be unable to accept additional FOGO in the future due footprint restrictions and changes in land ownership at the site.

[19] The recovery rates recorded for each waste stream in comingled recycling is very high, as audit data for incoming waste has a residual component of 15%, consistent with the 85% recovery rate. This residual component is not categorized by paper/card, plastic, glass etc.

## D.6 Miscellaneous assumptions

The modelling incorporates additional costs associated with new services. These are summarised in Table D-8 and have been assumed by MRA based on past experience in service change implementation processes.

**Table D-8 Equipment and education costs**

| Cost component | Unit cost per household |
|---|---|
| **Food liners: FOGO** | $8.50 |
| **Kitchen Caddies: FOGO** | $9.50 |
| **Community focus group: Any service change** | $3,000 |
| **1 leaflet every year for ongoing education** | $0.35 |
| **2 leaflets for service change** | $0.35 |
| **Mobile MSW bins** | $40 |

# Appendix E NSW Energy from Waste policy

## E. 1 NSW Energy from Waste policy

The NSW EfW Policy has three primary controls:

1. The thermal treatment must not cannibalise recycling (and be able to prove that it does not);
2. It must be a bona-fide waste to energy plant (not just a waste disposal plant); and
3. It must ensure that its air emissions conform to European emission standards.

The NSW EfW Policy states that facilities proposing to thermally treat wastes that are not listed as an eligible waste fuel must meet the requirements of an energy recovery facility that is it must meet international best practice with respect to:

- Process design and control;
- Emission control equipment;
- Emission monitoring with real time feedback to process controls;
- Arrangements for receipt of waste; and
- Management of residues.

In addition to implementing current best practice techniques, energy recovery facilities must ensure that they meet the technical, thermal efficiency and resource recovery criteria established in the NSW EfW Policy.

## E.2 Technical criteria

The NSW EfW Policy notes that meeting international best practice, in particular, the European Union's Industrial Emissions Directive (IED), on which the NSW EfW is based, will ensure that air toxins and particulate emissions are below levels that may pose a risk of harm to the community or environment.

Under the EfW policy the stack emissions from the Facility are required, as a minimum, to meet the Group 6 standard of concentration set out in the PoEO Clean Air Regulation. The Group 6 emissions standards are less stringent than the daily emissions standards set out in the IED. Other technical criteria include:

- The continuous measurement of exhaust gas for key pollutants $NO_x$, CO, particulate matter, total organic compounds, HCl, HF and $SO_2$;
- The data collected for the above must be made available to the EPA on a real-time basis with weekly reports made available online;
- Continuous measurement of key operational parameters including temperature at various stages of the process, pressure and oxygen concentration;
- Proof of performance trials to demonstrate that emissions are compliant with state regulations;
- Total organic carbon (TOC) or loss on ignition (LOI) content of the slag and bottom ashes must not be greater than 3% or 5%, respectively, of the comingled weight of the material;
- Appropriate process control and feed interlocks to prevent waste entering the process when the temperature is below the required combustion temperature; and

- An air quality impact assessment must be conducted in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.

A current issue facing proposed EfW facilities in NSW is the appropriate classification and disposal or recycling method of bottom and fly ash. This means that there are uncertainties in providing assurance to the NSW EPA that the outputs of any proposed EfW facility can be classified and dealt with appropriately and that emissions are compliant with state regulations.

Another issue faced by proposed EfW facilities is the ambiguity regarding the temperature that exhaust gas is to be raised to ensure adequate destruction of halogenated organic substances. The ambiguity arises from slight differences in wording between the NSW EfW Policy and the IED.

# Thermal efficiency criteria

The NSW EfW Policy Statement is restricted in its scope to facilities that are designed to thermally treat waste for the recovery of energy rather than as a means of disposal. The net energy produced from thermally treating waste, including the energy used in applying best practice techniques, must therefore be positive.

To meet the thermal efficiency criteria, facilities must demonstrate that at least 25% of the energy generated from the thermal treatment of the material will be captured as electricity (or an equivalent level of recovery for facilities generating heat alone).

# Resource recovery criteria

The EPA considers energy recovery to be a complementary waste management option for the **residual waste produced from material recovery processes or source-separated collection systems**. The NSW EfW Policy Statement's objectives in setting resource recovery criteria are to:

- Promote the source separation of waste where technically and economically achievable;
- Drive the use of best practice material recovery processes; and
- **Ensure only the residual from bona-fide resource recovery operations are eligible for use as a feedstock for an energy recovery facility.**

Table E-1 summarises the allowable thresholds on available waste feedstocks. Feedstock allowances vary greatly depending on the authorised facility and the type of waste processed by that facility. The more generous policy allowances are:

- 100% of residuals from facilities that process residual MSW collected under a three bin FOGO;
- 40% of residuals from facilities that process residual MSW collected under a three bin GO system;
- 100% of residuals from facilities that process residual C&I waste that has been collected under a source separated system;
- 50% of residuals from facilities that process mixed C&I waste;

- 100% of residual wood waste and textile waste from a manufacturing process, or extracted from a mixed wastes stream; and
- 100% of end-of-life tyres.

Scenario 1 (2 bin MSW and comingled recycling) under the NSW EfW Policy, would allow for **25%** of MSW to be processed via EfW, after it has been processed through an “authorised facility”.

Scenario 2 (3 bin FOGO depleted MSW, comingled recycling and FOGO) under the NSW EfW Policy, would allow for **100%** of MSW to be processed via EfW.

Table E-1 Residual waste allowable thresholds

| Waste | | Process | Waste Stream | Residual Waste Policy Allowance (%) |
|---|---|---|---|---|
| Mixed Waste Stream | MSW | 3 bin FOGO | MSW | 100 |
| | | 3 bin GO | MSW | 40 |
| | | 2 bin | MSW | 25 |
| | C&I | Mixed | C&I | 50 |
| | | Separate collection for all "relevant waste streams" residual | C&I | 100 |
| | C&D | Processing facility residual | C&D | 25 |
| | Source-separated recyclables: MSW | Processing facility: residual | MSW | 10 |
| | Source-separated garden waste: MSW | Processing facility: residual | MSW | 5 |
| | Source-separated food or food and garden waste | Processing facility: residual | MSW | 10 |
| | | | C&I | 10 |
| Separated Waste Streams (excluding biosolids and source-separated food and garden organics) | Waste wood | Residual from manufacturing or extracted from a mixed waste stream that does not meet the definition of an eligible waste fuel | MSW | 100 |
| | | | C&I | 100 |
| | | | C&D | 100 |
| | Textiles | Residual textiles from a manufacturing process or extracted from a mixed waste stream | MSW | 100 |
| | | | C&I | 100 |
| | | | C&D | 100 |
| | Waste tyres | End-of-life tyres | All | 100 |

# Appendix F Waste facilities within the SMRC region

**Table F-1 Waste facilities within the SMRC region**

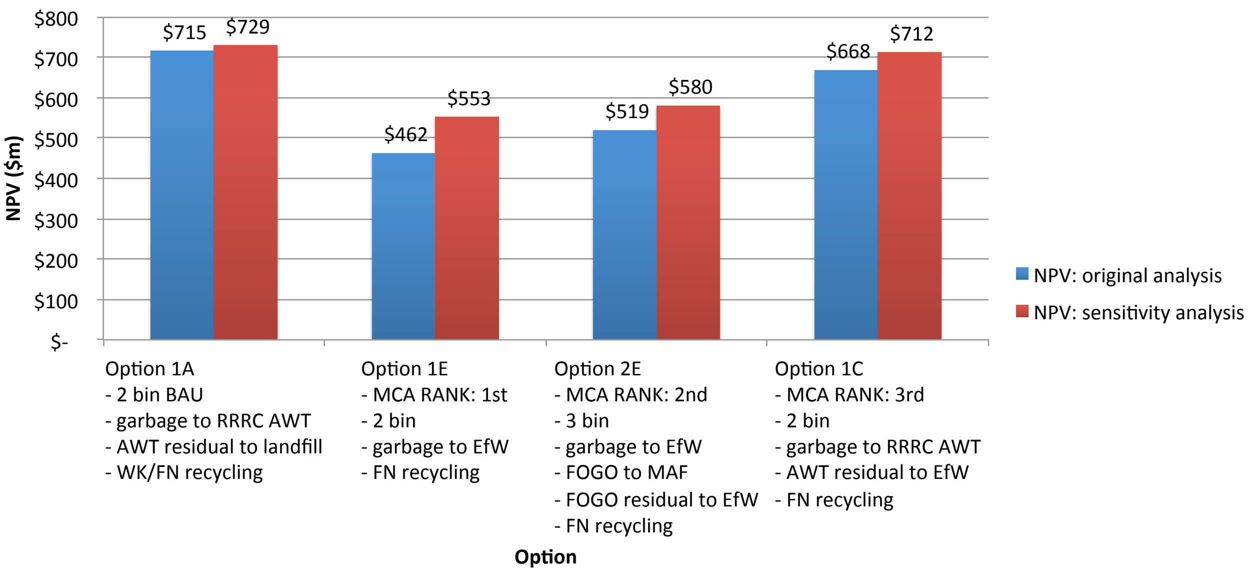
| Facility Name | Type | Location |
|---|---|---|
| Henderson Waste Recovery Park | Landfill Class 2, WtE | 920 Rockingham Rd, Henderson |
| Midland Brick | Manufacturing | 102 Great Northern Highway, Middle Swan |
| Perthwaste Materials Recovery Facility | Resource Recovery | 65 Howson Way, Bibra Lake |
| Veolia Jandakot Recycling Facility | Resource Recovery | Site 312 Marriot Rd, Jandakot |
| Eclipse Resources Landfill | Landfill Class 1, Green Recycling | Abercrombie Rd, Postans |
| Wastestream Management Landfill | Landfill Class 1&2 | Thomas Rd, Kwinana Beach |
| Phoenix Energy | WtE | Kwinana Industrial Area |
| Suez Environment Neerabup BioVision Advanced Resource Recovery Technology Facility | Resource Recovery, Transfer Station | 87 Pederick Rd, Neerabup |
| SMRC Regional Resource Recovery Centre | Resource Recovery | 350 Bannister Rd, Canning Vale |
| Ranford Rd Transfer Station | Transfer Station | Lot 502 Ranford Rd, Canning Vale |
| Suez Environment Welshpool facility (formerly SITA) | Resource Recovery, Transfer Station | 116 Kurnall Rd, Welshpool |
| Millar Rd Landfill Facility | Landfill Class 1,2&3, Resource Recovery and Waste Education Centre | Millar Rd West, Baldivis |
| Suez Environment Shale Rd Landfill (formerly SITA) | Landfill Class 2 | Shale Rd, Cardup |
| New Energy | WtE | 26 Office Rd, East Rockingham (Proposed site) |
| Red Hill Waste Management Facility | Landfill Class 1,2,3,4 and WtE | 1094 Toodyay Rd, Red Hill |

# Appendix G System sensitivity testing

## G.1 EfW operational risk: gate fee increase to $170/t

The results show that all options will increase in cost resulting from Kwinana's base MSW tonnes being contracted to Phoenix. Option 1E is the worst affected, increasing by 20%. This is followed by Option 2E, which increases by 12% (Figure G-1). The modified gate fee does not impact upon the relative cost of BAU and the top three scoring options.

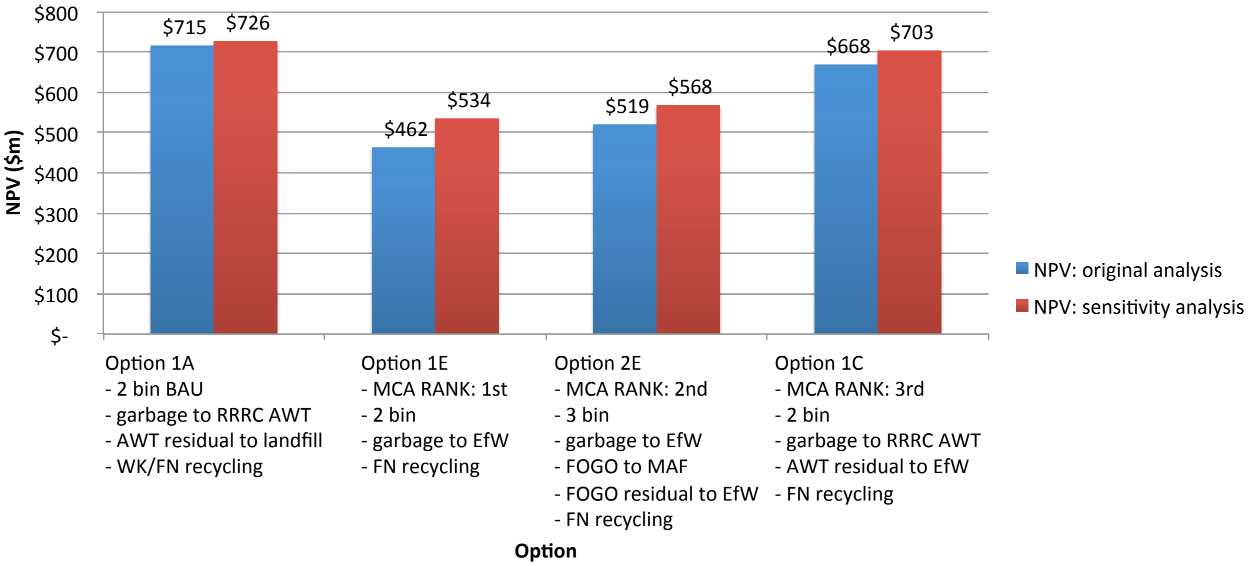
**Figure G-1 System NPV comparisons assuming the EfW gate fee increases to $170/t**




## G.2 EfW capital risk: gate fee increase by $44/t

The results show that Option 1E is the worst affected, increasing by 16%. This is followed by Option 2E, which increases by 9% (Figure G-2). The modified gate fee does not impact upon the relative cost of BAU and the top three scoring options.

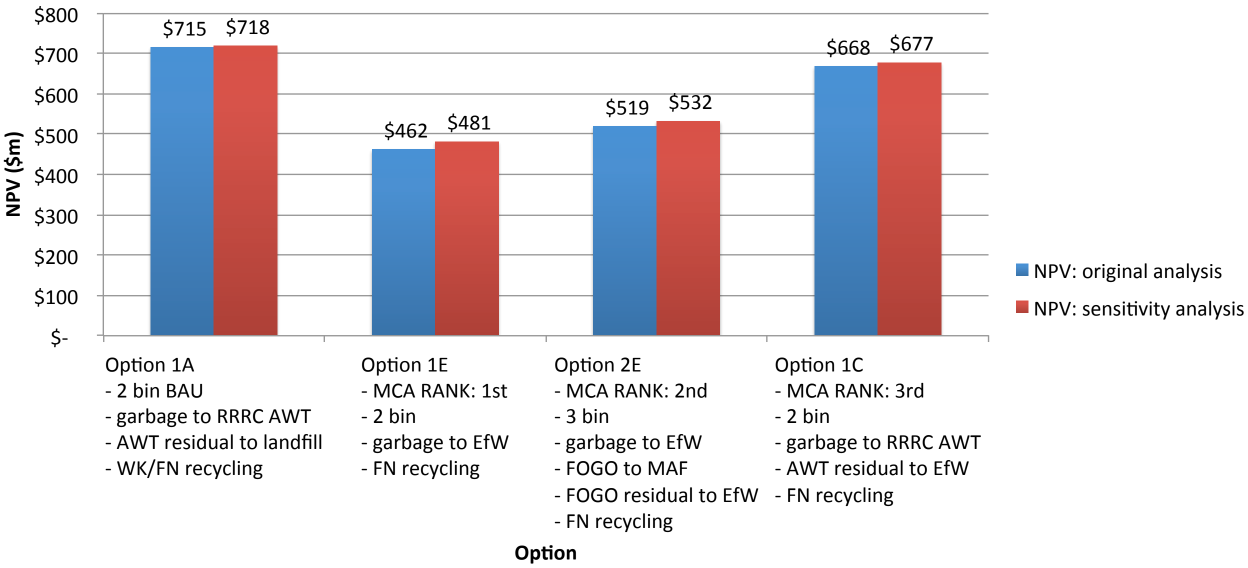
Figure G-2 System NPV comparisons assuming the EfW gate fee increases by $44/t




## G.3 EfW brick manufacturing risk: EfW residual brick making cost of an additional $100/t

The results show that Option 1E is the worst affected, increasing by 4%. This is followed by Option 2E, which increases by 2% (Figure G-3). The modified gate fee does not impact upon the relative cost of BAU and the top three scoring options.

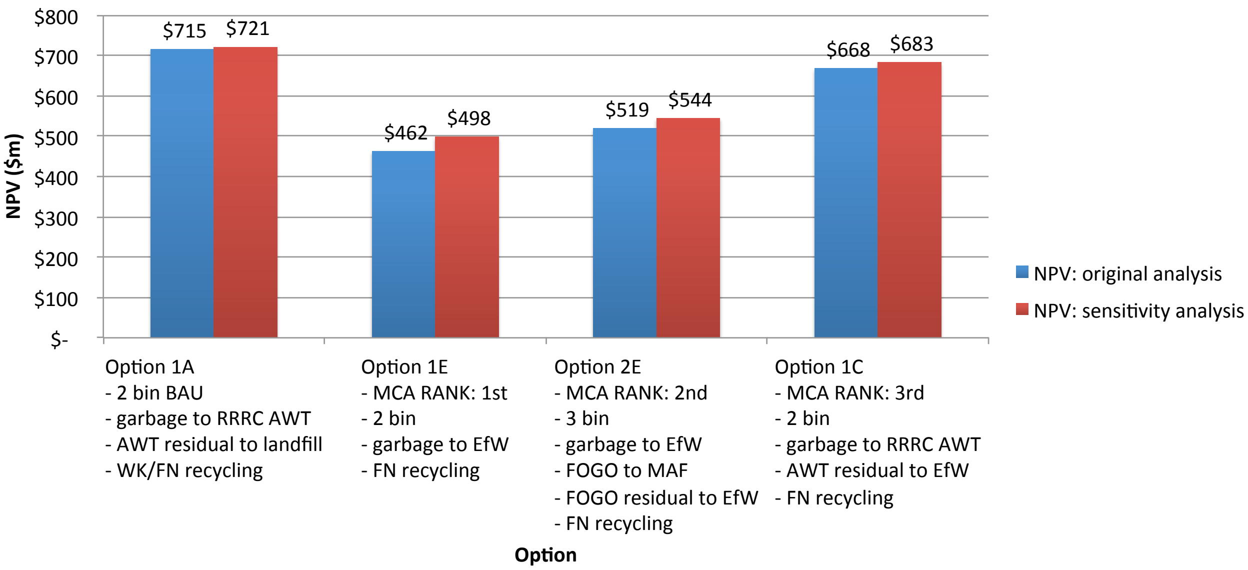
Figure G-3 System NPV comparisons assuming the cost to recycle bottom ash is $100/t of ash



## G.4 EfW ash disposal risk: class 3 and class 4 landfill disposal cost

The results show that Option 1E is the worst affected, increasing by 8%. This is followed by Option 2E, which increases by 5% (Figure G-4). The modified gate fee does not impact upon the relative cost of BAU and the top three scoring options.

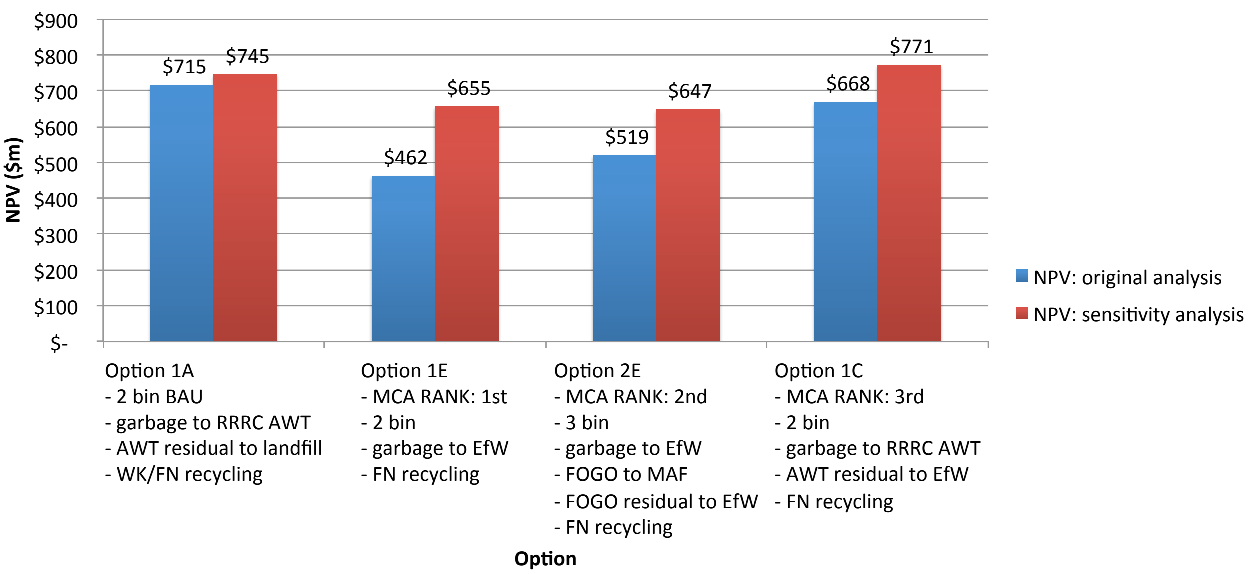
**Figure G-4 System NPV comparison: bottom and fly ashes sent to Class 4 landfills**




## G.5 EfW combined risks

The results show that Option 1E is the worse affected, increasing by 42%. This is followed by Option 2E, which increases by 25% (Figure G-5). The modified gate fee impacts upon the relative cost of BAU and the top three scoring options. Option 1E exceeds the cost of Option 2E by $8m. The cost would increase further if the EfW gate fee approached eastern seaboard AWT gate fees for all options, but would be highest for Option 1E.

**Figure G-5 System NPV comparison assuming cumulative EfW risks**



## G.6 Sensitivity summary

Options 1E, 2E and 1C are consistently the preferred options (in terms of MCA ranking).

The relative ranking of these options is not affected by marginal increases in the cost of EfW, however the risks and uncertainties regarding the performance and cost of EfW technology in Australia are considerable.

In the event that multiple risks occur concurrently, it is possible that the cost of Option 1E will exceed Option 2E. This was demonstrated in the EfW combined risk sensitivity analysis, conservatively assuming that the gate fee increased to $233/t.

# Appendix H Risk analysis

*@Risk* was used to perform a risk analysis using Monte Carlo simulations on the two highest scoring options from the MCA.

## H.1 Risk inputs

The software was used to determine the probability of different resource recovery and processing cost outcomes, taking into consideration a range of inputs (Table H-1 and Table H-2). The costs analysed exclude collection and miscellaneous costs used in the CCM.

The greatest gate fee risk is assumed for Phoenix Energy due to operational, capital and residual management concerns. This is followed by FOGO composting, which would need to be confirmed by tender. As SMRC owns both the SMRC and WCF, the risk associated with these gate fees is significantly less, which is reflected in the ranges included in the @risk inputs.

**Table H-1 @Risk analysis input: processing gate fee ex landfill disposal**

| Facility | Unit | Min | Most likely | Max |
|---|---|---|---|---|
| Phoenix Energy | $/t | $98 | $233 | $350 |
| WCF | $/t | $209 | $220 | $231 |
| RRRC MRF | $/t | $60 | $63 | $66 |
| FOGO Composting | $/t | $89 | $174 | $189 |

Diversion potential also varies across facilities, technologies and waste streams. The greatest diversion risk is assumed for Phoenix Energy, as the technology has not been successfully tested in the Australian market to date and it is unknown if any or all of the residual ash can be recycled. As all other technologies have been proven, the variation input for the @risk model is significantly lower compared against Phoenix Energy.

**Table H-2 @Risk analysis input: diversion**

| Facility | Unit | Min | Most likely | Max | Variation |
|---|---|---|---|---|---|
| Phoenix Energy | % | 68% | 85% | 102% | 20% |
| WCF | % | 54% | 60% | 66% | 10% |
| RRRC MRF | % | 77% | 85% | 94% | 10% |
| FOGO Composting | % | 81% | 90% | 99% | 10% |

## H.2 Risk results

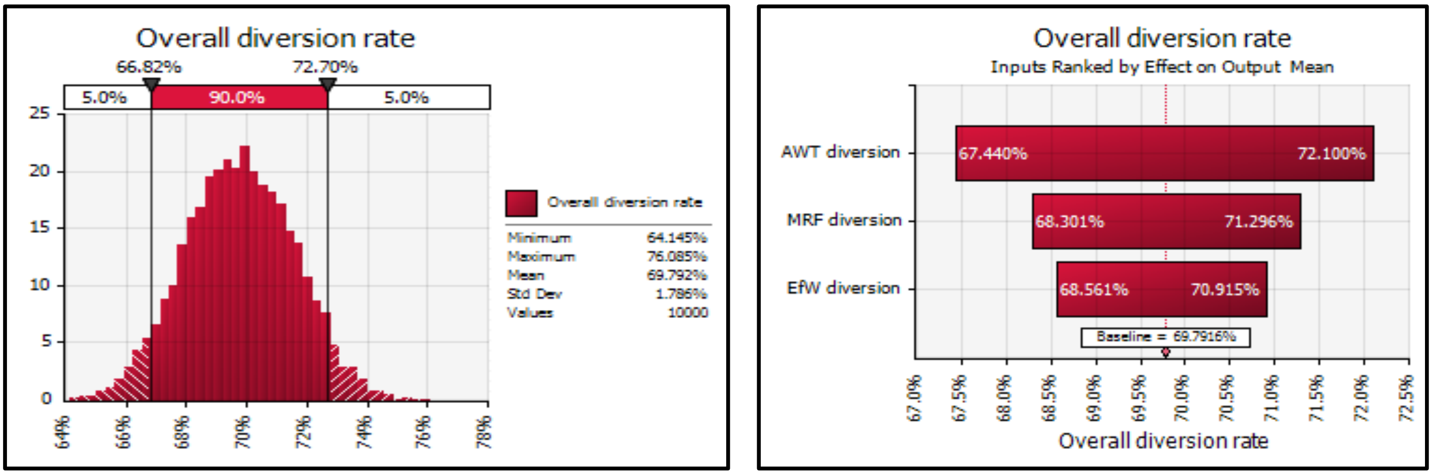
The most likely outcomes from the analysis show that the risk profile is much higher in Option 1E compared with Option 2E for all key performance indicators (KPIs) (Table H-3).

**Table H-3 @Risk analysis findings: Option 1E and Option 2E**

| *@Risk* KPI | Unit | Option 1E | | | Option 2E | | |
|---|---|---|---|---|---|---|---|
| | | P5 | Most probable | P95 | P5 | Most probable | P95 |
| Overall diversion rate | % | 66.82% | 69.79% | 72.70% | 83.76% | 88.92% | 94.00% |
| NPV of total processing cost | $m | 466.3 | 490.7 | 513.4 | 338.2 | 438.4 | 516.5 |
| Total project cost - 1st year | $m | 24.2 | 25.5 | 26.7 | 17.7 | 22.9 | 27.0 |
| Total project cost per input tonne - 1st year | $/t | 201.25 | 211.77 | 221.57 | 141.80 | 183.75 | 216.18 |

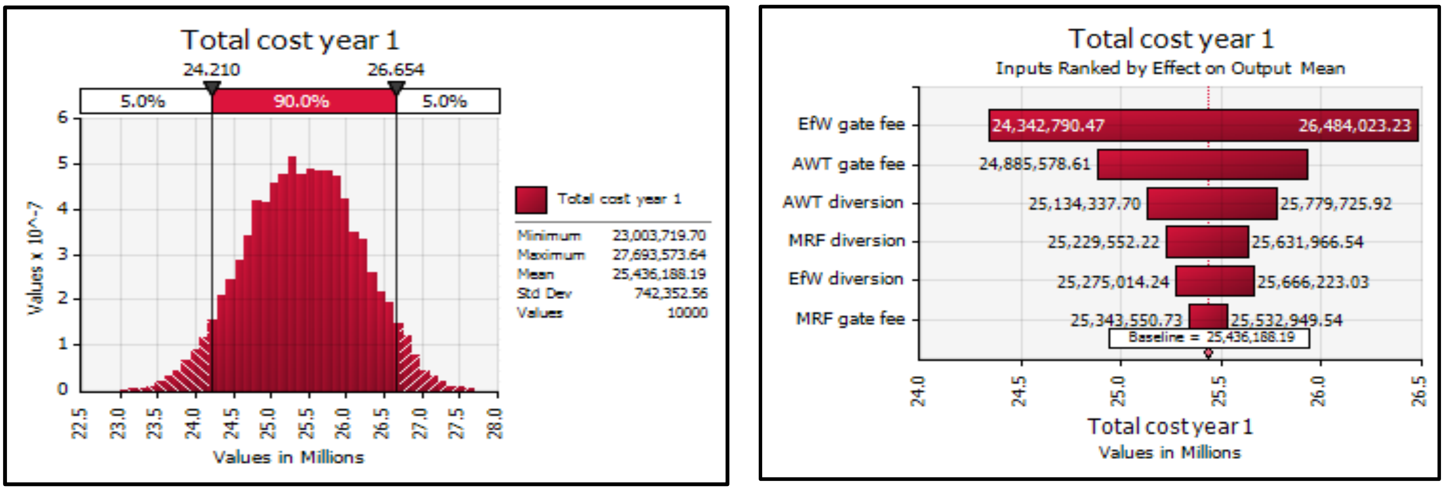
In Option 1E, the 90% confidence interval for resource recovery falls between 67% and 73%. The diversion risk is primarily driven by the large tonnes that are being processed via the WCF (Figure H-1).

**Figure H-1 Option 1E @Risk results: diversion**



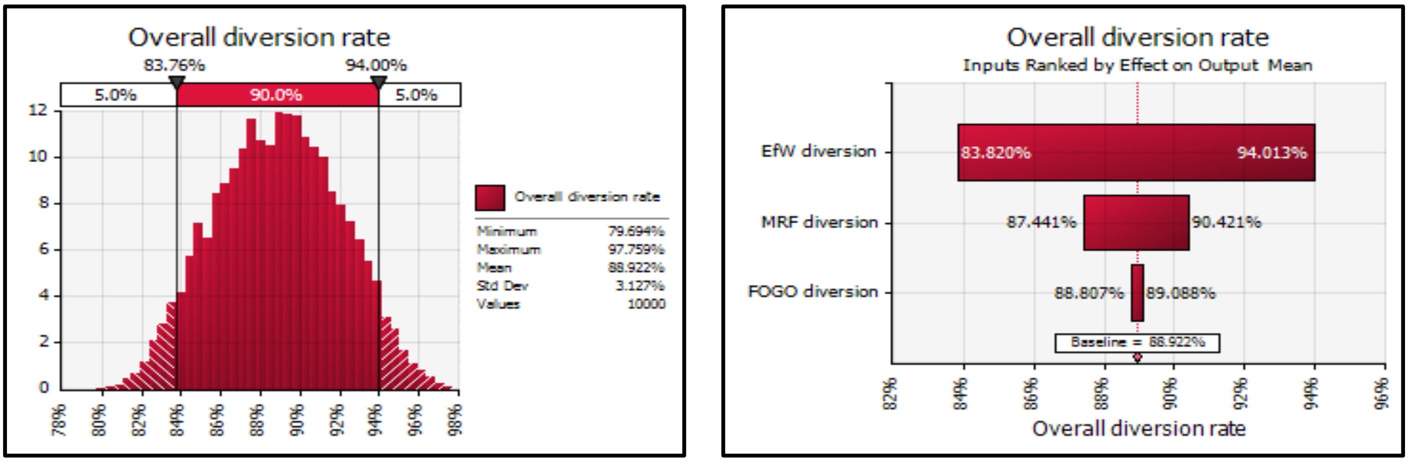

The 90% confidence interval for total processing cost in year 1 falls between $24m and $27m (Figure H-2). The processing gate fee risk is primarily driven by the large tonnes processed via EfW and the uncertainty regarding the gate fee of a viable EfW facility.

**Figure H-2 Option 1E @Risk results: total cost in year 1**



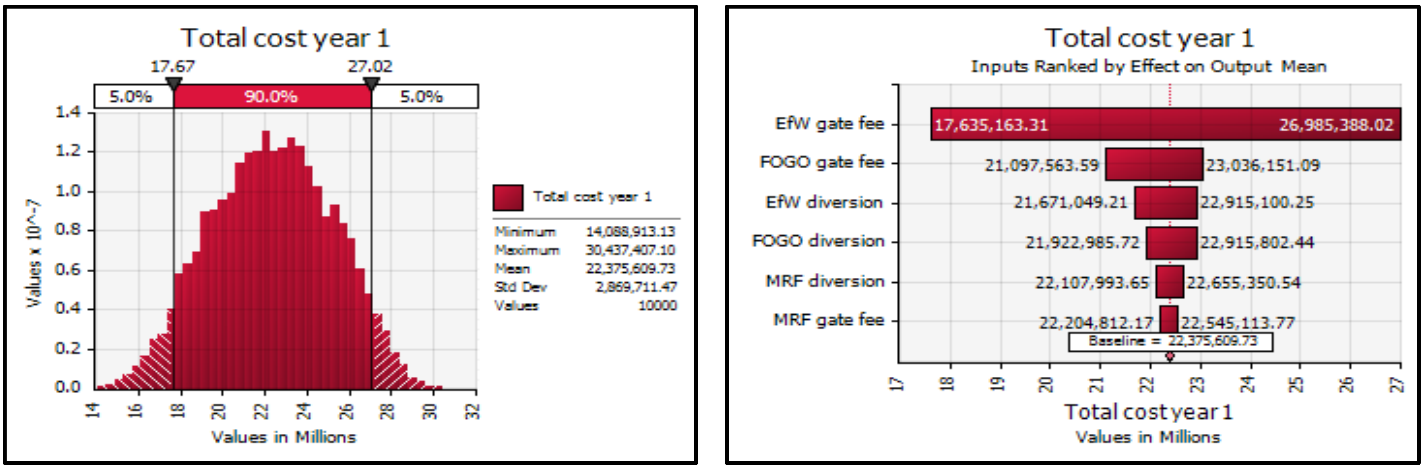

In Option 2E, the 90% confidence interval for resource recovery falls between 84% and 94% (Figure H-3).

**Figure H-3 Option 2E @Risk results: diversion**




The 90% confidence interval for total processing cost in year 1 falls between $18m and $27m (Figure H-2).

**Figure H-4 Option 2E @Risk results: total cost in year 1**




Option 1E if found to be a higher risk option than Option 2E. This is because:

- Significant tonnes are sent to EfW under Option 1E;
- The end use for EfW residual ash is uncertain (it may be recycled or landfilled depending on regulatory requirements and cost);
- The gate fee cannot be validated for EfW (The gate fee for facilities owned by SMRC are known);
- The gate fees for FOGO processing facilities (while not confirmed and should be resolved via a tender process) are known. There are FOGO composting operations in the market that are proven to operate in a known gate fee range and recovery rate range; and
- Landfill is a proven disposal technology posing minimal cost risk and known recovery rates.

The above risk analysis does not vary any of the recommendations of the Plan.

# Appendix I 3 bin GO options analysis

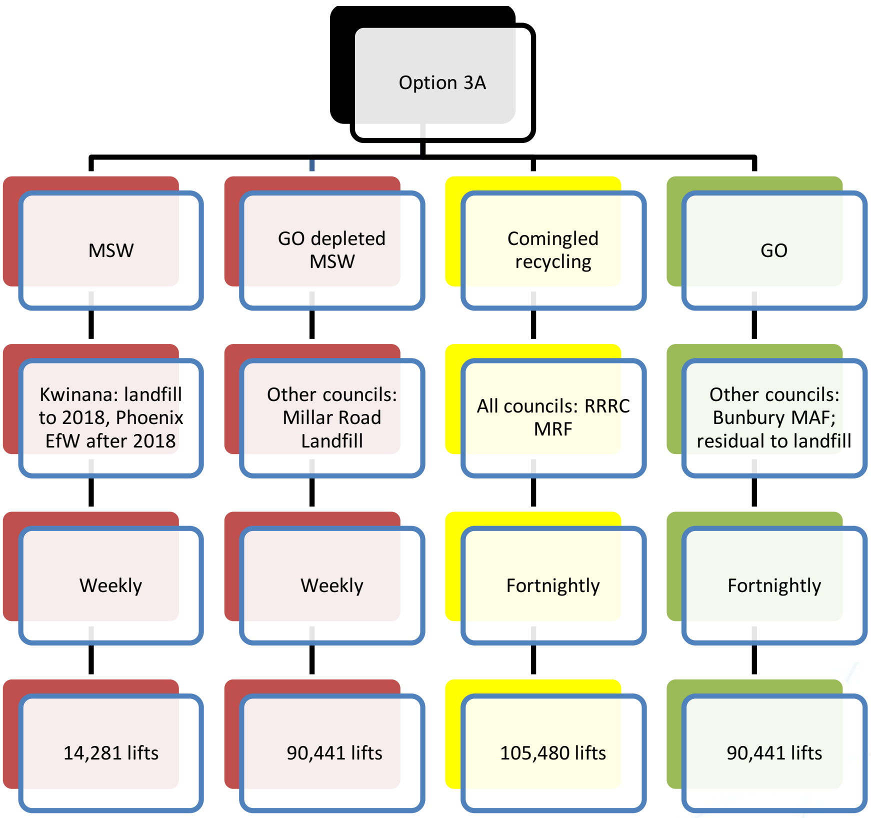
In addition to the 2 bin and 3 bin FOGO options modelled, SMRC wishes to investigate the relative cost and resource recovery differences between establishing a 3 bin FOGO system in comparison to a 3 bin GO system.

## I.1 Options

Three 3 bin GO options were modelled for the purposes of comparison. The options and analysis results are detailed in the following sections. For the purpose of analysis, the gate fee for GO processing at Bunbury MAF was assumed to be $80/t (inclusive of transport at $30/t).

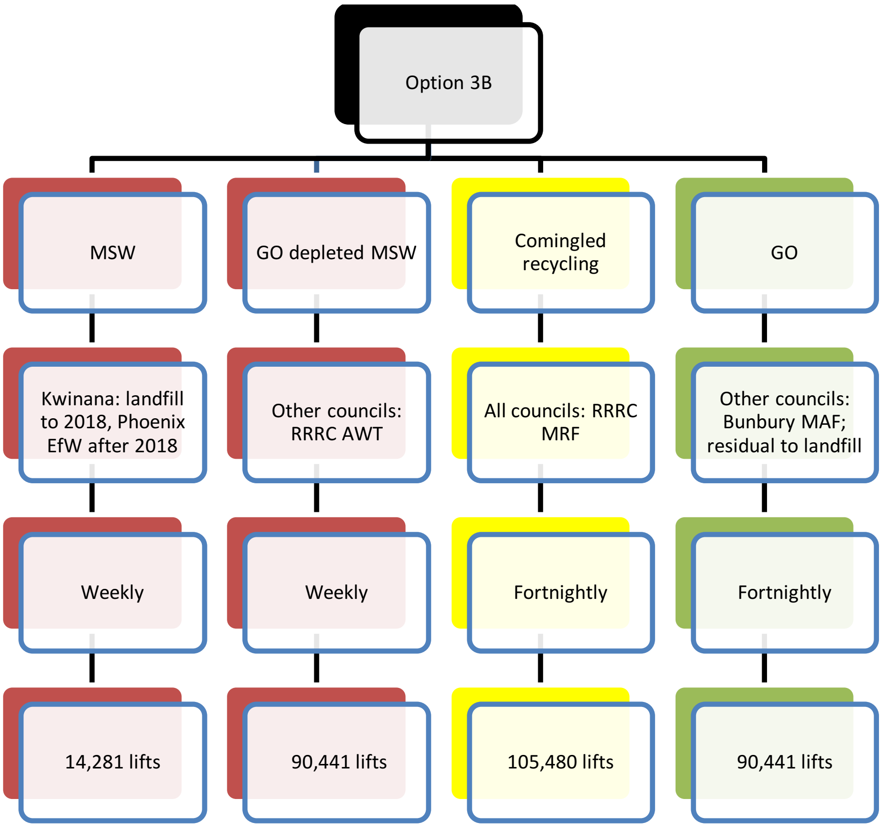
# Option 3A: 3 bin; MSW to landfill; GO to MAF; FN recycling

Option 3A reverts all dry recycling to a fortnightly collection service. GO depleted MSW is sent to landfill and GO is sent to an alternative composting facility (Bunbury MAF for the purpose of analysis).



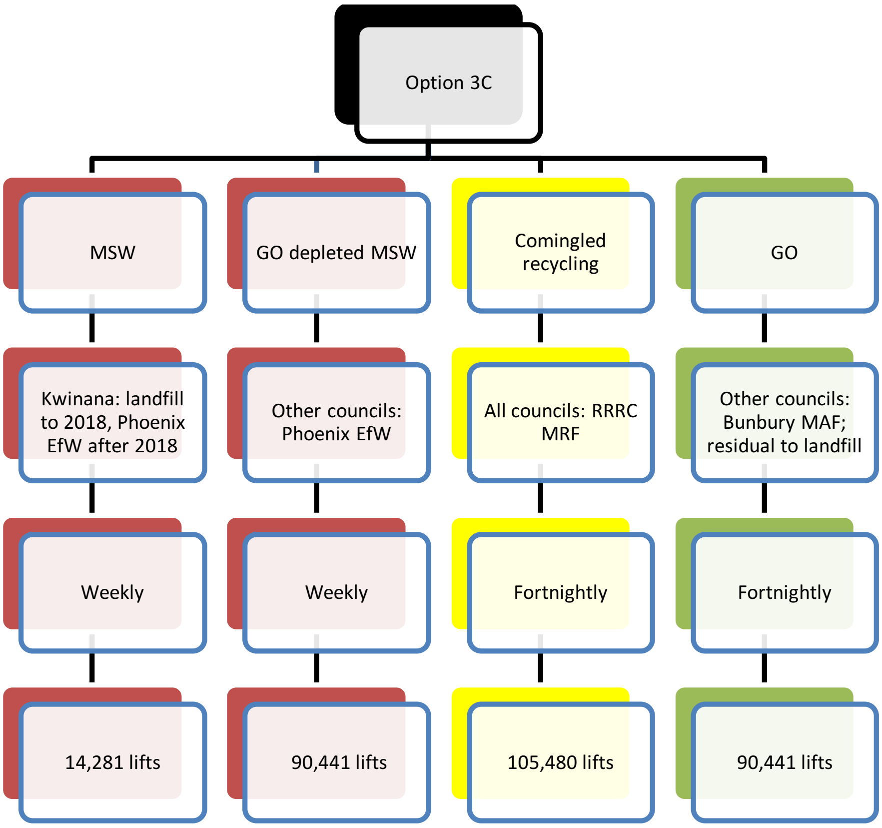
# Option 3B: 3 bin; MSW to RRRC AWT; GO to MAF; FN recycling

Option 3B reverts all dry recycling to a fortnightly collection service. GO depleted MSW is sent to RRRC AWT and GO is sent to an alternative composting facility (Bunbury MAF).



# Option 3C: 3 bin; MSW to EfW; GO to MAF; FN recycling

Option 3C reverts all dry recycling to a fortnightly collection service. GO depleted MSW is sent to an EfW facility (Phoenix) and GO is sent to an alternative composting facility (Bunbury MAF).



## I.2 Quantitative results

The results of the analysis have been provided in conjunction with the results for Scenario 1 (2 bin) and Scenario 2 (3 bin FOGO).

**Table I-1 NPV and recovery rate of full system options over 20 year planning horizon**

| Scenario | | System options | | System NPV ($m) | Recovery rate |
|---|---|---|---|---|---|
| 1 | 2 Bin | Option 1A BAU | - MSW to WCF<br>- AWT residual to landfill<br>- WK/FN recycling | $715.49 | 70% |
| | | Option 1B | - MSW to WCF<br>- AWT residual to landfill<br>- FN recycling | $676.98 | 70% |
| | | Option 1C | - MSW to WCF<br>- AWT residual to EfW<br>- FN recycling | $668.09 | 90% |
| | | Option 1D | - MSW to landfill<br>- FN recycling | $469.92 | 33% |
| | | Option 1E | - MSW to EfW<br>- FN recycling | $462.26 | 85% |
| 2 | 3 Bin | Option 2A | - Residual waste bin (red lid) to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to landfill<br>- FN recycling | $573.13 | 57% |
| | | Option 2B | - Residual waste bin (red lid) to landfill<br>- FOGO to RRRC drums<br>- FOGO residual to EfW<br>- FN recycling | $572.49 | 59% |
| | | Option 2C | - Residual waste bin (red lid) to landfill<br>- FOGO to MAF<br>- FOGO residual to landfill<br>- FN recycling | $520.77 | 57% |
| | | Option 2D | - Residual waste bin (red lid) to landfill<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | $519.76 | 59% |
| | | Option 2E | - Residual waste bin (red lid) to EfW<br>- FOGO to MAF<br>- FOGO residual to EfW<br>- FN recycling | $519.33 | 89% |

| Scenario | | System options | System NPV ($m) | Recovery rate | Scenario |
|---|---|---|---|---|---|
| 3 | 3 Bin | Option 3A | - Residual waste bin (red lid) to landfill<br>- GO to MAF<br>- GO residual to landfill<br>- FN recycling | $518.79 | 48% |
| | | Option 3B | - Residual waste bin (red lid) to RRRC AWT<br>- GO to MAF<br>- GO residual to landfill<br>- FN recycling | $673.01 | 65% |
| | | Option 3C | - Residual waste bin (red lid) to EfW<br>- GO to MAF<br>- GO residual to landfill<br>- FN recycling | $515.90 | 85% |

The results demonstrate that for comparable 3 bin organic systems (Option 3A and Option 2C), the FOGO option delivers significantly better recovery results for approximately the same cost. These results are consistent with other comparable GO and FOGO options implemented by local councils across Australia. It is recommended that if SMRC or a member council wish to implement a 3 bin system, that a FOGO system should be considered as a first priority.

There are additional costs with FOGO, including kitchen tidies, biodegradable bags, education and some contamination management. However even taking these into account, as the above analysis does, the difference between GO and FOGO at a system level is immaterial.

Therefore, if SMRC was to move to 3 bin system, this analysis suggests it should be to a full FOGO configuration.

# Appendix J Existing collection and processing systems

In Australia, landfill has been the default waste disposal method for decades. Increased public environmental awareness and technological innovations have led to a number of alternative waste management (AWT) methods. SMRC and its pioneering RRRC facility has achieved significant and persistently high rates of waste diversion from landfill. This section provides an overview of the existing and emerging technologies available for maximising diversion from landfill and increasing resource recovery.

## J.1 Collection systems and waste flows

The choice of waste management technology ultimately depends on the waste strategy's aims. In turn, the technology will determine the waste collection system choice and associated bin set up. This chapter presents the potential material waste flows in the SMRC including waste generation, resource recovery and landfill for municipal solid waste.

MSW is generated by residents and is managed by local councils. The MSW collection system varies from council to council. There are three overarching bin systems used by councils across Australia:

- Two bin system (residual and comingled recyclables);
- Three bin system (residual, dry comingled and garden organics (GO)); and
- Three bin system (residual, dry comingled and food and garden organics (FOGO)).

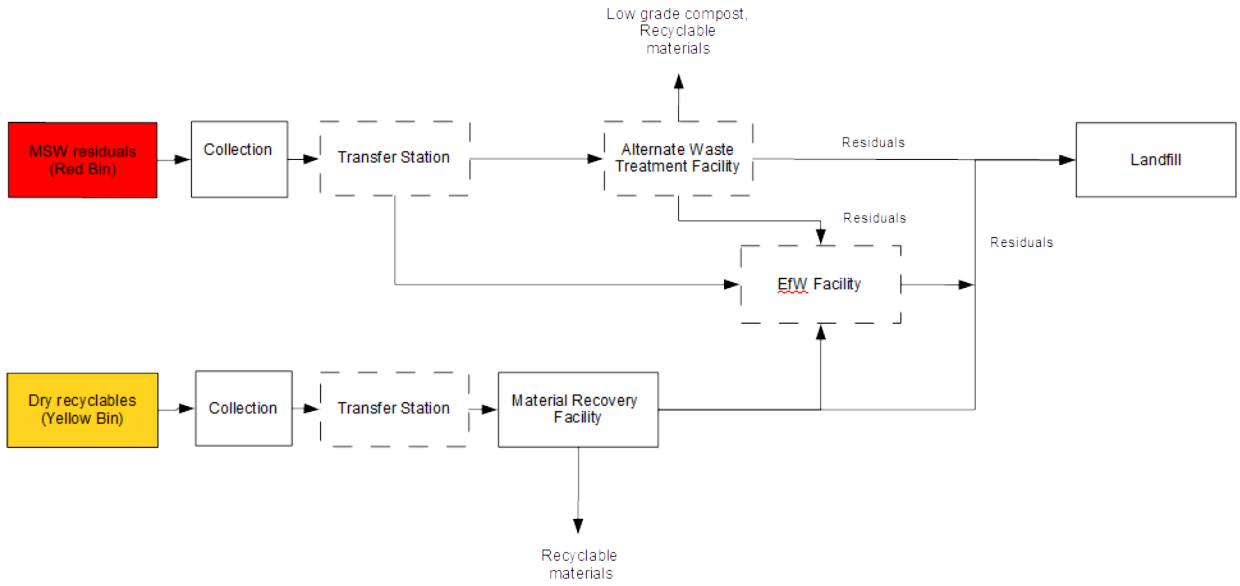
Although the above systems, are the major ones and the only potentially applicable to SMRC, a limited number of councils employ different systems. Some councils, mainly in rural Australia, continue using single bin systems where all household waste, including recyclables, is collected in one bin. Nowadays, this system is considered obsolete and the main reason for its continued existence is that due to area remoteness and low waste generations, it is uneconomical to have two collections in these rural areas. In such instances, it is common for councils to provide paper, container and green waste recycling drop off locations to residents.

Three/four bin systems based on the three systems listed above, also exist although they are being phased out due to a combination of higher costs and more efficient MRFs. In these systems councils offer two comingled recycling bins, one for containers and one for paper and cardboard. Although these systems are still in operation, in an attempt to rationalise costs, councils now often run them in parallel with the listed systems only offering the paper bin option to MUDs or office buildings.

# Two bin system

Under a two bin system, comingled recyclables are separated from general domestic waste and placed in a second yellow lidded bin that is collected separately and processed through a MRF to separate and recover materials. The MSW residual waste in red lidded bins can either go directly to landfill or be diverted through an AWT to extract valuable materials including organics to produce low grade compost and recyclable materials. After extraction of valuable materials residual waste from both AWT facilities and MRF are currently sent to landfill however this could change if an EfW becomes operational in WA. Figure J-1 outlines the main waste flows under a two bin system. Facilities shown within a dotted border introduce optional processing and therefore waste may or not pass through such a facility.

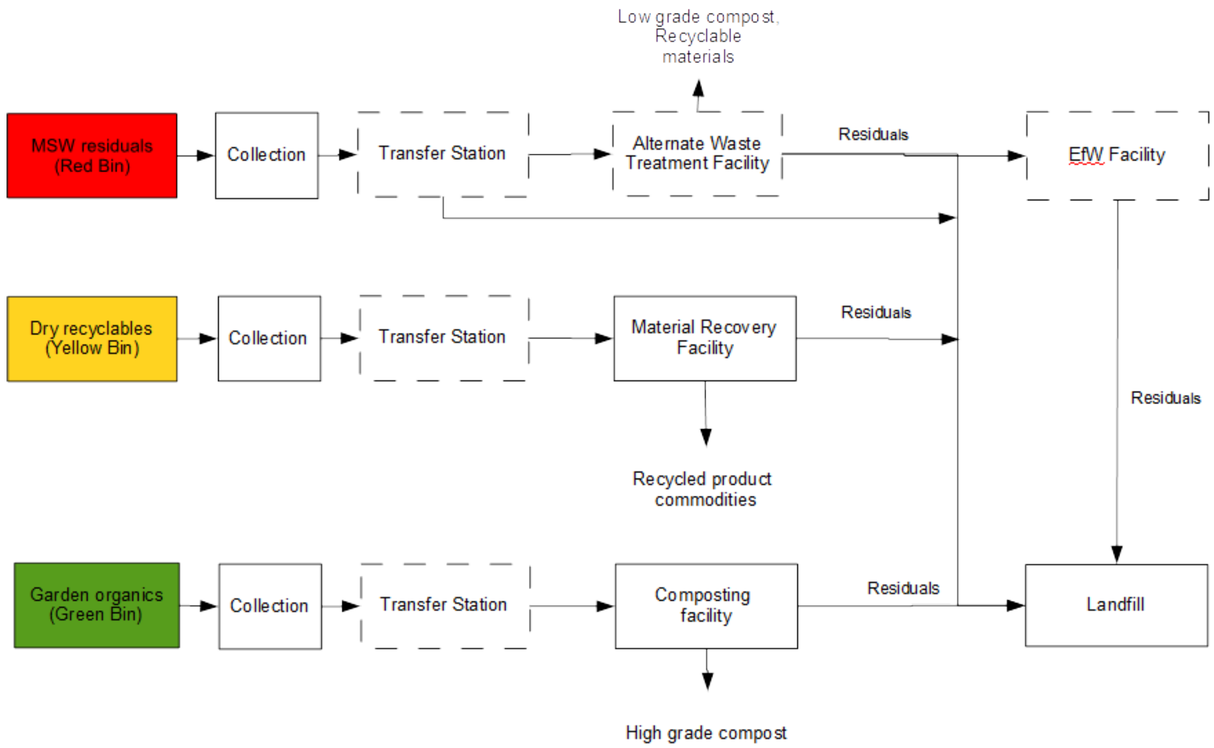
**Figure J-1 Two bin system waste material flows**



# Three bin garden organics system

Under a three bin GO system, residents are provided with separate bins for comingled recyclables and for garden organics. The remaining residual solid waste is placed in the red lidded residual waste bin. In addition to the recovery of recyclable materials at a MRF, GO are sent to a composting facility to produce high-grade compost (Figure J-2).

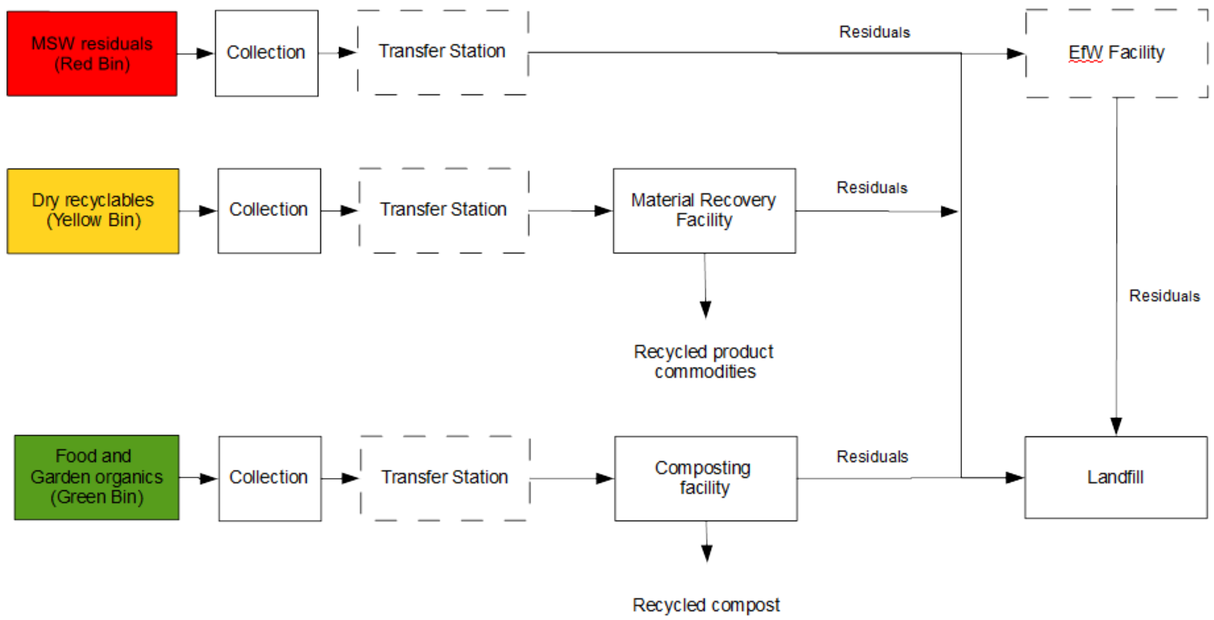
**Figure J-2 Three bin GO waste material flows**



# Three bin food and garden organics system

The three bin FOGO system follows a similar process to the three bin GO system however, food organics are also placed in the green lidded organics bin (Figure J-3).

**Figure J-3 Three bin FOGO waste material flow**



# Appendix K Alternative waste treatment

## K.1 Introduction

The waste flow figures above identify a number of general post collection waste management options. Landfill, although in widespread use, is becoming less desirable as a lot of potentially recoverable material is lost. Moreover, landfill technology is relatively straightforward and any new landfill in Australia would be required to follow best practice to be approved. This entails the installation of impermeable substrate layers, gas capture, odour, litter, water and runoff management systems. The most significant innovation in landfills in recent years is the bioreactor landfill which is built and managed in a way that accelerates anaerobic waste decomposition to produce as much methane as possible during the initial years after waste burial. Such landfills have extensive gas capture systems in place that collect methane to power electricity generators. However as waste is still being buried, bioreactor landfills do not serve to assist in achieving resource recovery targets and any waste buried still attracts the appropriate landfill levies.

Given that WA has implemented a landfill levy that will continue to grow and that SMRC already operates a successful Alternative Waste Treatment (AWT) facility that is achieving diversion rates much higher than what can be achieved in a system where landfill is the main management option, this section will focus on AWT.

For the purpose of this report, AWT facilities are defined to include the following technologies:

1. Tunnel/Enclosed/Drum Composting;
2. Anaerobic Digestion;
3. Gasification;
4. Incineration; and
5. Pyrolysis.

AWT in Australia is growing at a rapid pace. Many technologies are already in place or under trial. There are now more than ten AWT plants processing approximately one million tonnes of household waste. That represents approximately 5% of Australia's MSW. Rising landfill levies, carbon pricing and community attitudes are driving the adoption of AWT.

## K.2 Cost

The main threats to all AWT options have to do with the uncertainty surrounding current or announced policies in relation to waste management and the future cost of landfill. Cheap landfill undermines all alternative technologies. Other than composting, most of the above technologies require gate fees of $150/t or higher. The average cost of incineration and gasification overseas is $300 plus. The costs considerations are summarised below:

- All technologies have strengths and weaknesses, risks and opportunities;
- Thermal treatments generally have higher inherent risks than biological systems although incineration is a well-established technology;
- Anaerobic Digestion has a higher operational risk than the composting systems;
- Composting of residual household waste has a higher risk profile than composting SSO or GO;

- Composting GO has a lower risk profile than SSO but produces lower grade compost;
- Composting of SSO in combination with gasification of the high calorific fraction of MSW offers a two-step implementation process that provides for progressive evolution; and
- Pyrolysis competes with composting for the organic rich fraction of waste for the purposes of producing bio char.

## K.3 Climate change

Climate change is one of the most significant problems in environmental and economic management in Australia. Australia is the 15th largest emitter of greenhouse gases in the world and the highest emitter per capita.

Australia's landfills generate 3% of Australia's greenhouse gas emissions and as such, are targeted by the Federal and State governments for both reductions in organics disposal and improvements in or establishment of gas capture infrastructure. As alternatives to landfill, composting and Anaerobic Digestion technologies lead to reductions in greenhouse gas emissions. As such, both have been granted Carbon Credits under the Government's former Greenhouse Friendly Accreditation Scheme, and now under the Carbon Farming Initiative. There is still some debate about which technology type delivers the best comparative gain and there is no clear picture of the best way forward.

Anaerobic Digestion can be used for generating renewable energy however it commonly suffers from methane leakage while the types of organic feedstock it can process are more limited than that of composting.

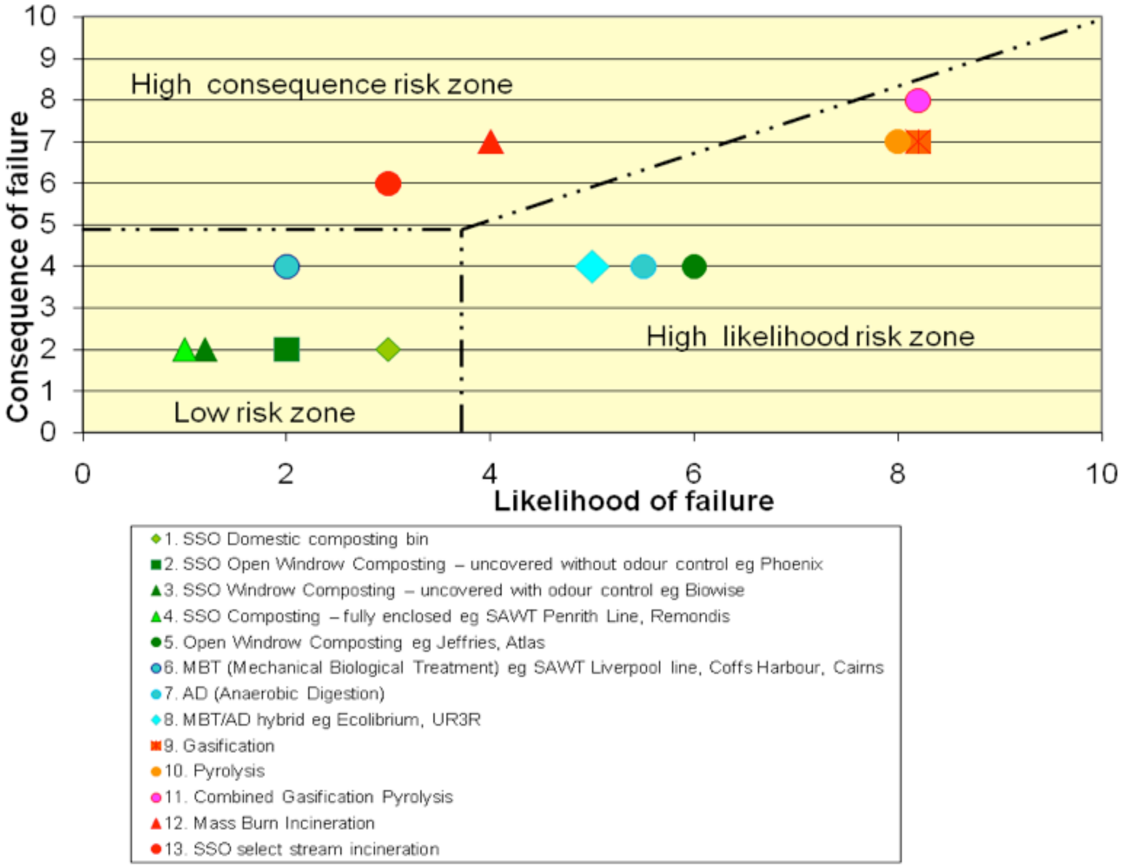
Thermal treatments have obvious greenhouse gas benefits as they both divert waste from landfill and extract thermal calorific value from waste. Pyrolysis has the added benefit of producing biochar from organic material that can be used to sequester carbon in soil. The sequestration rates and permanence of the sequestration are still the subjects of intense scientific investigations.

The combination of composting/AD for the organic rich fraction of the waste with thermal treatment of the high calorific fraction provides the greatest diversion from landfill and greenhouse gas benefits. For example 3-bin SSO composting combined with gasification of the high calorific fraction (textiles and plastics) provides maximum diversion from landfill and significant greenhouse benefits. Such combinations are advantageous in that they can be implemented in stages, as technology becomes verified and available.

## K.4 Technology risk

Each technology has a unique risk profile. Risks are a function of both the likelihood of failure and a measure of the consequence or severity of failure. Incinerators for example have a relatively low likelihood of failure but the consequences of for example, any accidental dioxin emissions, are high. **Error! Reference source not found.** shows a relative risk profile matrix compiled by MRA for various AWT technologies.

**Figure K-4 Relative risks associated with various forms of AWT (as assessed by MRA)**




Windrow and in-vessel composting facilities along with traditional landfills are considered more reliable options having been tried and proven in Australia over many years. Anaerobic Digestion is relatively higher risk when applied to waste streams. Food Organics (FO) and bio-solids processing through AD is well developed. However, there are no examples of MSW processing through AD being successful in Australia (although several companies claim success in facilities operating overseas).

Incineration is a robust and well tested technology while gasification and pyrolysis are not as established or implemented and therefore carry higher technology risk. Any move toward these technologies would constitute an increased risk profile for the Councils. The Victorian, WA[20] and NSW governments have recently released draft Energy from Waste guidelines. These guidelines essentially have three controls: the thermal treatment must not cannibalise recycling (and be able to prove that it does not); it must be a bona fide waste to energy plant (not just a waste disposal plant) and it must ensure that its air emissions conform to European emission standards. Combined these effectively rule out mass burn incineration as an option in these states.

[20] www.wasteauthority.wa.gov.au/publications/waste-to-energy?resources/waste-to-energy

## K.5 Mechanical biological treatment (MBT)

Organic MBT systems generate both low and high grade composts. Australia has some of the most degraded soils in the world. As a result, high grade composts have virtually unlimited markets.

Because of the lack of control on what a householder places in their residual bin, residual composting has a higher inherent risk than green or organics composting and generally produces lower grade composts. The market for low grade compost for mine site rehabilitation has proved positive and future additional regulation requiring mine site rehabilitation would further stimulate this market.

Like thermal processes, biological composting can release small amounts of methane if not controlled properly. Leachate and odour also need to be closely controlled. Odour management through full enclosure will be required as soon as food is added to the input material streams.

# Open windrow composting – some examples

Open windrow composting is an aerobic process. It requires air: controlled aerobic decomposition of organic garden waste in a windrow with the help of microorganisms to form stabilised debris (compost). This process involves passive aeration with periodic turning to build porosity and to release trapped gas and heat.

# Dulverton windrow composting, Tasmania

| | | |
|---|---|---|
| A. | Description | Windrow composting system which opened in 2008. Inputs are analysed for nutrients and elements prior to composting, and continual monitoring is undertaken throughout to comply with Australian Standards (AS 4454). |
| B. | Location | Latrobe, Tasmania. |
| C. | Throughput | 20,000tpa |
| D. | Inputs | Fish frames, milk factory by-products, abattoir manure waste, bio-solids, municipal green waste and high quality wood chips, sourced from across Tasmania. |
| E. | Residence Time | 8 weeks with daily monitoring, another 8 weeks with bi-weekly monitoring. |
| F. | Saleable Outputs | High quality organic compost, popular in agriculture, orchards and vegetable growing. |
| G. | Capital Cost | $1 |
| H. | Cost/t | $50-70/t |
| I. | Diversion Rate | 95% |
| J. | Footprint | 2 ha |
| K. | Reference Plants | Not required |
| L. | Experience to Date | Since early 2011 odour complaints have been made to the EPA. |

# Groundswell Composting, Goulburn NSW

| | | |
|---|---|---|
| A. | Description | Open windrow composting system using inoculants (VRM) and plastic covers. This is a "no turn" system and therefore reduces labour and operating costs. Material is only turned once during the composting cycle (as compared to fortnightly), resprayed, cured and then stored. It is a low intensity composting system with minimal capital costs. Groundswell system at Goulburn serviced 9200 households. The technology was used at 4 sites and were trialled. |
| B. | Location | Goulburn, NSW. |
| C. | Throughput | Collectively the scheme processes 1,800 t (Soil to Project scheme serviced Goulburn, Queanbeyan, Palerang and Lachlan Council). Data is not available for Goulburn. |
| D. | Inputs | Household food and green waste. |
| E. | Residence Time | 4-6 weeks, turned, and another 4-6 weeks. |
| F. | Saleable Outputs | Compost. |
| G. | Capital Cost | $0 (Much of infrastructure was already in place). |
| H. | Cost/t | $50-70/t. |
| I. | Diversion Rate | 95% |
| J. | Footprint | 1 ha |
| K. | Reference Plants | The trials were conducted at 4 councils in Southern NSW. The other councils were Lachlan Shire, Queanbeyan City and Palerang Shire. |
| L | Experience to Date | Trials for the Groundswell Project were conducted in 2009 and 2010.<br>At the time of the trail, there were some odour problems, however not clear cut. Very low contamination through coupling introduction of food and green waste bins with successful community education and engagement programs. |

# Katoomba Waste Management Facility, Blue Mountains NSW

| | | |
|---|---|---|
| A. | Description | Open Windrow Composting Facility is located at the Katoomba Waste Management Facility in the Blue Mountains. Incoming organics are preliminary sorted to remove contaminants such as plastics and organics unsuitable for processing. Material is then stockpiled and shredded and placed in open windrows. Temperature and moisture levels in the windrows are monitored and additional water/leachate is added when necessary. Aerobic conditions are maintained through periodic turning of the windows. |
| B. | Location | Katoomba, Blue Mountains NSW. |
| C. | Throughput | Approximately 3,000tpa. |
| D. | Inputs | Organic waste. |
| E. | Residence Time | Organics stockpiled for approximately 4 months until 1,000 tonnes of waste has been collected. This is then shredded and stockpiled for a further 4 to 5 months. |
| F. | Saleable Outputs | Majority of the material is transferred to a wholesaler for blending and bagging. The final product is then sold as potting mix. |
| G. | Capital Cost | $0.25 |
| H. | Cost/t | $60/t |
| I. | Diversion Rate | 95% |
| J. | Footprint | 1ha |
| K. | Reference Plants | Not required |
| L | Experience to Date | Open Windrow Technology is commonly utilised in Australia and internationally, as it is a relatively simple and inexpensive process. |

# Greenchip, Wodonga Vic

| | | |
|---|---|---|
| **A.** | **Description** | The collected material is monitored on arrival for contamination and is then mulched, blended and formed into composting windrows. These windrows are then thoroughly wet with recycled water from the manufacturing site and the adjacent saleyards. They are then monitored for temperature, odours, and moisture and then turned for a period of seven to eight weeks according to Australian standards for composts. |
| **B.** | **Location** | Bandiana, Victoria. |
| **C.** | **Throughput** | 15,000 tpa/30,000 cubic metres. |
| **D.** | **Inputs** | Green waste, mill waste, animal manure, food waste and other organic materials from a 100km radius of the local area. |
| **E.** | **Residence Time** | 8 weeks, not including storage for maturity. |
| **F.** | **Saleable Outputs** | Compost including ground cover and high level compost, 16,000 cubic metres in total. Markets in the area include garden supply centres, viticulturists, orchardists, vegetable growers, tree propagators, landscapers, farmers and forest industries. |
| **G.** | **Capital Cost** | $0.25 |
| **H.** | **Cost/t** | $60 |
| **I.** | **Diversion Rate** | 95% |
| **J.** | **Footprint** | 1.3 hectares. |
| **K.** | **Reference Plants** | Not required |
| **L** | **Experience to Date** | It has been the subject of ongoing odour complaints since at least 2008, largely from residents at the growing Killara housing estates.<br>2013: Wodonga councillors lodged proceedings with VCAT (Victorian Civil and Administrative Tribunal Cases), which are still ongoing.<br>April 27, 2015: Wanting to build a new shed for pellet fertiliser. |

# Aerated Static Pile – Some Examples

Aerated static pile composting: Odour issues which have been experienced with open windrow can be overcome by removing the turning process and instead using controlled aeration with perforated piping to decrease biodegradation time and control air flow. One form is mobile aerated floor (MAF), which is a compact and mobile system of this type. Other forms can take place in open or covered windrows or in closed containers.

# MAF (Mobile Aerated Floor), Taree NSW

| | |
|---|---|
| **Description** | This trial is a collaboration between the Greater Taree City Council, the NSW EPA and the Mobile Aerated Floor (MAF) personnel, and was conducted under the supervision of the Recycled Organics Unit (formerly of UNSW). The MAF channels air under the windrows to accelerate the composting process. The system is lightweight, mobile and flexible. |
| **Location** | Taree, NSW |
| **Throughput** | 6,500 tpa. |
| **Inputs** | Food and garden waste from local council area, chicken manure, wool mfg. residue and liquid waste from the food industry. |
| **Residence Time** | 8 weeks |
| **Saleable Outputs** | Compost for both council and public use. AS4454 composts. |
| **Capital Costs** | $0.25million |
| **Operating Costs** | $60-80/t |
| **Footprint** | $0.3m- $1.5m for MAF system only. |
| **Diversion Rate** | 95% |
| **Experience to Date** | Taree City Council intends to proceed and expand the trial facility, as it has met expectations. The system has met reasonable expectations for control of odour and vector nuisance problems. |

# MAF The Jeffries Group, Adelaide SA

| | | |
|---|---|---|
| A. | Description | South Australian owned company using MAF windrow technology, 'Jeffries Recycled Organics Sorting System'. Organic material is placed on top of concrete channels with pipes that deliver fresh air. Probes measure the oxygen levels. Previously used mechanical turning. |
| B. | Location | MRF at Wingfield, composting at Buckland Park Composting facility, SA. |
| C. | Throughput | 100,000tpa. |
| D. | Inputs | Municipal green organics from Adelaide's council kerbside and business collections along with larger organic waste producers such as hotels, supermarkets, schools, office buildings, food processors and manufacturers. |
| E. | Residence Time | 8-10 weeks |
| F. | Saleable Outputs | Stock and custom blend compost, soil and mulch for landscaping, gardening, vineyards, vegetable growers, orchards and turf management. |
| G. | Capital Cost | $3 M |
| H. | Cost/t | $50-70/t est. |
| I. | Diversion Rate | 95% depending on input quality |
| J. | Footprint | Main processing site in Jeffries Buckland Park is 125 ha. |
| K. | Reference Plants | Not required |
| L | Experience to Date | In 2007, it recovered 90% of the nearly 1 Mt of waste received. |

# MAF Peats Soil, Adelaide SA

| | | |
|---|---|---|
| A. | Description | Open triangle windrow composting with eighteen aeration units. |
| B. | Location | Adelaide, SA. |
| C. | Throughput | 60,000tpa. |
| D. | Inputs | Municipal green waste, chicken manure, woof manufacturing residue, liquid waste from food industry. |
| E. | Residence Time | 8 weeks |
| F. | Saleable Outputs | Fresh compost for agriculture. |
| G. | Capital Cost | $1million |
| H. | Cost/t | $50-70/t est. |
| I. | Diversion Rate | 95% depending on inputs |
| J. | Footprint | 1ha |
| K. | Reference Plants | Custom Composts in Perth WA, Pinegro in Victoria, Universal in Gunnedah NSW, and Gelita, and a trial is underway in Taree. Also two plants in Germany. |
| L | Experience to Date | Have experienced some elevated odour emissions, maturation issues and high material handling costs. The plant does not have a grid electricity supply and uses a small generator for base load power, a strategy which they have found to be very successful. In 2010 Peats increased the number of units they were using from 6 to 18. |

# Custom Composts, Perth WA

| | | |
|---|---|---|
| A. | Description | Uses 12 master MAF units and 18 sub units to produce an advanced windrow-composting unit. |
| B. | Location | Perth, WA. |
| C. | Throughput | 10,000 |
| D. | Inputs | Green waste bio-solids, bark and wood chips, agricultural waste, various liquid wastes. |
| E. | Residence Time | 8-10 weeks |
| F. | Saleable Outputs | Australian standard composts and mulches. |
| G. | Capital Cost | $0.5 – 1 million to set up for 10,000t. |
| H. | Cost/t | $50/t |
| I. | Diversion Rate | 95% depending on inputs |
| J. | Footprint | 1ha |
| K. | Reference Plants | Peat's Soils in Adelaide SA, Pinegro in Victoria, Universal in Gunnedah NSW, and Gelita, and a trial is underway in Taree. Also two plants in Germany. |
| L | Experience to Date | Switched to MAF from open windrow composting after rapid growth required an increase in plant capacity. Experience has been mostly positive with reductions in surface area requirements. |

# Generic MAF Costs for Australian Proposals

| Quantity Processed (input tonnes/year) | Capital Budget (indicative cost in $) |
|---|---|
| 5,000 | $800,000 |
| 10,000 | $1,600,000 |
| 15,000 | $2,200,000 |
| 25,000 | $4,000,000 |
| 30,000 | $4,4 00,000 |
| 50,000 | $7,000,000 |

## Biowise

Closed in 2014 after the DEC and the City of Kwinana imposed tighter restriction and required the company to fully enclose its operations to negate all odour issues.

## Perthwaste North Bannister Resource Recovery Facility (Opened March 2015), WA

| | | |
|---|---|---|
| A. | Description | |
| B. | Location | Perth, WA. |
| C. | Throughput | 23,000 t |
| D. | Inputs | Household and commercial organic waste. |
| E. | Residence Time | 8 weeks. |
| F. | Saleable Outputs | Compost used in landscaping and agriculture. In most cases, it will be used back in the Council areas where the garden waste was collected. |
| G. | Capital Cost | $0.5million compost only |
| H. | Cost/t | $50-70/t est. |
| I. | Diversion Rate | 95% |
| J. | Footprint | One windrow is 585 $m^2$ in area. Piles measure 15m x 35m x 3.5m. |
| K. | Reference Plants | Nil required |
| L | Experience to Date | Expected 80 year life. Stockpiles are watered and once conditioned to 60% moisture, a thick 300mm layer of coarse composted mulch is placed over the stockpile. |

## Fabric Covers – some examples

Covers that aid the composition process. GORE Cover is one type of fabric cover that has a semi-permeable membrane.

## GORE cover TPI (Wodonga)

| | | |
|---|---|---|
| A. | **Description** | Windrow composting of organic material using highly engineered covers which permit moisture ingress and egress but block odour molecular movement. |
| B. | **Location** | Trialled in Wodonga Vic. Permanent in Timaru, NZ. |
| C. | **Throughput** | 5000t |
| D. | **Inputs** | Green waste bio-solids, bark and wood chips, agricultural waste, various |
| E. | **Residence Time** | 8 weeks |
| F. | **Saleable Outputs** | Australian standard composts and mulches. |
| G. | **Capital Cost** | \$0.5 – 1 million to set up for 10,000t. More than MAF but lower costs than engineered tunnels. |
| H. | **Cost/t** | \$70-80/t est |
| I. | **Footprint** | 1ha |
| J. | **Diversion Rate** | 95% depending on inputs |
| K. | **Experience to Date** | TPI are proposing the first commercial scale GORE system for the Albury Wodonga green waste service in Albury NSW - Currently subject to legal action. Gore and Biodegma systems have operated successfully in Europe for many years. |




# Tunnels – some examples

A static biological process where the composting process is accelerated through forced supply of air.

## Shepparton Tunnels

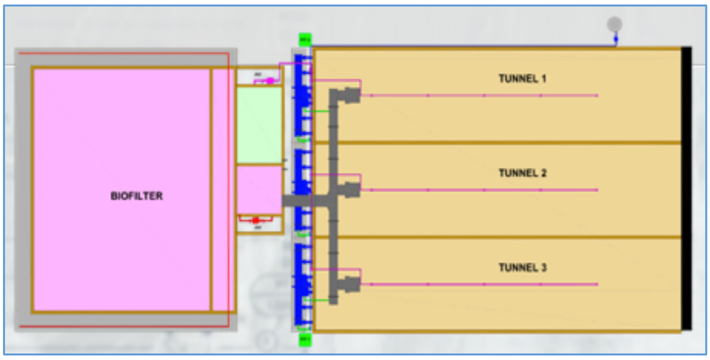
| | |
|---|---|
| **Description** | The facility for the processing and marketing of green waste collection in Greater Shepparton Council is operated by Western Composting Technology Pty Ltd. The technology automatically adjusts and regulates air volumes, temperature and moisture levels as the facility is remotely controlled by a process control computer in the plant office. Emission generated from the process are captured and deodorised of all offensive odours through biofilter technology. |
| **Location** | Shepparton, VIC. |
| **Throughput** | 20, 000 tpa of green waste. |
| **Inputs** | Source separated organics form kerbside collection. |
| **Residence Time** | Approximately 21 days. |
| **Saleable Outputs** | High grade compost. |
| **Diversion Rate** | 95%. |
| **Cost/t** | $60 – 100/t |
| **Reference Plants** | Shepparton Victoria |
| **Experience to Date** | Operating successfully. |

# Remondis Tunnels, Port Macquarie NSW

| | |
|---|---|
| **Description** | Built in 2001 to process organic waste and prestabilise residual waste so that it could be landfilled in a Class 2 landfill. This system has two different process lines. The first utilises mechanical mixing and in-vessel (tunnel) composting to process domestic and commercial source separated organics (garden waste, food waste and biosolids). Temperature, air flow and moisture are monitored and controlled. Air emissions are scrubbed in a biofilter.<br>The other utilises mechanical separation (trommel) and composting on an aerated static floor in order to render inert the organic fraction of mixed solid waste. This stream is landfilled (but could form an EfW stream in future). |
| **Location** | Hastings NSW, Cairncross landfill. |
| **Throughput** | Source separated organics 30,000tpa. MSW and C&I are currently 21,000tpa with expansion modules of 2,500tpa available. |
| **Inputs** | Domestic and commercial source separated organics, biosolids, residual MSW and C&I. |
| **Residence Time** | 31 days. |
| **Saleable Outputs** | 13,000tpa of high grade composts, 500tpa of steel. |
| **Diversion Rate** | Average of 55% since commencement in 2001. |
| **Capital Cost** | $10 million. |
| **Cost/t** | $120/t or more. |
| **Footprint** | 20, 000 $m^2$. |
| **Experience to Date** | The plant has been operational since 2001 and over the intervening 12 years has suffered no significant downtime and no waste has been rejected during this period. The plant would be regarded as one of the benchmarks of organic processing technology in Australia.<br>Two Tunnel units, tunnels converts organic material. |

# Grafton Tunnel Composting

| | | |
|---|---|---|
| A. | Description | A tunnel composting plant was commissioned in September 2012 for Grafton Valley Council. JR Richards & Sons have been awarded a 10-year contract for the construction and operation of the plant. The incoming material is shredded and loaded into tunnels where it is composted for 2 weeks. After this time the material is removed and stockpiled in open windrows for maturation for an additional 3 weeks. Air is treated via biofilters to extract offensive odours. |
| B. | Location | Grafton Regional Landfill, NSW |
| C. | Throughput | Three tunnels with a total processing capacity of 12, 000 tpa. |
| D. | Inputs | Garden and food organics. |
| E. | Residence Time | 5 weeks. |
| F. | Saleable Outputs | AS 4454 compost standard products. |
| G. | Capital Cost | Capital is financed by Council |
| H. | Cost/t | $100-120/t |
| I. | Diversion Rate | 95% depending on inputs |
| J. | Footprint | 20,000sqm |
| K. | Reference Plants | A similar 4 tunnel composting plant was recently constructed by JR Richards & Sons for Orange City Council. Similar technologies, which operate under the same principles, such as box and container systems, have been utilised at a commercial scale in Australia. |
| L | Experience to Date | Combined with the MRF, results from Clarence Valley Council showed:<br>• Diversion rate increased 24%<br>• Kerbside recycling increased by 31% and kerbside organics increased by 41%<br>• Organics rejects <1% |




# Veolia Tunnel Composting NRS

| | | |
|---|---|---|
| A. | Description | The Veolia In-Vessel Composting system utilises enclosed, aerobic conditions to convert garden and food waste into high quality compost. Natural Recovery Systems (NRS) is a joint venture between Veolia Environmental Services and CR Hudson and Associates-the developers of the in-vessel composting technology. The plant currently has five vessels operating at the facility. |
| B. | Location | Dandenong, VIC. A further licence has been granted to Gippsland Water, for the construction of another facility in Eastern Victoria. |
| C. | Throughput | 4,000-6,000tpa per in-vessel unit. This is dependent on the type of waste and the amount of time waste is retained in the vessel. |
| D. | Inputs | Garden and food organics. |
| E. | Residence Time | 6 - 8 weeks. |
| F. | Saleable Outputs | High quality compost. 20,000 t of CO2 abatements. |
| G. | Capital Cost | Capital is financed by Council |
| H. | Cost/t | $5.8 million est |
| I. | Diversion Rate | 95% depending on inputs |
| J. | Footprint | 20,000sqm |
| K. | Reference Plants | The in-vessel composting was constructed in response to the Bulla landfill being 2 years out from reaching capacity. |
| L | Experience to Date | This is a mature technology, which was developed and vigorously tested over a five-year period during the late 1990's. The facility is still operating, a testimony to its ongoing success.<br>2013: Gained CFI accreditation. The accreditation means Veolia can issue Kyoto ACCUs based on the tonnage of material diverted from landfill. |

# Biomass Solutions, Coffs Harbour NSW

| | | |
|---|---|---|
| A. | Description | Waste treatment facility with plant processing organic and residual waste (green and food waste and garbage). Organic waste is delivered to the plant with a low contamination rate of approximately 1%. Waste unable to be composted is separated and recyclables recovered. The residing biomass is reduced to <100mm using an autoclave and loaded into the composting bays. Over a period of 28 days mechanical turners assist in the composting process. Temperature is controlled by the injection of under bed aeration and/or the addition of water. Product is saleable after a further 28 days curing. |
| B. | Location | Coffs Harbour, NSW. |
| C. | Throughput | 40,000 tpa (50% garbage, 50% compost). |
| D. | Inputs | Organics, Municipal Solid Waste (MSW). |
| E. | Residence Time | Garbage = 3 hours; organics = 66 days. |
| F. | Saleable Outputs | Grade A Compost, growing media, composted biomass used for rehabilitation. |
| G. | Capital Cost | $10 million for each processing plant, making $20 million/t. |
| H. | Cost/t | $160/t (including capital over 20 years). |
| I. | Diversion Rate | 49% recovery rate. |
| J. | Footprint | MSW processing – two vessels, enclosed tipping floor and odour control about 10,000m$^2$, organics processing – 6 bays and odour control about 5000m$^2$, plus soil mix yard about 20,000m$^2$. |
| K. | Reference Plants | NIL. Bespoke facility |
| L | Experience to Date | The Biomass Solutions plant has been operating successfully since commissioning. However, it is reported that it currently operates at an economic loss. The plant suffers from a high percentage of batteries in the in-feed material which it is reported are resulting in elevated lead levels in the composts. Output composts are subject to the 3F regulation. Operators have stated that compliance with 3F greatly reduces the profitability of the plant. |

# SITA SAWT, Kemps Creek NSW

| | | |
|---|---|---|
| A. | Description | This facility processes organic and MSW waste streams separately. MSW is sorted into waste types, and the organic material has contaminants removed. Organic material from both lines is then composted using tunnel technology, controlling the factors which assist breakdown including temperature, humidity and moisture content. |
| B. | Location | Kemps Creek, NSW. |
| C. | Throughput | 134,000tpa. |
| D. | Inputs | FOGO from Penrith City Council and MSW from Liverpool City Council. |
| E. | Residence Time | 4 weeks + maturation |
| F. | Saleable Outputs | Compost. |
| G. | Capital Cost | $60 million. |
| H. | Cost/t | $180 - $260. |
| I. | Diversion Rate | 55% overall. |
| J. | Footprint | 2ha |
| K. | Reference Plants | Penrith SAWT |
| L | Experience to Date | The plant is expanding to 220,000tpa, and to include plastic recovery in 2013 in response to growing demand from local councils. |

# Drum Composting Residual Waste – Some examples

## SITA Bedminster Drum, Port Stephens NSW

| | | |
|---|---|---|
| A. | Description | First AWT Facility in Australia, the Port Stephens Bedminster plant has been operating since 1998. Waste undergoes mechanical and biological treatment utilising two 90 metre drums for initial composting and decomposition. |
| B. | Location | Port Stephens, NSW. |
| C. | Throughput | 35,000tpa. |
| D. | Inputs | Port Stephens Council household residual waste (servicing 57, 000 inhabitants). |
| E. | Residence Time | 72 hours in digester drums then up to four weeks' active composting on the aeration floor. |
| F. | Saleable Outputs | Compost sold to farmers. |
| G. | Capital Cost | $12 million in 1999. |
| H. | Cost/t | $95/t originally but since 2010 likely $160+. |
| I. | Diversion Rate | 65% |
| J. | Footprint | 30,000m$^2$ including infrastructure. |
| K. | Reference Plants | Cairns in Australia, South Perth SMRC and several other sites internationally. |
| L | Experience to Date | The Port Stephens drum has been performed at expectations. The drum technology produces a low to medium grade compost which is ideal for mine site rehabilitation, forestry and limited land application. The plant has suffered from maintenance problems and in 2009 $1.5 million was spent reinforcing the drum liners.<br>The plant is an appropriate benchmark for Bedminster drum technologies. Another drum technology located at Canning Vale in Perth WA (SMRC, Southern Metropolitan Regional Council) operates on a similar basis. It can processes 109,000 tonnes at a capital cost of over $35 million. All plants have suffered from problems with odour and the quality and acceptability of output compost products. |

# SITA Bedminster Drum, Cairns QLD

| | | |
|---|---|---|
| A. | Description | Mechanical and biological treatment, opened in 2003. Uses drum composting and maturation to create a saleable product. |
| B. | Location | Cairns, QLD. |
| C. | Throughput | 125,000tpa. |
| D. | Inputs | Cairns and regional council household waste and C&I waste. |
| E. | Residence Time | 72 hours in digester then up to four weeks' active composting on the aeration floor. |
| F. | Saleable Outputs | Ferrous materials recovered. Compost sold to cane farmers. There has been significant demand for this compost since SITA took over the plant from EWT in early 2006. Cane Farmers Ag Study has shown significant (25%) increase in crop productivity over traditional fertilisers. |
| G. | Capital Cost | Plant was built by another company but it suffered a number of design and operational problems. In 2009 the receival hall collapsed. The plant was closed for 6-12 months. |
| H. | Cost/t | $160+/t |
| I. | Diversion Rate | 50% as the plant also takes in C+I waste which is not processed. |
| J. | Footprint | 30,000m$^2$, including infrastructure. |
| K. | Reference Plants | Port Stephens in Australia and several other sites internationally. |
| L | Experience to Date | The floor of the recieval hall collapsed a few years ago and consequently the plant was closed for a number of months. Built on an old landfill the substructure engineering was underspecified. Previous to that the plant was also closed for 4 years due to odour problems. Since being taken over by SITA these issues have been resolved. This is a benchmark facility for Bedminster drums. All plants have suffered from problems with odour and the quality and acceptability of output compost products. |

# SMRC RRRC, Perth WA

| | | |
|---|---|---|
| A. | Description | The facility includes a MRF and green waste facility on top of its waste composting facility. |
| B. | Location | Canning Vale, WA. |
| C. | Throughput | 109,200 tpa |
| D. | Inputs | MSW |
| E. | Residence Time | 5 to 7 weeks |
| F. | Saleable Outputs | Compost & soil conditioner – MSW derived |
| G. | Capital Cost | $35 million in 2002. |
| H. | Cost/t | $240/t |
| I. | Diversion Rate | The whole RRRC diverts more than 142,000 tpa and the drums currently process 85,000t of MSW. |
| J. | Footprint | 3ha |
| K. | Reference Plants | Bedminster Cairns & Port Stephens |
| L | Experience to Date | Odour complaints from residents in the past. Resolved with investment in odour control, input tonnage and operations management. |

# Global Renewables UR-3R, Eastern Creek NSW

| | |
|---|---|
| **Description** | Australian engineered mechanical/biological treatment previously utilising a wet anaerobic digestion process to convert organic materials to methane gas. Commissioned in 2004, it was the largest Digestion facility in the Southern Hemisphere. The Digestion tanks were decommissioned and removed in 2010 due to engineering and commercial failures.<br>The plant now operates successfully as a large scale composting facility only. Operations now include mechanical and hand sorting, and intensive enclosed composting in the SCT Biomax for maturation and refining. |
| **Location** | Eastern Creek, NSW. |
| **Throughput** | 220, 000tpa. |
| **Inputs** | MSW or source separated organics. |
| **Residence time** | 12 weeks. |
| **Saleable Outputs** | 17,000t (10%) of material as recyclables (metals, glass, paper and plastics), 60,000t organic growth medium (34%) used in agriculture and mine rehabilitation. It provides emission reduction units of 0.8t $CO_2e$ per tonne of MSW. |
| **Diversion rate** | 66% |
| **Capital Cost** | $70 million originally but upgrade post a significant fire brought capital investment to approximately $110m for 175,000tpa. |
| **Cost/t** | $280 plus from 2013. |
| **Reference Plants** | There are two plants under construction in the UK: Thornton Lancashire – 220,000tpa (275,000 incl. green waste) and Leyland, Lancashire – 250,000tpa (305,000 incl. green waste). |
| **Experience to date** | The GRL plant has suffered from an over optimistic contract tender rate by GRL combined with operational problems with the design of the plant. Problems surrounding the percolators, the anaerobic digesters and the refining process have hampered the plant. GRD (now defunct) took a $58 million write down on the value of the plant and sold it to private investors in 2008 with additional payment to cover debt obligations. The plant was converted to composting via open beds with the closure of the percolators and digestion tanks.<br>The plant is now operating successfully as a composting facility for MSW organics. |


BioMax
SORAIN CECCHINI TECNO


# The Wombat (New name of Woodlawn's Facility), Tarago NSW

| | | |
|---|---|---|
| A. | Description | AWT facility which would employ dry mechanical separation techniques to process MSW through the following major stages; delivery and screening, separation into primarily inert and organic streams, and the recovery of recyclable materials.<br>Wombat consumes about 2000 Mwh/a to run its facilities, but through its harvesting of methane the company produces more than 30,000 Mwh electricity, which equates to approximately, 5000 homes. Much of the electricity is sold back into the grid, the remainder is used to heat water tanks for its fish farming operations. |
| B. | Location | Woodlawn, NSW. |
| C. | Throughput | Modular in nature but designed for an initial throughput of about 120,000tpa. |
| D. | Inputs | Residual MSW. |
| E. | Residence Time | Dependent upon the initial organic volumes as a percentage of total inputs. |
| F. | Saleable Outputs | Mine site rehabilitation material (compost); refuse derived fuel (RDF) material and metals. |
| G. | Capital Cost | Expected $50 million. |
| H. | Cost/t | Expected $180/t. |
| I. | Diversion Rate | Only residual materials that cannot be used as the three main categories of RDF, compost products and metals are expected to be landfilled in the Woodlawn Bioreactor. |
| J. | Footprint | Approximately 100,000m$^2$. |
| K. | Reference Plants | Similar to a Veolia plant in Alexandria, Egypt. |
| L | Experience to Date | |

# SITA Conporec Drum, Mindarie WA

| | | |
|---|---|---|
| A. | Description | The ARRT Facility is composed of a two-stage composting system. The first uses the Conporec Drum for the decomposition of organics. The second uses the digester drum to rotate a mixture of new MSW and stock bacteria from old compost constantly, aerating the drum. The now dry material is then separated and refined using a trommel for fine organics, and a wind sifter to remove light plastics. The organics are then loaded into condition controlled bays were they are turned every 1-3 days. |
| B. | Location | Neerabup, NSW. |
| C. | Throughput | 100, 000tpa.. |
| D. | Inputs | Mindarie regional council household waste, Perth. |
| E. | Residence Time | 72 hours in digester then up to four weeks' active composting on the aeration floor. |
| F. | Saleable Outputs | 40,000tpa of compost useful in agricultural industry. |
| G. | Capital Cost | $70 million. |
| H. | Cost/t | This plant is subsidised by the gate fee paid by the regional Council. |
| I. | Diversion Rate | 60% |
| J. | Footprint | 30,000m$^2$, including infrastructure. |
| K. | Reference Plants | There are many Conporec Drums sites operating internationally. |
| L | Experience to Date | The plant is operating according to specification and all compost products are being sold to markets in Perth. Given that much of Perth is arid with a lot of sandy soils, markets for even low grade organics are robust. The initial contractual and tender consortium fell apart during the contract negotiations. SITA bought into an amended consortia as both owner and operator of the facility. Conporec was an existing partner and drum supplier. |

# Miscellaneous Small Vessel Composting – Some examples

## Hot Rot, In Vessel Composting

| | | |
|---|---|---|
| A. | Description | HotRot is a continuous in-vessel composting system. Wastes are fed in one end on a regular basis via hopper or bin lifter. A central revolving shaft mixes the contents ensuring even distribution of bulk, temperature and moisture. Supplementary air is added regularly, $CO_2$ and excess moisture is extracted and passed through a bio filter. HotRots produce no leachate. Guaranteed odour free. $CO_2$, temperature and acidity are data logged and can be monitored remotely. |
| B. | Location | Christchurch, New Zealand. |
| C. | Throughput | Modular units can be combined to provide a scalable solution from 0.5 to 100 tonnes per day. |
| D. | Inputs | Food, garden, grease trap, biosolids, poultry mortalities, hatchery waste, DAF sludge. |
| E. | Residence Time | 10 days. |
| F. | Saleable Outputs | Stable compost complying with AS4454. Field ready but windrowing for up to 4 weeks is recommended for maturation. |
| G. | Capital Cost | AU $160,000 to AU $1.4 per unit. |
| H. | Cost/t | Gate fee: $80 - $120/t |
| I. | Diversion Rate | 40% reduction |
| J. | Footprint | 75 $m^2$-500 $m^2$ for individual units includes waste reception, feed system, in-vessel unit discharge bunkers and bio filter. (maturation area is not included). |
| K. | Reference Plants | 37 units in 13 countries. |
| L | Experience to Date | Manufacturing in-vessel composting units and designing waste processing sites since 2002. |

# BiobiN, LGSA Conference, Nowra NSW

| | | |
|---|---|---|
| A. | **Description** | It is an on-site, capture and containment system for organic material processing in an odour-free, easily accessible vessel. Once the composting process is initiated, it reduces bacteria and other pathogens. BioBiN offers three bin sizes for personal or company use. The composting process maximises the amount of organic material that can be collected by the BiobiN.<br>Once collected, the processed organic material can be added to products such as soil conditioners, compost and biofuels – providing a valuable supply of nutrients, carbon and organic matter.<br>An onsite aerated compost system was supplied by BiobiN to compost the following materials. |
| B. | **Location** | Nowra, NSW |
| C. | **Throughput** | 1 Tonne/week/bin |
| D. | **Inputs** | Organic – food and other compostable material.<br>Compostable material included: compostable paper plates, corn starch knives and forks, as well as compostable paper cups, biodegradable plastic cups and recyclable plastic cups. |
| E. | **Residence Time** | 1-4 weeks |
| F. | **Saleable Outputs** | Compost – semi stabilised |
| G. | **Capital Cost** | $21,000 - $52,000. |
| H. | **Cost/t** | $10/t additional to lift cost |
| I. | **Diversion Rate** | 95% depending on inputs |
| J. | **Footprint** | 4sqm |
| K. | **Reference Plants** | Nil |
| L | **Experience to Date** | Total waste: 19,250 L<br>% recycled: 82%<br>% to landfill: 18% |

# Envirocomp Rangiora, New Zealand

| | | |
|---|---|---|
| A. | Description | Once the nappies arrive, they are removed from bags prior to being fed up the conveyor into the shredder. The shredded nappies are then mixed with pre chipped green waste and are fed into the feed hopper.<br>The Hot Rot in-vessel composting system is used.<br>Once discharged the compost is stored for a further 4-6 weeks to mature prior to screening. |
| B. | Location | North of Rangiora, New Zealand which services the Christchurch, Waimakariri, Ashburton, Hurunui and Kaikoura Districts. |
| C. | Throughput | Capacity to compost around 60,000 nappies/month at each site, and diverts 2,280 t of organic waste, which is equal to 1.44 M nappies/yr. |
| D. | Inputs | Baby nappies, diapers, adult incontinence products, adult health products. |
| E. | Residence Time | 2 weeks |
| F. | Saleable Outputs | Compost |
| G. | Capital Cost | $1million |
| H. | Cost/t | $60-100/t est. |
| I. | Diversion Rate | 80% depending on inputs |
| J. | Footprint | 0.5ha |
| K. | Reference Plants | NIL – bespoke plant |
| L | Experience to Date | Envirocomp is thought to be a world first for commercial processing of baby nappies. |

# Mobigas

| | | |
|---|---|---|
| A. | Description | MobiGas is aimed at generating energy that is not used in conventional waste disposal methods.<br>The organic waste is filled in the fermenter container to a volume of approx. 58 $m^3$ and produces biogas in a three-stage process.<br>First phase-aerobic: material is ventilated in the fermenter. Second phase-fermenter: ventilation ceases and the anaerobic phase begins<br>A percolate is sprayed onto the material and the fermenter container gets heated via a floor heater. The generation process of biogas lasts around 2-6 weeks. After analysis, the fermenter container is ventilated again and thus the process is stopped. |
| B. | Location | - |
| C. | Throughput | Capacity to process 58 $m^3$ organic waste. |
| D. | Inputs | Organic waste |
| E. | Residence Time | 2-6 weeks |
| F. | Saleable Outputs | Compost |
| G. | Capital Cost | $0.5million |
| H. | Cost/t | $100/t est. |
| I. | Diversion Rate | 95% depending upon inputs |
| J. | Footprint | 0.1ha |
| K. | Reference Plants | NIL |
| L | Experience to Date | Not yet operational. Recently entered the market. |

# Anaerobic Digestion

AD in Australia has performed much worse than MBT plants. UR3R, ArrowBio and Atlas, the major AD facilities in Australia, have all suffered mechanical, operational or financial problems in their start up or ongoing operations. The AnaeCo facility is at pilot stage and therefore it is too early to ascertain its future performance results. (In August 2010 AnaeCo declared a cash flow problem that forced the company to sell all of its shareholding in the DiCom AD technology).

AD does however a route from waste to electricity at a lower risk, without relying on thermal treatment such as incineration. For that reason it is being pursued by both government agencies and some local Councils. It is a higher risk option than MBT composting.

Anaerobic digesters facilitate the conversion of solid and liquid food wastes using bacteria operating in a controlled environment. These produce a combustible gas (biogas), which is principally CH4 and CO2 similar to natural gas, and a sludge which is dried to produce a high nutrient organic fertiliser.

The breakdown of organic materials involves a number of biological steps, each step involving a well-defined class of bacteria which absorb energy for their survival from the gradually decomposing biomass. AD is best suited for source separated wet organic materials.

The process of anaerobic digestion consists of three steps:

1. Decomposition (hydrolysis) or plant or animal matter. Breaks down the organic material to usable-sized molecules such as sugar.
2. Conversion of decomposed matter to organic acids
3. Finally, acids are converted to methane gas

Process temperature affects the rate of digestion and should be maintained in the mesophilic range (35-40.6°C) with an optimum of 37.8°C.

# ArrowBio Anaerobic Digester, Jack’s Gully NSW

| | | |
|---|---|---|
| A. | Description | The ArrowBio technology is a water-based separation method for processing mixed solid waste. |
| B. | Location | Jack’s Gully Waste Management Facility, Mt Annan NSW. |
| C. | Throughput | 90,000tpa at full capacity with two AD modules. |
| D. | Inputs | Municipal solid waste (MSW); Source separated green waste. |
| E. | Residence Time | 8 weeks including digestion. |
| F. | Saleable Outputs | Claimed 10,000MWh excess energy, enough to power 1,700 homes. Claims to avoid 33,000t CO2/yr when compared with a landfill, equivalent to taking 8,000 cars off the road. Approximately 10,000tpa of organic fertiliser is produced. |
| G. | Capital Cost | $40+ million. |
| H. | Cost/t | $200/t plus in 2010. |
| I. | Diversion Rate | Target of 60% diversion. |
| J. | Footprint | 20, 000m$^2$. |
| K. | Reference Plants | Tel Aviv, Israel and the Macarthur Resource Recovery Park in Camden, Sydney. |
| L | Experience to Date | The technology has not worked well at Jacks Gully. WSN Environmental Solutions, who operates the resource recovery park, has acknowledged publicly significant problems with the introduction of the technology. This has included changes to the process flow from the original design used in Tel Aviv and difficulties in disposing of the output products. Digestate output products are subject to the 3F regulation in NSW.<br>The plant also received 30,000tpa of source separated green wastes, which were composted separately in tunnels. The anaerobic digestion part of the plant is now closed and only the front end is working. |

# AnaeCo DiCOM Anaerobic Digester, WMRC Facility in Shenton Park, WA

| | | |
|---|---|---|
| A. | Description | The DiCOM System combines a separation process that recovers marketable recyclable materials from MSW and a clean organic fraction.<br>This fraction is treated using an advanced hybrid biological process that integrates, within a closed vessel, the natural anaerobic and aerobic bioconversion cycles into a continuous automated system, producing biogas and compost in a fast, 21-day cycle. System is fully automated. |
| B. | Location | Perth, WA. |
| C. | Throughput | 55, 000tpa modules. |
| D. | Inputs | All MSW and some C&I. |
| E. | Residence Time | 5 days loading, 14 days processing. |
| F. | Saleable Outputs | 8,760MWh energy and 27,000tpa of AS 4454 compliant organic fertiliser, a 55,000tpa module. |
| G. | Capital Cost | $120 million. |
| H. | Cost/t | Owner believes it will be the cheapest, but this cannot be proven. |
| I. | Diversion Rate | 70-95%. |
| J. | Footprint | 4,000 $m^2$ for 55,000tpa module. Traditional compost systems: 20,000 $m^2$ |
| K. | Reference Plants | First reference facility is under construction for Perth's Western Metropolitan Regional Council. |
| L | Experience to Date | A $4.6 mil loan facility has been agreed upon for AnaeCo's project WMRC, to help with delays the plant was experiencing in the biological and operational ramp-up.<br>June 10, 2015<br>Approval from Western Power of the plant's permanent connection to the electricity grid, of the 1.2 MW combined head and power gas powered generator.<br>July 6, 2015<br>Both the MRF and the AD are now accepting materials on a commission basis. Hopefully it will be fully operational in the next 18-24 weeks. |

# Food Waste Co-Digestion at Glenelg Sewage Treatment Plant, SA

| | | |
|---|---|---|
| A. | Description | The AD is used to stabilise sludges generated from primary and secondary treatment. Organic material fed into these digesters undergoes biological breakdown to ensure optimum end product quality. Methane is generated, which can be used to produce electricity.<br>The sludge retention time is critical to ensure a good degradation of sludge. Glenelg has a SRT of 18 days.<br>There is a table of materials that may be suitable for the trial for example, dairy whey, waste milk, dissolved air flotation sludge, starch sludge, fruit/beverage waste, organic soils, organic fats, high carbon organic sludge, other organic sludge and food manufacturing sludge.<br>The primary sludge is directly fed to the digesters. |
| B. | Location | Glenelg, SA |
| C. | Throughput | 1000t food |
| D. | Inputs | Regular tanker loads of industrial waste are received at the plant to boost biogas production. |
| E. | Residence Time | 18 days |
| F. | Saleable Outputs | Stable sludge. |
| G. | Capital Cost | Unknown – ancillary to STP |
| H. | Cost/t | Unknown |
| I. | Diversion Rate | 95% depending upon inputs |
| J. | Footprint | 5 x 3.2 ml volume of the anaerobic digesters. |
| K. | Reference Plants | Several STP's trialling food and FOGs (fats, oils, greases, glycerol). |
| L | Experience to Date | Constructed and commissioned in July 2013. An increase in the amount of power generated of 20%. |

# Earthpower Anaerobic Digester, Sydney NSW

| | | |
|---|---|---|
| A. | **Description** | Anaerobic Digester processing organic waste into energy (biogas) and digestate sludge, which is dried and sold as high nutrient fertiliser. The process utilises a hydro pulping process to homogenise the input materials which are then digested anaerobically in either of the facility's 5000m$^3$ digesters. |
| B. | **Location** | Camellia, Sydney, NSW. |
| C. | **Throughput** | 80, 000tpa. |
| D. | **Inputs** | Liquid and solid food and organic waste. |
| E. | **Residence Time** | 72 hours in digester. |
| F. | **Saleable Outputs** | Biogas energy (3MW: enough to power over 3,600 homes) and digestate fertiliser sludge used in agriculture and horticulture. |
| G. | **Capital Cost** | $20 million. |
| H. | **Cost/t** | To 2009 $60/t. In 2010 $90/t. Likely to grow with the landfill levy. |
| I. | **Diversion Rate** | 95% but highly dependent upon input contamination. |
| J. | **Footprint** | 15,000m$^2$, including infrastructure. |
| K. | **Reference Plants** | Nil. Similar to Kompogas Europe |
| L | **Experience to Date** | This plant has suffered from a combination of economic and operational problems. To be economical it needs a high diversion rate. As a result of very high contamination rates of the input material, as much as 50% of the input tonnage has been sent to landfill (at full landfill costs inclusive of the levy). Low energy prices have exacerbated the problem. The result has been an economic downward spiral. The plant was sold in 2007 for $1.00 to a joint venture of TPI and Veolia. The plant has been losing a reported $4 million per year since then. The plant was closed for front-end pbs and was reopened in 2013. |

# International – some examples

## Overseas: Kompogas Technology Botarell Plant in Spain

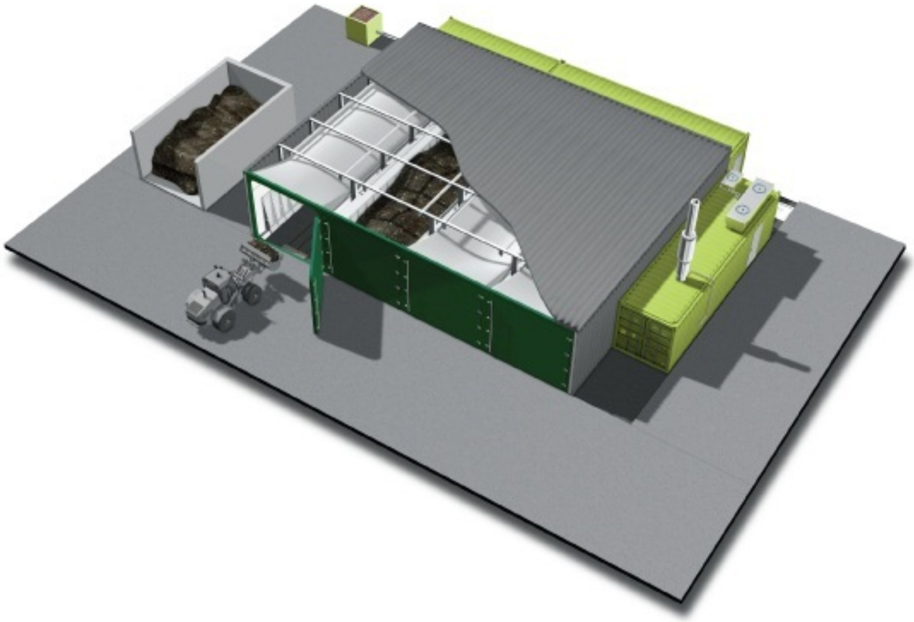
| | | |
|---|---|---|
| A. | Description | Kompogas triple module PF1300-3 which runs non-stop on a fully automated basis. It is fed 365 days a year to generate high-grade biogas.<br>Waste is separated to have MSW and organics before it is taken to the digester,<br>The biogas generated is fed into two cogeneration units that produce electricity and heat. Heat is used to maintain the temperature of the digesters, whereas the electricity is fed into the public grid.<br>Digestate recovered is separated into solid and liquid digestate. Solid is refined further and recycled as covering for material for gardens and road-sides. Part of the liquid is used to moisten the input of materials, while the rest is purified. |
| B. | Location | Botarell, Spain |
| C. | Throughput | 54,000 tpa |
| D. | Inputs | 54,000 t/a of MSW from 100 communities in the Reus/Tarragano region. |
| E. | Residence Time | 15-20 days |
| F. | Saleable Outputs | 4,300,000 $Nm^3$/a of biogas<br>9,900,000 kWh/a of electricity<br>40,000 t/a of solid digestate and no liquid digestate |
| G. | Capital Cost | $20 milliion |
| H. | Cost/t | $150/t excluding transport |
| I. | Diversion Rate | 90% depending upon inputs |
| J. | Footprint | 2ha |
| K. | Reference Plants | There are over 60 plants that use Kompogas. Most of these plants generate electricity or heat energy. |
| L | Experience to Date | Operating successfully since 2009. Since the establishment, the plant has provided electricity for approx., 2,500 households from biowaste, and recycling of organic and non-organic material. Prior to this, all waste had been dumped or incinerated. |

# Kompogas Dry Anaerobic Digester Fermentation

| | | |
|---|---|---|
| A. | Description | From the digestion process, carbon-neutral biogas is produced which is transformed into green electricity and heat or turned into natural gas.<br>After the organic waste is processed by the anaerobic digester, biogas or fertiliser is produced.<br>SSO and OFMSW (organic fraction of MSW) produce biogas.<br>Anaerobic digestion generated biogas. |
| B. | Location | n/a |
| C. | Throughput | n/a |
| D. | Inputs | Organic fraction of MSW |
| E. | Residence Time | 15-20 days |
| F. | Saleable Outputs | Biogas: 4,300,000 $Nm^3$/yr<br>Electricity: 9,900,000 kWh/yr<br>Solid digestate: 40,000 t/yr |
| G. | Capital Cost | $6 million integrated facility |
| H. | Cost/t | $200/t est |
| I. | Diversion Rate | 60% inclusive of MSW |
| J. | Footprint | 3ha |
| K. | Reference Plants | NIL |
| L | Experience to Date | Dry fermentation is relatively low risk and provides a low grade digestate (which cannot be applied to land in Europe) |

# Smart Farm Facility, Marina California, USA

| | | |
|---|---|---|
| A. | Description | Constructed by Zero Waste to Energy on behalf of the Monterey Regional Waste Management District (MRWMD) in Marina California. The facility consists of 4 digesters is addition to an aeration bay for organic waste. |
| B. | Location | Marina California, USA. |
| C. | Throughput | 5,000tpa. |
| D. | Inputs | Organic Waste – food organics |
| E. | Residence Time | 3 weeks |
| F. | Saleable Outputs | 100kW of electricity or up to 3,200 BTU/Ton of biogass with 58-60% methane content. |
| G. | Capital Cost | - |
| H. | Cost/t | MRWMD have released a statement admitting that at present the project is not economically viable. They currently charge $38 per tonne of food waste and $51 for other waste streams however the real cost of processing is closer to $51 per tonne. The difference is currently subsidised by MRWMD. |
| I. | Diversion Rate | 95% dependent on inputs |
| J. | Footprint | 18.5m x 15m. The technology is specifically designed for the needs of small cities, or the outskirts of larger industrial cities where there is limited waste accumulation. |
| K. | Reference Plants | Unknown |
| L | Experience to Date | Limited |



# Kompoferm Dry Fermentation, San Jose California, USA

| | | |
|---|---|---|
| A. | Description | Owned and operated by Zero Waste Energy Development Company (ZWEDC), it is a joint venture between Green Waste Recovery and Zanker Road Resource Management. The facility is the largest Kompoferm High Solid, Dry Fermentation Anaerobic Digester in the world at current.<br>Dry fermentation anaerobic digestion is a natural biological process whereby bacteria break down organic matter in an oxygen-free environment. Decomposition occurs in several stages and converts organic matter into a combustible biogas with a high methane content.<br>The facility is enclosed and ventilated and includes 16 anaerobic digesters plus four in-vessel composting tunnels. |
| B. | Location | San Jose California, USA. |
| C. | Throughput | 90,000tpa. |
| D. | Inputs | Commercial Organic Waste |
| E. | Residence Time | 4 weeks |
| F. | Saleable Outputs | Biogas produced will supply power for the facility and sold to the utility power grid 1.6MW of renewable energy and 32,000 tonnes of compost p.a. Target 75% diversion from landfill. |
| G. | Capital Cost | $6million integrated facility |
| H. | Cost/t | Unknown |
| I. | Diversion Rate | 95% depending on quality of inputs |
| J. | Footprint | 2ha |
| K. | Reference Plants | - |
| L | Experience to Date | Another firm, Zero Waste Energy, LLC (ZWE) holds the exclusive license for the patented anaerobic digestion technology in the Americas and Asia with 20 projects in the planning and development phase throughout North and South America, as well as China and the Middle East. |

## K.6 Thermal Treatments

Thermal treatments are used to treat non-recyclable and non-reusable waste in an environmental and economical friendly way. The treatment reduces the volume and mass of waste and inerts the hazardous components, while at the same time generates thermal and/or electrical energy and minimizes pollutant emissions to air and water.

The processes that deal with these waste are: incineration, gasification and pyrolysis.

After thermal treatment ferrous and non-ferrous metals can be recovered and recycled. Grate ash and slag produced can be recovered for building purposes.

ATT's use products have a large amount of chemical energy stores, from these products a mixture can be created. There are two options for the use of this mixture:

1. It is burnt to create steam
2. It can be burnt directly in gas engines or gas turbines, or converted to transport fuels or synthetic natural gas.

Although the second option may be more efficient than the first in producing EfW, it has not been tested at the commercial size. Some of the generated energy is used to power the process, thus reducing the overall benefits.

The emissions clean up step ensures that the waste gases emitted, meet the EU legislation limits. EfW plants contribute only a small fraction of both local and national particulate and other emissions.

## K.7 Incineration

Incineration dominates in Europe, where the processes result in residual products and flue gas cleaning additives products, which have to be disposed of at a controlled site such as a landfill or mine. Gases generated are 'cleaned' so that any particulate matter and acid gases are removed.

As incineration occurs in combustion chambers, ash is left as residue at the bottom of the chamber. This ash consists of sintered combustion products, mineral components, metal scrap and other unburnt materials, which can either by recycled or landfilled. Dependent on the ash it can be reused, Phoenix Energy uses part of the ash to make road bricks. More and more companies are inventing technologies that make use of this ash.

Hazardous materials are burned at high enough temperatures to destroy contaminants. Many different types of hazardous materials can be treated by incineration, including soil, sludge, liquid, and gases. The process destroys many kinds of harmful chemicals, such as solvents, PCBs and pesticides, however it does not destroy metals.

## K.8 Grates

Most incinerators have a moving grate, to treat MSW when it passed through the combustion chamber. The idea is that the grate will give way for complete and effective combustion. Such plants are capable of taking in 35 metric ton of waste every hour for treatment.

Waste is poured in the grate via a crane, then the grate moves the waste forward to the ash pit. The waste is further treated, water washes out the ash, forced aeration occurs to cool down the grate.

Air is blown through the boiler one more time, which helps in complete burning of the flue gases. In order to fully breakdown toxins of organic nature, the flue gases must reaches 85°C within 2 seconds.

# Martin Reverse-Acting Grate Kwinana WtE Facility, WA (Proposed)

| | | |
|---|---|---|
| A. | Description | 1. MSW is deposited onto the moving grate by a crane.<br>2. Underfire air is supplied to ensure optimal reaction conditions for the fuel. Overfire air is injected to efficiently mix the flue gases and burns out completely at temperatures of up to 1,200 degrees celcius.<br>3.<br>4. With this type of grate, cooling is not necessary as the drive concept maintains a stable covering on the grate and consequently the grate elements are protected from excessive thermal loads.<br>Bottom ash residue, typically <10 vol% of feedstock, dependent on composition) can be recovered and used as aggregate or further processed to create bricks or pavers. |
| B. | Location | Kwinana, WA |
| C. | Throughput | Up to 400,000 t/a |
| D. | Inputs | • Residual MSW |
| E. | Residence Time | - |
| F. | Saleable Outputs | 32MW of base load electricity to the grid. Bottom ash is generated as a residue. |
| G. | Capital Cost | $380 M |
| H. | Cost/t | - |
| I. | Diversion Rate | Recycle over 6,000 tpa of metal. City of Kwinana will be able to divert 100% of its residential residual waste. |
| J. | Footprint | 3.5 ha. |
| K. | Reference Plants | SMS Infrastructure Plant in Nagpur India, Hitachi Metals plants in Mihama/Mikata Yoshi and Utashinai, Japan. |
| L | Experience to Date | Not yet operating.<br>2013: City of Kwinana and Phoenix energy enter into a 20 year Waste Supply Agreement.<br>2015: EPA has released a report and recommendation on the Kwinana WtE project. Estimated to begin operation in late 2016. |