SUNSHINE COAST COUNCIL

Alternative Waste Technology

Options Review

Prepared for

SUNSHINE COAST COUNCIL

January 2011

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EXECUTIVE SUMMARY

REPORT SUMMARY

Engagement	Resource Innovations was engaged by Sunshine Coast Council (Council) to prepare an options review of Alternative Waste Technology (AWT) that may be suitable for the resource recovery of household waste generated within the Sunshine Coast region. The options review has been prepared to present the findings and recommendations of Council's project team which includes Council representatives and advisors from Resource Innovations.
The project	Council's objectives for the project are: 1. deliver an AWT facility that recovers resources from the household waste stream, diverts waste from landfill and achieves the goals of the *Waste Minimisation Strategy 2009-2014.* 2. add value to the Sunshine Coast economy and maximise the re-use of embodied resources. 3. ensure that the preferred AWT facility is scaleable to accommodate future capacity expansion and integration with future technology developments in AWT. 4. maximise value to Council by procuring the project using the most cost-effective delivery model from a whole of life perspective, and 5. meet Local, State and Federal Government regulatory requirements.
Strategic fit	Councils *Waste Minimisation Strategy 2009-2014* stated goal is to increase the recovery of resources from waste to over 70 per cent by 2014. The State government recently passed the *Waste Reduction and Recycling Act 2011,* establishing a target of 65 per cent recycling of household waste by 2020. Council currently achieves a total diversion rate of 41 per cent. The project goal and objectives are aligned with Council's strategy and corporate plan.

KEY OBSERVATIONS

The key observations are detailed below:

Key conclusions

1. Councils existing collection contracts expire in June 2014 and Council will need to issue a Request for Tender for collection by November 2012. The collection configuration, waste disposal and AWT are intrinsically linked. Failure to decide on the preferred AWT by July 2012 may result in the inability to integrate an AWT with the collection contract configuration. In the long term, this may result in service inefficiencies, contractual complexity, and higher costs incurred by Council.
2. An AWT developed or contracted by Council is most suited to the household waste stream as it provides Council with the single greatest opportunity to achieve waste diversion. The household waste stream is a local government responsibility, represents almost 50 per cent of waste disposed to landfill and will continue to increase with population growth. All planning and investment decisions should be based on household waste volumes, until Council can guarantee additional waste volume supply from other waste streams or surrounding Councils.
3. Within the household waste stream, organics (garden and food waste) make up almost 50 per cent. As an initial step, technology that makes use of the organic fraction offers the most sustainable use of these resources.
4. The technology assessment has been largely based on the evidence and experience of AWT operations within Australia. Anaerobic Digestion (AD) has not been included in the scenario development, due to the poor record of performance of AD within Australia.
5. Based on the forecast waste volume rates and known landfill airspace capacity, all landfill space will be consumed by FY2029. Landfill closure year, ranked in order of closure will be:
    a. Nambour landfill – FY2019
    b. Caloundra landfill – FY2027
    c. Noosa landfill – FY2029
6. Landfill closure of the existing landfills is extended most significantly by implementing Scenario 4 – 3 bin compost (mixed waste and organics) and Scenario 5 – 2 bin compost and thermal (mixed waste). These AWTs extend the closure year by 5 years to FY2034.
7. Scenario 3 – 3 bin compost (organics only) delivers the lowest cost AWT for Council. This scenario extends landfill life by one year to FY2030.
8. Landfilling will need to continue to be part of the waste management approach for the region. Future planning of the waste disposal approach, post the closure of the existing landfills will need to be considered.

Delivery

9. The risk workshop identified that Scenario 3 – Compost household separated organics represents the lowest risk option and Scenario 2 – Thermal mixed waste represents the highest risk option. Further risk workshops will need to be completed with Councillors and the Council officers to define Council's risk appetite and align the appropriate technology selection with risk appetite.
10. At this time, thermal conversion treatment may not be a suitable technology solution for Council. The QTC Energy from Waste Feasibility Review found that thermal conversion facility represents a high-cost waste management option, with high technology risks, complex procurement and significant regulatory and community perception risks. While it is acknowledged that thermal technology is well established in Europe and the USA, the potential lead-time for thermal facility development could be 6-10 years and would require a 25 year contract commitment. This defers Council's opportunity to achieve waste diversion in the medium term and commits Council to a single long-term approach. Thermal technology may be best considered as a second stage approach based on improved technology development and regulatory/community acceptance.
11. Scenario 3 (3 bin compost household separated organics) provides the lowest cost option to Council, based on the waste utility rate. The waste utility rate would need to increase from $202 per annum (2011/2012) to $287 per annum (2011/2012) to deliver this approach. This is based on the implementation of a mandatory 3rd bin to all suitable dwelling types.
12. Composting of organics from either mixed waste (Scenario 1) or household separated waste (Scenario 3) significantly varies the recovered product quality and potential marketability. These aspects will need to be further workshopped by Council and balanced against capital cost, collection configuration, waste diversion rates and community education/acceptance
13. Higher diversion rates and improved recovered product quality and marketability can be achieved by composting of garden and food waste. The inclusion of food waste will generate odour in the compost process and eliminates simple windrow composting. A more advanced compost process, such as enclosed composting or Gore Cover composting will be required. This will deliver improved process control and odour capture would need to be developed
14. A 3 bin collection system will require significant change to the bin configuration and will need to be factored into the new collection contract. Scenario 3 (3 bin compost household separated organics) would require the following bin configuration and collection frequency to achieve the highest waste diversion rate:
    - Waste – 240L fortnightly
    - Recycling – 240L fortnightly
    - Garden and food – 240L weekly
15. Introduction of a 3 bin collection system (which would be required for Scenario 3) will need to be tailored for dwelling types and may not be suitable for multi-unit dwellings (MUDs) or rural residential dwellings. The bin options and charging regimes for all

property types will be further considered in business case development if a 3 bin system is short listed as a potential technology approach.

16. Landfill will continue to be required as part of the waste management approach for Council. Long-term planning will be required to identify the future disposal options, once the existing landfill assets reach capacity. This may involve the establishment of a new greenfield landfill or bulk transport of waste to a landfill outside the region.
17. There is little community awareness of AWT. The introduction of an AWT will benefit from strong community education. The level of education/community engagement will need to be significantly higher if a 3 bin system is introduced.
18. Sustainability Park, Caloundra South is the preferred location for the establishment of an AWT as it is owned by Council and is zoned appropriately for waste management use.

Commercial aspects

19. A Design, Construct, Operate, Maintain (DCOM) contract is likely to offer Council the optimal mix of sustained market competitive tension during procurement, cost minimisation, risk management, operational outcomes and compliance with State and local government purchasing requirements. All market sounding participants indicated support for a DCOM contract.
20. Further work will need to be completed to determine the most suitable procurement approach. The options include an Early Contractor Involvement (ECI) approach or a more traditional Expression of Interest (EOI), following by a Request for Tender (RFT).

Risk management

The significant risks for the project are:

1. Preferred AWT technology is does not achieve design capacity, recovery rates or air pollution discharge criteria
2. Preferred AWT technology delivery is delayed due to complex procurement process, regulatory approvals and/or community objection.
3. Preferred AWT technology does not achieve design capacity and/or recovery rates
4. Delay in Request for Tender for collection and recyclables processing Localised skill shortage in project management, construction, mechanical and electrical labour.
5. Inability to secure Council resolution on preferred AWT approach by July 2012
6. Delay in the development of Sustainability Park

A robust governance structure over the project's life will be required if Council is to effectively deliver an AWT facility. Council will require an experienced project team with a broad set of skills to manage the procurement and delivery of the preferred AWT.

KEY RECOMMENDATIONS

A summary of key recommendations are listed below:

Delivery	1. Establish an AWT working group consisting of Councillors and Council representatives to select the preferred AWT scenario and develop a business case for implementation 2. Composting based technology delivers the lowest risk and cost solution to Council and can be implemented within a 2-3 year period. Comparatively, thermal treatment technology may require a 7-10 year lead time for delivery. Initial technology focus on composting approaches will deliver more immediate outcomes. 3. Implement the AWT project in a staged approach. Stage 1 delivery is to focus on composting technology approaches. Stage 2 will focus on the application of composting technology to other waste streams, including commercial waste. Stage 3 may involve thermal treatment technology or Anaerobic Digestion on mixed waste or separated waste types. 4. Complete quarterly waste audits on waste streams to better understand the waste composition and support the procurement documentation. 5. Complete rateable property analysis to understand the property types that may not be able to utilise a 3 bin configuration (i.e. multi-unit dwellings, rural residential) 6. Complete financial modelling of the preferred AWT scenarios to define the waste utility rate that will be charged to ratepayers 7. Identify the most cost effective approach for transporting waste from the Northern region to an AWT located in the southern region.
Procurement aspects	8. Develop the AWT approach based on a Design, Construct, Operate, Maintain (DCOM) contract 9. Refine the most suitable procurement approach for an AWT. The options include an Early Contractor Involvement (ECI) approach or a more traditional Expression of Interest (EOI), following by a Request for Tender (RFT). 10. Submit the Environmentally Relevant Activity (ERA) application to the Department of Resource and Management (DERM) for the preferred AWT, prior to commencing the preferred procurement approach.

1| INTRODUCTION

1.1 PURPOSE AND APPROACH

Sunshine Coast Council (Council) is examining the development of an Alternative Waste Treatment (AWT) to achieve improved waste diversion from landfill, recover resources and move towards the attainment of local and State resource recovery targets. The focus of this report is on an AWT suitable for the household waste stream.

This paper outlines the options review for the development of an AWT facility proposed to be located at Sustainability Park, Caloundra South. In doing so, it considers each of the following areas:

- Future waste demands for the region
- Technology options
- Options appraisal
- Affordability
- Procurement strategy, and
- Delivery

1.2 COUNCIL OBJECTIVES

Council's objectives for the Project are to:

- deliver an AWT facility that recovers resources from the household waste stream, diverts waste from landfill and achieves the goals of the *Waste Minimisation Strategy 2009-2014.*
- add value to the Sunshine Coast economy and maximise the re-use of embodied resources.
- ensure that the preferred AWT facility is scaleable to accommodate future capacity expansion and integration with future technology developments in AWT.
- maximise value to Council by procuring the project using the most cost-effective delivery model from a whole of life perspective, and
- meet Local, State and Federal Government regulatory requirements.

These objectives also directly align with the broader Council waste business objectives, which have been defined within the Council Corporate Plan 2009–2014.

1.3 PROJECT TEAM

This options review case has been prepared with contribution from the project team members listed in Table 1.

Table 1: Project team members

ORGANISATION & TEAM MEMBER		ROLE
Sunshine Coast Council		
1	Wayne Schafer – Branch Manager, Waste and Resource Management	Principal stakeholder representative
2	Graeme Emmerson, Innovation Engineer, Waste and Resource Management	Innovation engineer
3	Simon Crock, Commercial Manager	Commercial manager
4	Robyn Barrett, Business Analyst	Business analyst
Resource Innovations		
5	Joel Harris – Principal	Project manager

1.4 LIMITATIONS OF ADVICE

The following limitations of our analysis should be noted:

- Resource Innovations has relied on the financial and operating performance information of AWT facilities provided by industry sources. Resource Innovations work did not include commenting on the validity of the financial or operational information provided.

1.5 INFORMATION SOURCES

The following information was supplied by Council or sourced by Resource Innovations to provide background information necessary for the options review:

- AMPM, 2011, Draft Feasibility Report for Sustainability Park.
- Aurecon, 2011, Domestic Waste Collection System Model. Project Completion Report.
- Queensland Treasury Corporation, 2011, Sunshine Coast Regional Council Energy from Waste Feasibility Review
- Sunshine Coast Council, 2011, Alternative Waste Technology Options Review
- Waste Minimisation Strategy 2009-2014

2| INVESTMENT OBJECTIVES

Council broad vision for the Sunshine Coast is to become Australia's most sustainable region – vibrant, green and diverse. Council recently adopted the *Waste Minimisation Strategy 2009-2014,* with the overarching objective of assisting Council to achieve its vision of becoming Australia's most sustainable region by minimising waste, adding value to the Sunshine Coast economy and maximising the re-use of embodied resources.

The strategic goals established by Council that guide waste management for the region include:

Goal 1. Australia's most sustainable region.
Councils Corporate Plan 2009-2014 has an overarching goal of achieving sustainable approaches within the region. The waste hierarchy will be adopted to examine approaches to maximise the highest and best uses.

Goal 2. Community engagement
Recognition that the community are partners in the strategy, the development and implementation of new resource recovery processes will be undertaken in conjunction with open and transparent community and stakeholder communication and education practices.

Goal 3. Focus on resource recovery
Aiming to increase the recovery of resource to over 70 per cent and add value to the local economy. This will be achieved by evaluating incoming waste streams and investing in collection approaches and technology in partnership with the private sector to maximise resource recovery. The focus will be on organics diversion from landfill and energy from waste opportunities.

Goal 4. Landfill airspace preservation
Ensure that current and future operating practices at landfills maximise airspace capacity utilisation and prolong existing landfills for future generations.

2.1 PROJECT NEED

Council has established a strategic direction for waste management in the region, that emphasizes resource recovery. Currently, Council achieves a total resource recovery rate of 41 per cent and a kerbside resource recovery rate of 33 per cent. Over the past three years and in the medium term, Council is upgrading resource recovery infrastructure at the three major landfills to improve resource recovery of construction wastes and self-haul household waste.

In the immediate future, Council will face the challenge of significantly improving the resource recovery rate of waste across all waste streams.

The key drivers for Council include:

State Resource Recovery Targets – the Queensland Waste Reforms, legislated by the Waste Reduction and Recycling Bill passed on 12 October 2011, establishes a target of achieving 65 per cent recycling of household waste by 2020. Council currently achieves 33 per cent resource recovery from kerbside. Meeting the target level will require at least an 80 per cent increase over the current resource recovery volume. This can only be achieved by an investment in resource recovery technology and complimentary collection approaches.

Preserving limited landfill space – waste generated within the Sunshine Coast region is currently disposed at one of three major landfills, being Caloundra, Nambour and Noosa. The Nambour landfill, the most centrally located landfill has a forecast closure in 2018-2019. The remaining landfills have a forecast life until 2028-2030 based on current plans. Preservation of existing landfill capacity within the region is an imperative to defer the establishment of new greenfield landfills as well as the bulk transport of waste to landfills located in South-East Queensland.

Australia's most sustainable region – Councils Corporate Plan 2009-2014 has an overarching goal of achieving sustainable approaches within the region. In the waste context, this means targeting 70 per cent diversion of waste from landfill through the development of technology and partnerships that diversify economic opportunities for the region.

Financial sustainability – Waste Levy. The States resource recovery strategy included the introduction of a waste levy on 1 December 2011 to act as a price signal to drive behaviour change in waste management. Household waste is currently levy exempt, but subject to review in 2013. Commercial and construction waste will be charged a levy of $35 per tonne, plus annual CPI adjustments. By 2020, the levy impost will represent 20 per cent of landfill disposal costs and in conjunction with landfill gate increases planned by Council, will see landfill disposal rates increase to $220 per tonne.

Carbon cost avoidance – The recent passing of the Clean Futures legislation (CFI) sets a price on carbon and landfill gas emissions represent approximately 75 per cent of Councils carbon liability. Selection of an alternative resource recovery approach that minimises landfill gas generation and associated carbon liability actively manages Councils future liability. Furthermore, AWT are eligible for Australian Carbon Credit Units (ACCUs) and may be used to partially offset Councils carbon liability.

3| STRATEGIC WASTE MANAGEMENT OBJECTIVES

3.1 STATE DRIVERS

Queensland's Waste Reduction and Recycling Strategy 2010-2020, released in December 2010 incorporates a policy framework and pricing mechanisms to improve resource recovery practices in Queensland. The framework has been strengthened by legislation, the *Waste Reduction and Recycling Act 2011* that outlines legislative targets for waste diversion and the collection of a waste levy that commenced on 1 December 2011.

3.1.1 Targets and priorities

The *Queensland's Waste Reduction and Recycling Strategy 2010-2020* outlines key targets and outcomes that are relevant to local government and are listed in Table 2.

Table 2: State waste reduction and recycling targets relevant to local government

OUTCOME	TARGET
Waste avoidance	Reduce waste generation by 15 per cent
Increase resource recovery	Recover and recycle by 2020: ▪ 65 per cent of municipal solid waste ▪ 60 per cent of commercial and industrial waste ▪ 75 per cent of construction and demolition waste
Reduce waste disposal to landfill (compared to business as usual)	Reduce waste to landfill by 50 per cent by 2020
	Reduce landfill gas emissions by 50 per cent

The development of an AWT is likely to be the key infrastructure for Council to move towards achievement of the State resource recovery targets.

3.1.2 Levy

The Queensland Government has introduced a waste levy as a price signal to drive behaviour change in waste management. The levy will apply at the disposal point and will be paid in addition to the normal waste disposal gate fee. Table 3 summarises the levy amount for each waste stream.

Table 3: Levy amount by waste stream

WASTE STREAM	DISPOSAL LEVY AMOUNT ($ PER TONNE)	COUNCIL LANDFILL GATE FEE WITH LEVY ($ PER TONNE)
Household	0	$110
Commercial	35	$148.50
Construction	35	$148.50
Contaminated and acid sulphate soils	35	$148.50
Lower hazard regulated waste	50	$165
Higher hazard regulated waste	150	N/A

MSW, which includes household kerbside waste and self-haul waste, does not currently attract a levy payment, however, this will be reviewed in 2013. Residual waste from an AWT that will require final disposal at a landfill would attract a levy consistent with the rate applied to Commercial waste.

3.2 LOCAL STRATEGY

Council endorsed a *Waste Minimisation Strategy 2009–2014* in 2010 to provide a clear strategic direction for future waste management within the region.

Councils stated goal is to increase the recovery of wasted resources to over 70 per cent by 2014. Council intends to follow the waste hierarchy to maximize the highest and best use of waste resources. The targets summarized in Table 4 highlights Council goals for the household waste streams.

Table 4: Local strategic targets and priorities

OUTCOME AREA	TARGET (2014)
Reduce waste disposal to landfill (compared to business as usual).	70 percent by 2014
Increase resource recovery	Recover and recycle: ▪ 100 per cent of non-compostable plastic shopping bags by 2012 ▪ 70 per cent of construction and demolition by 2012 ▪ 70 per cent of MSW by 2014 ▪ 70 per cent of C&I by 2014
Organics	Focus on recovering the organic waste from domestic residences that can't be utilised at home.
Waste to energy	Derive renewable energy from the residual wastes after reduction and improved recycling has been implemented

The strategy also defines a set of guiding principles that will be used to guide decision making for a suitable AWT and are listed below:

- follow the waste waste hierarchy
- focus on diverting organic waste from landfill to minimize future liabilities and carbon emissions.
- partner with the community and private sectors to determine and deliver services
- maximise the economic opportunities from any recovered resources
- provide an efficient, convenient and safe waste systems for residents and business
- minimize cost and risk to ratepayers by using proven technology and competitive tendering to engage private sector and deliver value for money

3.3 CURRENT RESOURCE RECOVERY PERFORMANCE

Current resource recovery activities provided by Council across all waste streams include:

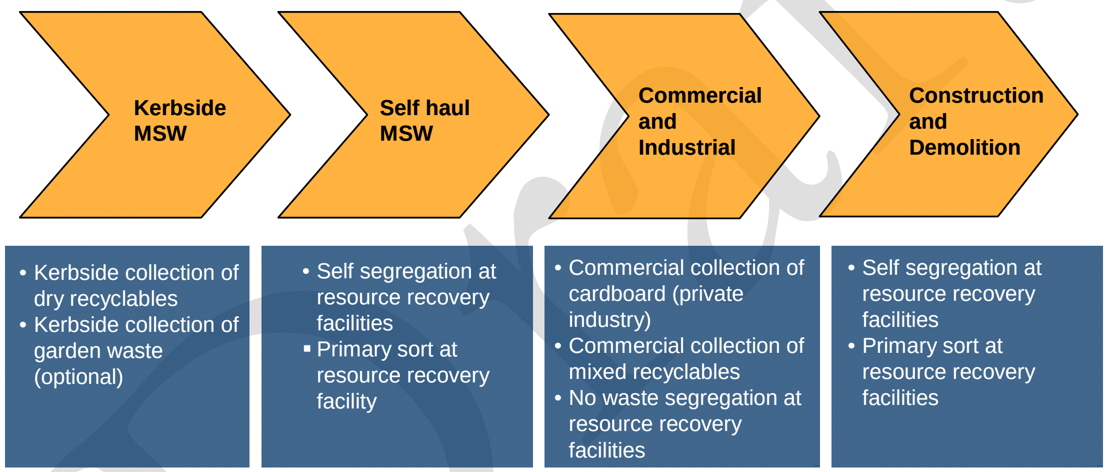


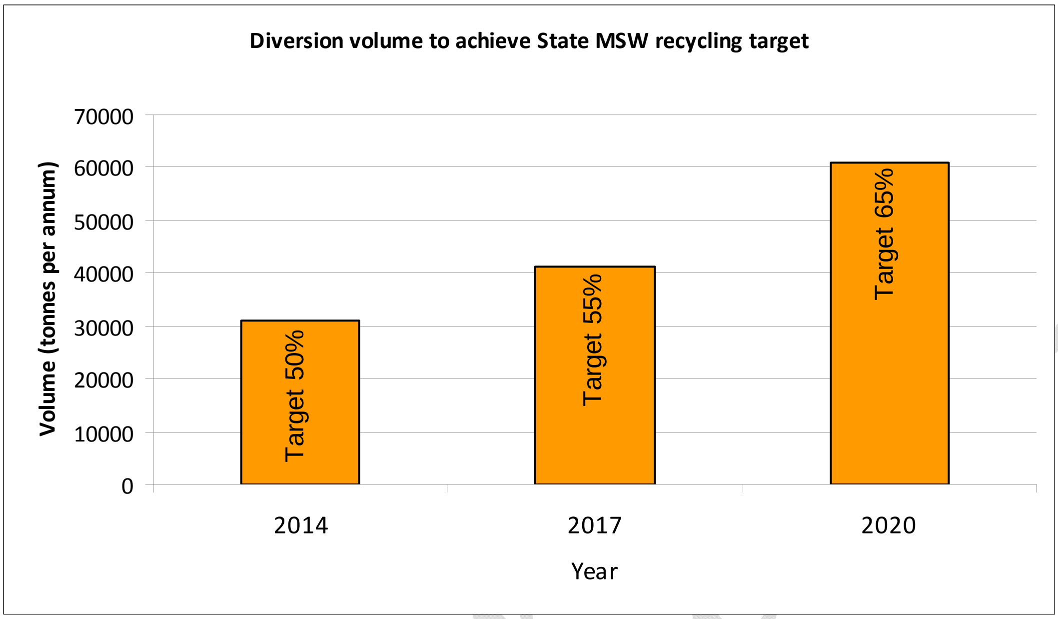
Table 5 summarises the historic kerbside waste generation rates and recycling performance for the period 2008/09 to 2010/11.

Table 5: Waste volume by waste stream for FY2009 to FY2011

MUNICIPAL KERBSIDE COLLECTION	FY2009	FY2010	FY2011	TOTAL
Kerbside MSW (tonnes)	97,899	96,653	99,388	293,940
Public place bins (MSW) (tonnes)	5,593	5,766	5,754	17,114
Recyclables (tonnes)	34,317	36,537	35,972	106,826
Garden organics (tonnes)	2,612	3,235	5,375	11,222
Resource recovery rate	26%	28%	28%	27.5%

The kerbside resource recovery performance for FY2011 indicates that approximately 41,000 tonnes (28 per cent) was recovered. Based on current generation rates, to achieve the State targets over the next 8 years will require significant additional diversion, as illustrated in Figure 1.

Figure 1: Diversion volume required from the household waste stream



The volumes required to achieve target attainment are more likely to be achieved by the introduction of a resource recovery technology and complimentary collection approach to extract the resources currently contained within the mixed waste kerbside bin.

4| WASTE COLLECTION APPROACH

Council currently manages three different collection arrangements, through three separate contracts with three contractors. While the bin configuration for domestic kerbside services across the three areas is largely the same, there are differences in bin sizes. These arrangements are detailed in Table 6.

Table 6: Current collection contractors and contract scope of work

	FORMER COUNCIL AREA		
DESCRIPTION	CALOUNDRA	MARCOOHYDORE	NOOSA
Contractor	Thiess Services	J.J Richards	TPI Cleanaway
Contract expiry	31 July 2014	31 July 2012 (2 x 1 year options for extension)	31 September 2014
Bin configuration (domestic kerbside service)			
Waste	80/140L (weekly)	140/240L waste (weekly)	140/240L waste (weekly)
Recycling	240L (fortnightly)	240L (fortnightly)	240L (fortnightly)
Garden (opt in)	240L (fortnightly)	240L (fortnightly)	240L (fortnightly)
Service scope	Domestic Commercial Public place Dead animals Roll On/Roll Off	Domestic Commercial Public place Dead animals Roll On/Roll Off	Domestic Commercial Public place Dead animals Roll On/Roll Off
Disposal location	Caloundra landfill	Caloundra/Noosa landfill	Noosa landfill

4.1 CURRENT SERVICE VOLUMES

Council has identified Sustainability Park, in Caloundra South as the preferred location for an AWT. The AWT location and final bin configuration will have a significant influence how waste is collected and transported within the region. This will affect waste being transported to the AWT, as well as residual waste flowing from the AWT to Council landfills.

Figure 2 summarises the current service volumes by type for the North, Central and South areas of the region. For the general waste and recycling services, the central area (formerly

Marcoochydore) accounts for just under 50 per cent of all mobile garbage bin (MGB) services, followed by south (Caloundra) with 30 per cent. For the garden waste service, a voluntary service offered across each area, demand is highest in south, with 58 per cent, followed by Central with 28 per cent. Collectively across the region, the uptake of garden waste services is 6.6 per cent.

Collectively across the region, domestic services of MGB's account for 90 per cent of all collections. Commercial collections make up the remaining 10 per cent, as illustrated by Figure 3 and Figure 4.

Figure 2: Mobile bin service numbers by service type and region

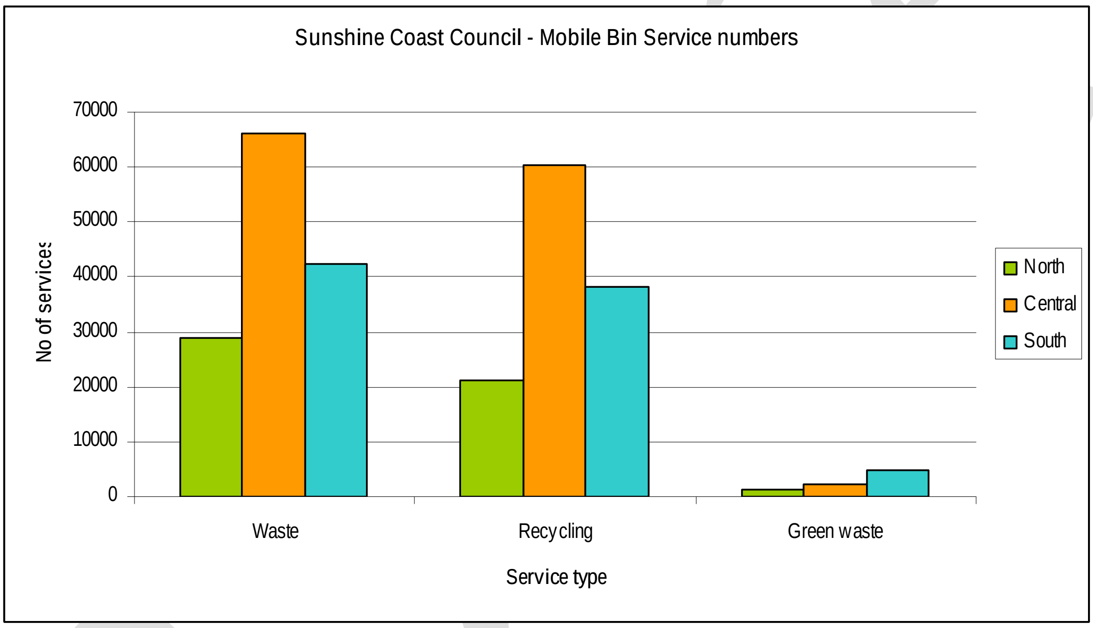


Figure 3: Mobile garbage bin proportion – Waste service

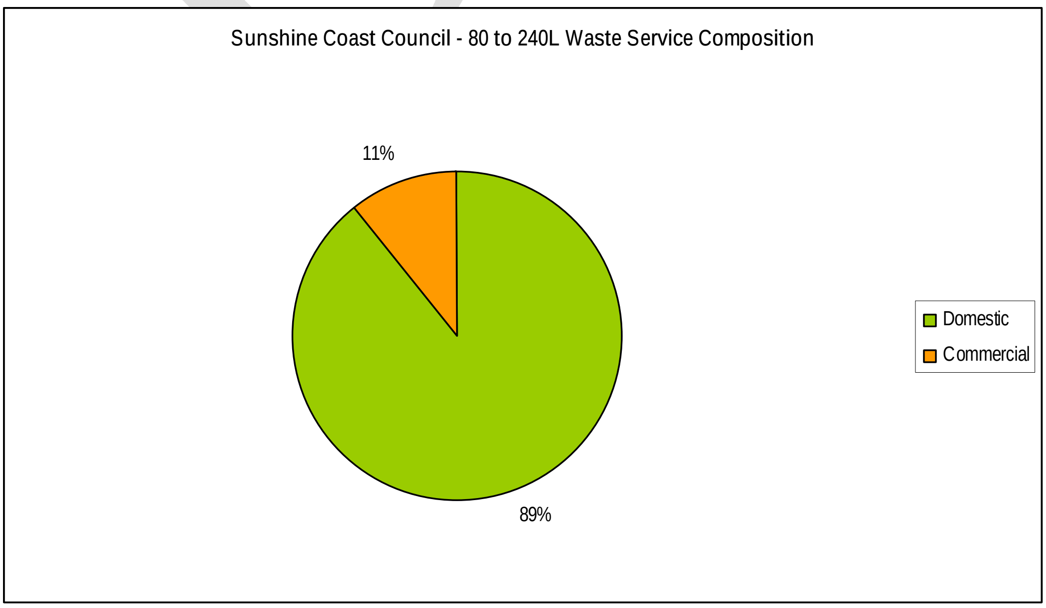
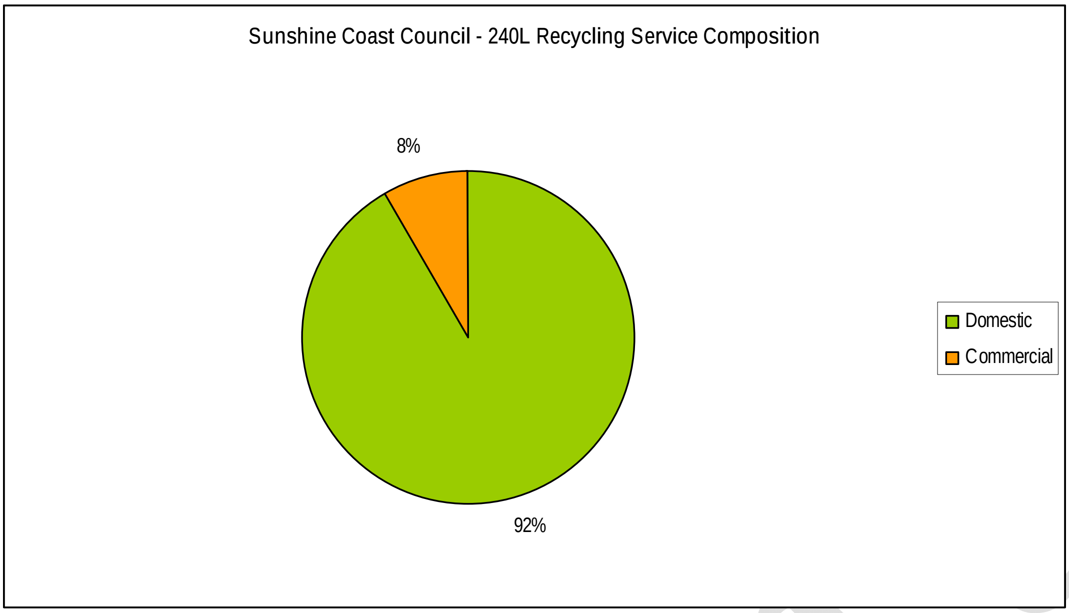


Figure 4: Mobile garbage bin proportion – Recycling services



4.2 FORECAST SERVICES VOLUMES

Council's next waste collection contract will commence in 2014 and continue for a seven to 10 year term (2021-2024). Throughout this period, the region will undergo significant population growth and generate additional dwelling demand that will require domestic waste servicing and increase the forecast waste volume.

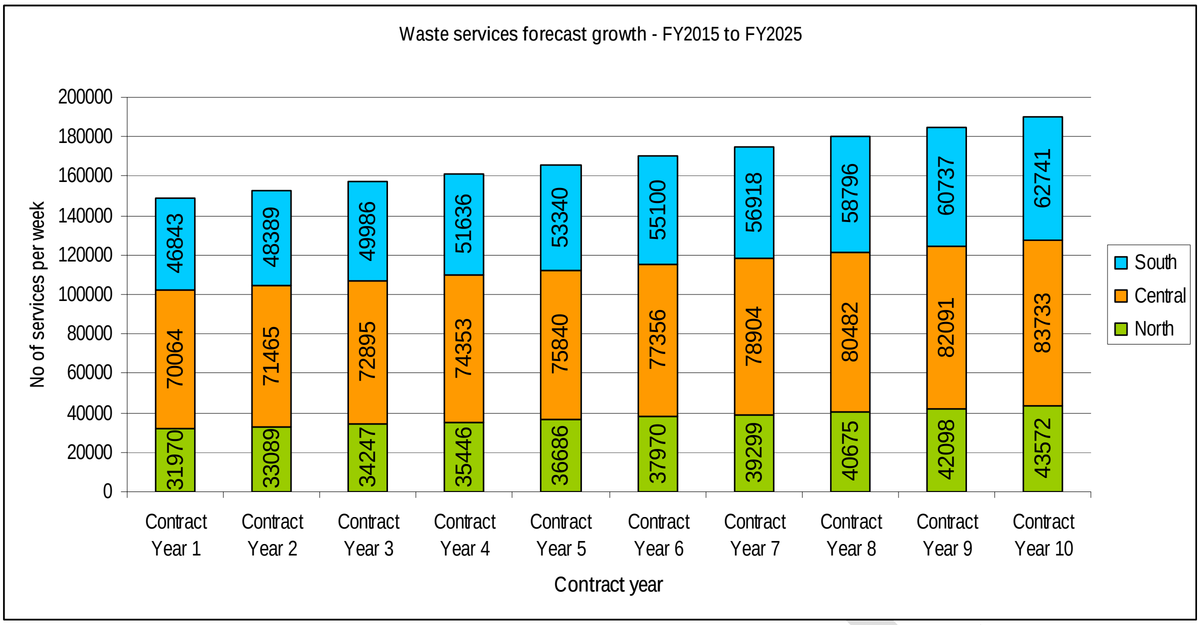
Urban development to date has been largely concentrated within 10kms of the coastline. Over the next decade, the relative share of the population is likely to change, as existing suburbs reach dwelling capacity and newer suburbs are developed. Forecast growth areas for the region include Sippy Downs, Palmwoods, Palmview and Caloundra South. Development trends for the region suggest that dwelling growth across the region will be highest in the south of the region, following by the north area, as summarised in Table 7.

Table 7: Forecast growth rates by region

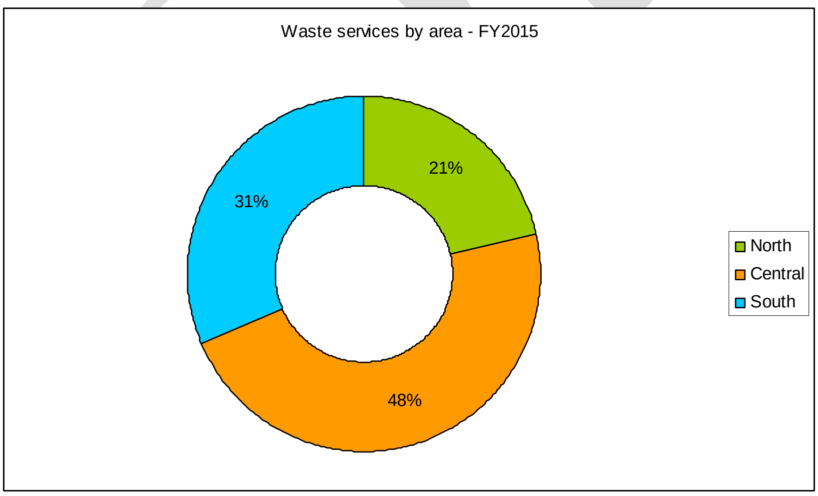
	NORTH	CENTRAL	SOUTH
Dwelling growth (% per annum)	3.5	2.0	3.3

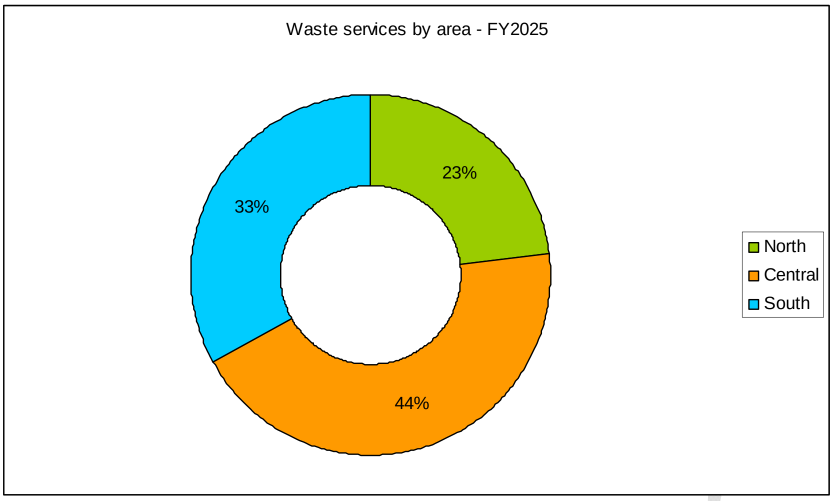
Considering that the per capita waste generation rate may be slow to change, future dwelling growth provides an indicator of future waste volumes. Figure 5 provides a forecast of service growth for waste services only by area, based on the growth rates summarised in Table 7.

Figure 5: Forecast waste service growth – FY2015 to FY2025



Modelling indicates that waste collections per week will increase from 145,000 to 190,000 over a 10 year period, an increase of 28 per cent. Accounting for the different growth rates by area, there will be a relative decrease in the proportion of services delivered within the central area and corresponding increase in the northern and southern areas. However, the Central region will continue to be the significant centroid for services.





The central region Council will continue to contribute the highest proportion of domestic waste services to the region, followed by the southern region. The preferred location for an AWT facility would be in relatively close proximity to the central and southern regions.

5| WASTE GENERATION AND CHARACTERISATION

This section summarises the waste types and quantities of waste generated in the Sunshine Coast Council region. This information is critical to understand and evaluate the potential resources contained within the waste streams and forecast volumes available for an AWT.

5.1 WASTE FLOWS 2008-09 TO 2010-11

Council has robust weighbridge waste data for the financial year 2008-09 to 2010-11. To provide a clear understanding of waste flows to landfill from the main waste streams, the waste volumes were categorised as follows:

- household kerbside
- household self-haul
- commercial contracted
- commercial self-haul, and
- construction

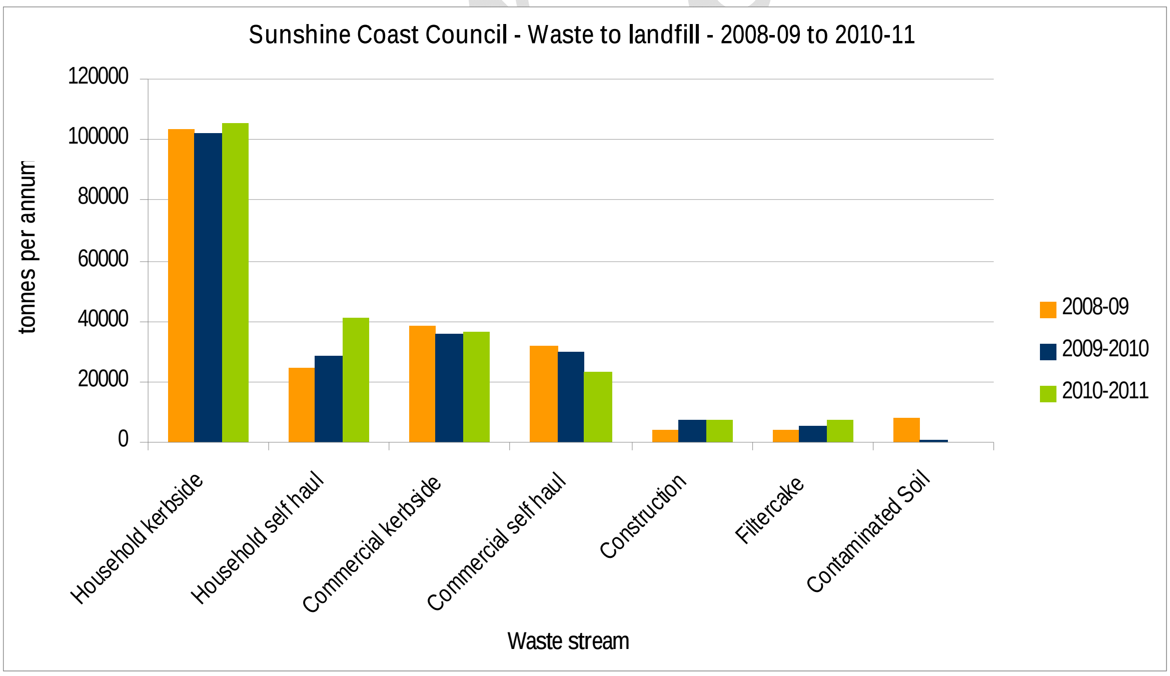
Table 8 summarises the waste volumes to landfill by category for financial year 2008-09 and 2010-11.

Table 8: Summary of waste to landfill 2008-09 to 2010-11

WASTE STREAM	2008-09 (TONNES)	2009-10 (TONNES)	2010-2011 (TONNES)
Household kerbside	103 493	102 415	105 137
Household self-haul	24 840	28 293	40 800
Commercial contracted	38 166	38 833	41 520
Commercial self-haul	31 940	29 796	23 001
Construction	4 025	7 029	7 467
Filtercake	3 811	5 021	7 572
Contaminated soil	7 893	830	39
Total	214 167	212 217	225 535

Figure 6 indicates the trend of waste streams over the past three years, indicating that the household kerbside and self-haul waste stream is increasing, while commercial contracted remains static. Construction has decreased significantly due to reduced development activity, increasing resource recovery and aggressive pricing by landfills outside the region. The household kerbside stream represents almost 50 per cent of waste to landfill and provides Council with the most significant waste stream to achieve diversion targets

Figure 6: Summary of waste to landfill



5.2 WASTE FLOWS BY LANDFILL

The region has three active landfills for the disposal of putrescible and non-putrescible waste. Table 9 summarises the key features of the landfills

Table 9: Airspace capacity by landfill

LANDFILL	WASTE CATCHMENT	DESCRIPTION	IDENTIFIED AIRSPACE CAPACITY (M3)
Noosa	North		2.55 M
Nambour	Central	Lot 1 and 2 on RP 208600	1.17 M
Pierce Ave	South	Lot 77 on SP177390	2.05 M

Household kerbside and contracted commercial waste flows into these landfills based on pre-amalgamation contract specifications. This means that household and commercial waste from the former Noosa Council is received at Noosa landfill, and similarly for the other landfill sites. This results in varying demands for air space at each landfill. Self-haul household and commercial waste flow is less restricted and is typically directed towards the site in closest proximity to the user. Figure 7 to Figure 9 illustrate the waste volume by waste stream for each landfill within the region.

The key observations from the waste flows review include:

- Nambour landfill currently receives 50 per cent of the total waste generated in the region, followed by 30 per cent for Caloundra and 20 per cent for Noosa
- Household kerbside waste is delivered in relatively equal proportions to all three site and represents almost 50 per cent of waste delivered to landfills
- Household self-haul waste is delivered in relatively equal proportions to all three site and represents 17 to 21 per cent of waste delivered to landfills
- Nambour landfill receives almost 60 per cent of the commercial kerbside waste stream, significantly higher than Caloundra and Noosa. This is due to the logistically central location of Nambour.
- Nambour has the lowest airspace capacity and as the centroid for waste disposal within the region, will continue to attract higher waste flows of domestic and commercial waste. Continuation of the current approach is likely to result in Nambour reaching airspace capacity in 2019 – 2020.

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Figure 7: Noosa landfill waste volume by waste stream (2010/11)

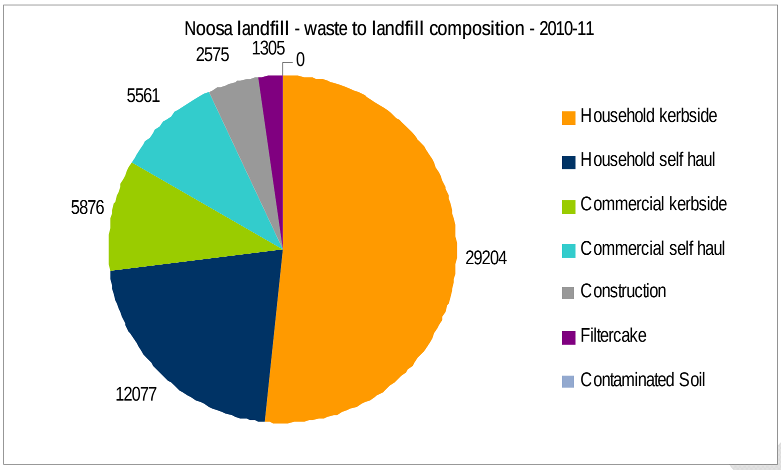


Figure 8: Nambour landfill waste volume by waste stream (2010/11)

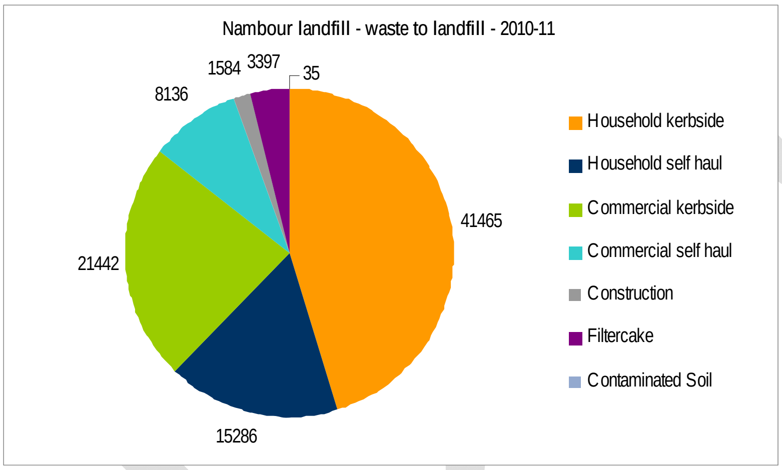
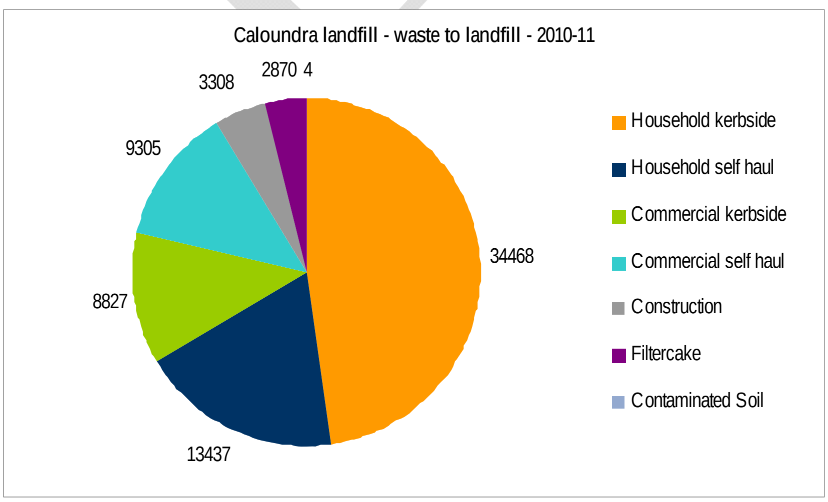


Figure 9: Caloundra landfill waste volume by waste stream (2010/11)



5.3 FORECAST WASTE GROWTH

Forecast volumes of waste generated within the region and requiring landfilling are influenced by a number of key factors including:

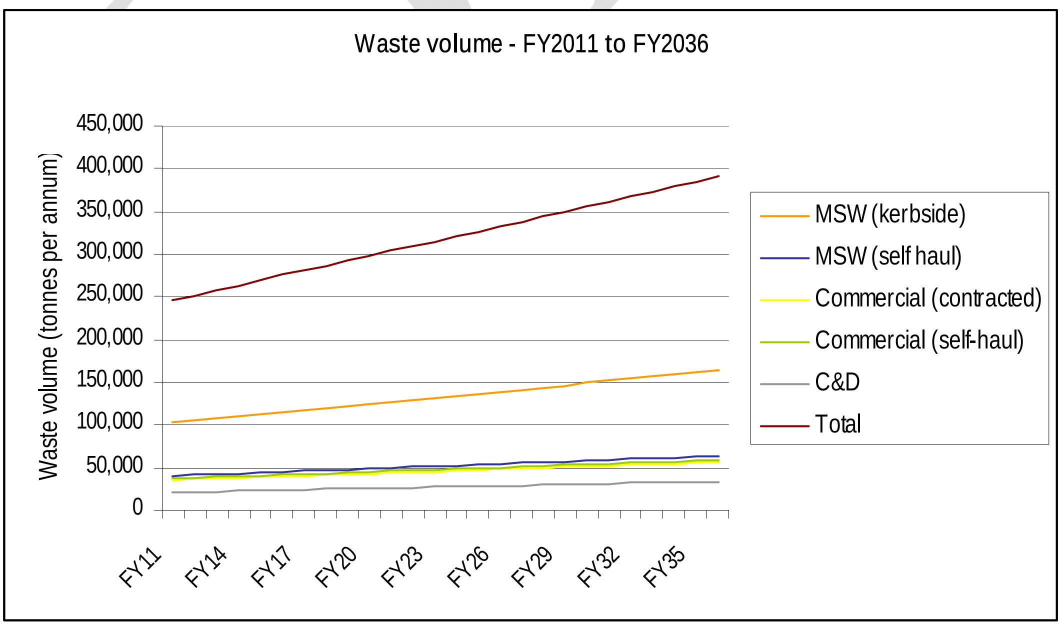
- population growth rate
- per capita waste generation rate, and
- resource recovery efficiency.

While the three year trend for commercial and construction wastes indicate static or decreasing waste volumes, household has continued to increase. It is likely that continued population growth and rising per capita consumption will result in increasing waste volumes for the region.

5.3.1 Business as usual

Forecast waste projections for the region have been modelled based on business as usual, over a 20 year period. Population estimates are based on the Planning Information and Forecasting Unit (PIFU) Medium series 2008 – 2033 and assuming that no change to the current per capita waste generation rate. Figure 10 illustrates the forecast waste annual waste volume by type. Waste volume forecasting indicates that continuing with current waste disposal practices, waste to landfill will increase from 225,535 tonnes per annum (FY2011) to around 380,000 tonnes per annum (FY2036). Domestic kerbside waste contributes almost 50 per cent of waste to landfill and provides a significant opportunity for waste diversion.

Figure 10: Forecast waste volume (FY2011 to FY2036)



5.4 FOCUS ON HOUSEHOLD WASTE

Council has perpetual responsibility for the management and disposal of household waste, under the statutory powers conferred by the DERM, the *Environmental Protection (Waste Management) Regulation 2000* and the *Local Government Act 2009.* Council's landfill assets primarily exist to manage household waste, as it represents approximately 55 to 60 per cent of all waste arriving at Council landfills.

The challenge for Council in achieving the recently introduced State targets is how to maximise recycling from the household waste stream and deliver the best value for money for the community.

5.4.1 Resource recovery potential

Waste to landfill characterisation audits were carried out at Council landfills located at Caloundra, Nambour and Eumundi in August 2010 (EnviroCom, 2010). The waste streams assessed were:

- domestic kerbside waste (household)
- transfer station domestic self-haul waste (household self-haul), and
- commercial

The waste characterisation percentages found within each waste stream are summarised below.

WASTE TYPE	HOUSEHOLD KERBSIDE (%)	HOUSEHOLD SELF-HAUL (%)	COMMERCIAL (%)
Organics Compostable (food)	49.4	9	30.2
Organic other, non-wood	5.3	10.4	1.57
Organic, wood/timber	1.8	27	21.7
Total organics	56.5	46.4	53.47
Paper	11.8	10.36	17.75
Glass	5.6	0.2	3.8
Plastic 1-7	2.9	0.83	2.00
Metal	1.95	0.6	1.00
Recyclables	22.25	12.00	24.55
Paper non recyclable	3.65	1.23	2.4
Plastic composite	9.5	11.42	9.6
Non recyclable ferrous/non-ferrous	5.5	7.7	3.8
Hazardous	0.45	0.6	0.22
Inert (building materials)	2.15	20.25	5.91
Mixed waste	0	0.4	0.05

WASTE TYPE	HOUSEHOLD KERBSIDE (%)	HOUSEHOLD SELF-HAUL (%)	COMMERCIAL (%)
General waste	21.25	41.6	21.98

Analysis of the waste composition indicates:

- Household kerbside waste has almost 50 per cent organics compostable, significantly higher than both commercial and household self-haul
- Recyclables contribute the next largest proportion of recoverable waste. Commercial waste, at 25 per cent, has a slightly higher recyclable composition than household kerbside waste (22 per cent)
- Paper is the highest proportion recyclable

6| TECHNOLOGY SUMMARY

In Australia, at least 17 AWT facilities have been constructed and operated at (or near) commercial scale across Australia over the past 10 years. These facilities have generally been designed to process either Household Separated Organics or Mixed waste from households. Table 10 below summarises the known performance statistics for the two waste streams.

Appendix A provides a detailed description of AWT technology options that could be considered by Council.

Table 10: Summary of performance of AWT in Australia

	IN PLACE	SUCCESS	CHALLENGED	UNKNOWN	FAILURE
Household Separated Organics	8	5	3	-	-
Anaerobic digestion	1	-	1	-	-
Compost – aerobic tunnel	3	3	-	-	-
Compost – aerobic enclosed windrow	1	1	-	-	-
Compost – aerobic windrow	1	1	-	-	-
Compost – aerobic enclosed vertical	1	-	1	-	-
Vermiculture	1	-	1	-	-
Mixed waste	13	5	3	4	1
Drum + aerobic compost	5	1	1	3	-
Autoclave + aerobic compost	1		1	-	-
Autoclave + gasification	1			-	1
Anaerobic – Aerobic batch drum				1	-
Anaerobic + aerobic compost	2	1	1	-	-
Shred/sort + aerobic compost	2	2		-	-
Shred/sort + RDF	1	1		-	-

Both the Australian and global experience in AWT highlight that each technology has a different risk profile. Risks that need to be considered to assess technology options include:

- Proven and reliable technology
- High potential to produce marketable products
- Flexibility to adapt to process changes
- Flexibility to accommodate in-feed variations
- Technological complexity
- Consistent ability to comply with environmental licence conditions, and
- Unit cost is within expected range

The technology options within Australia were assessed against these risks and are summarised in Table 11.

Table 11: AWT technology risk assessment

	Proven	Products	Process flexible	In-feed flexibility	Technological complexity	Environmental compliance	Unit cost
Household Separated Organics							
Anaerobic digestion	××	✓	××	××	××	✓✓	××
Compost – aerobic tunnel	✓✓	✓✓	✓	✓	✓✓	✓✓	✓✓
Compost – aerobic enclosed windrow	✓✓	✓✓	✓	✓	✓✓	✓✓	✓✓
Compost – aerobic windrow	✓✓	✓✓	✓	✓	✓✓	✓✓	✓✓
Compost – aerobic enclosed vertical	×	✓✓	×	×	✓	✓✓	✓✓
Vermiculture	✓	✓✓	×	×	✓	✓✓	✓✓
Mixed waste							
Drum + aerobic compost	✓✓	✓	✓	✓	×	✓	×
Autoclave + aerobic compost	×	×	✓	✓	×	×	×
Autoclave + gasification	××	×	×	×	××	×	××
Anaerobic + aerobic compost	×	×	×	×	×	×	×
Shred/sort + aerobic compost	✓✓	✓	✓	✓	✓✓	✓	✓✓

Legend

✓✓	Very positive delivery on objective
✓	Positive delivery on objective
×	Poor delivery on objective

××	Very poor delivery on objective

From the technology assessment it can be concluded that:

- There is a significantly lower risk profile where source separated green waste (only) or green and food are collected and processed
- Aerobic composting of organic wastes is the preferred option in Australia and enclosed composting systems are lower risk than outdoor systems
- Aerobic composting has been successful for both source separate and mixed waste
- The most successful mixed waste system to date involve simple mechanical pre-treatment of waste to sort the organics, from recyclables and residuals, following by aerobic composting of the organic fraction.
- Anaerobic digestion (wet) have a high risk profile, related to system breakdown and performance, rather than environmental harm
- There is limited experience with energy from waste in Australia. EfW plants have been operating in the Europe and UK for several decades with reliable performance. There are increasing stringent air pollution control standards which need to be met, which increase the unit cost of these facilities. Community and regulatory perception of EfW poses a significant risk to investment in the technology within Australia.

7| SCENARIO OPTIONS

To achieve Council's waste diversion target of 70 per cent, and the State household recycling target of 65 per cent by 2020 will require the implementation of different collection systems and processing approaches from the current 2 bin system and landfilling approach. The technology review indicated a range of AWT's that can be implemented to process waste and achieve Council's outcomes. Critical to the selection of a suitable AWT is ensuring that it fits Council's risk profile.

Council has long-term security of supply of the household waste stream due to its statutory responsibility for household kerbside collection and the long-term nature (10 years) of these contracts. This waste stream also represents approximately 50 per cent of waste flowing to landfill and presents the most significant opportunity for diversion.

To provide a comprehensive options analysis, a range of scenarios with different AWT technology and bin configuration were assessed to understand the environmental, social and financial impacts.

These options have been examined with the following assumptions:

- Household kerbside waste stream volume only
- Processing facility will be located at Sustainability Park, Caloundra South

The scenarios are summarised in Table 12 and are examined in more detail in the following section.

Table 12: AWT Scenarios

SCENARIO	NO OF BINS	AWT TYPE	COLLECTION FREQUENCY		
			MIXED WASTE	RECYCLABLES	ORGANICS
1	2	Compost (of sorted mixed waste)	Weekly	Fortnightly	N/A
2	2	Thermal treatment (of mixed waste)	Weekly	Fortnightly	N/A
3	3	Compost (of organics bin only)	Fortnightly	Fortnightly	Weekly
4	3	Compost (of sorted mixed waste and organics bin)	Fortnightly	Fortnightly	Weekly
5	2	Compost + thermal (of mixed waste)	Weekly	Fortnightly	N/A
Notes: 1. Organics bin includes garden and food scraps					

7.1 BASE CASE (DO NOTHING)

There is no change to the current approach. The collection configuration to service the region is summarised in Table 13.

Table 13: Collection configuration for Base Case (Do Nothing)

PARAMETER	MIXED WASTE	RECYCLABLES	GREEN (GARDEN WASTE)
Bin size	240L	240L	240L
Collection frequency	Weekly	Fortnightly	Fortnightly (voluntary)
North	Noosa landfill	Nambour MRF	Noosa landfill (for processing)
Central	Nambour landfill	Nambour MRF	Nambour landfill (for processing)
South	Caloundra landfill	Nambour MRF	Caloundra landfill (for processing)

Key outcomes of this approach include:

- No change of diversion rate (currently 28 per cent for kerbside domestic collection)
- No progress in achieving local and state diversion and recycling targets
- Fastest filling rate of existing landfill capacity and therefore requires earlier delivery of new Greenfield landfill within the region or bulk transport to landfill outside the region.

7.2 SCENARIO 1 - 2 BIN COMPOST (MIXED WASTE)

7.2.1 Description

This system retains the current bin configuration and collection frequency, with the separation of organics and other recoverables managed at the processing stage. All collection vehicles would transport waste collected from the kerbside to Sustainability Park. Residual waste from the process would be transported to either Caloundra, Nambour or Noosa landfill, subject to the best operational management outcomes.

The AWT process involves mechanical pre-sorting the incoming mixed residual waste, following by composting of the organic fraction in enclosed composting tunnels. The sorting process removes recyclables and oversized items. Mechanical mulching and enclosed composting in controlled conditions is performed on the organics. On completion of the compost process, product is placed on maturation pads (outside) for a 4-6 week period prior to being screened to produce different product size grades.

Figure 11 provides a schematic of the process operation.

Figure 11: Compost facility (mixed waste) schematic

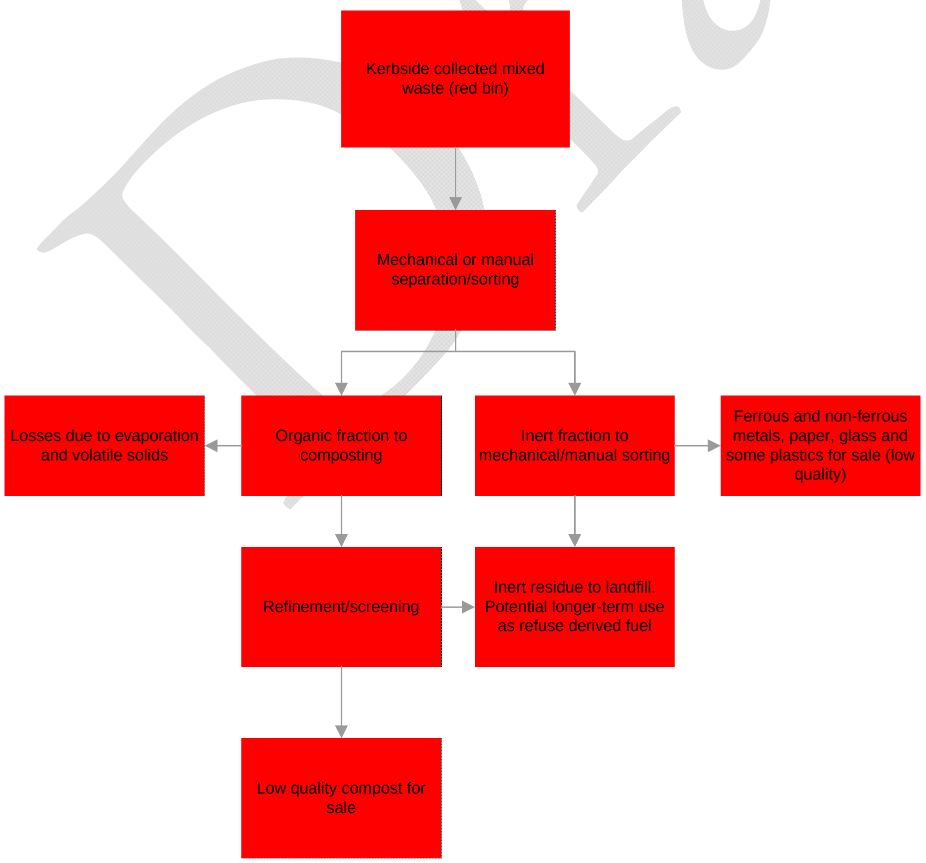


Table 14 summarises the key features of the 2 bin compost (mixed waste).

Table 14: Key features of 2 bin compost (mixed waste)

TECHNOLOGY	CAPACITY (TONNES PER ANNUM)	RECOVERED PRODUCTS	RECOVERED PRODUCT MARKETS	RECYCLING RATE	CONTRACT TERM
2 bin mixed waste compost	115,000 (2014) 140,000(2024) 180,000 (2034)	Specific use compost (low quality) Ferrous metals (low quality) Non-ferrous metals (low quality) Mixed plastics (low quality)	Compost - Mine site, quarry rehabilitation, feedstock for energy from waste plant Metals – recycled Mixed plastics - recycled	50-55 per cent	20 years

The 2 bin compost (mixed waste) system has the advantages of;

- generating a smaller carbon (green house gas) footprint than the three bin option
- achieving higher diversion rates than three bin options
- facilitating dry recyclables recovery from the waste stream
- reducing the education 'burden' of introducing a third bin
- reducing the extent of change management required in Council's own operations
- providing greater flexibility in future waste options, including a pathway to an energy from waste facility, and
- ability to recover recyclables from multi-unit dwellings (MUDs) that do not currently have systems in place for separate recyclables collection

The relative disadvantage of the two bin system is that it is more costly than a three bin solution and requires a longer term contract commitment from Council. This is due to the higher capital and operating costs of a mixed waste processing facility.

Significantly, the compost product produced from this process has limited application, due to the presence of contaminants (glass fines, plastic). This restricts the market for this product to non public contact areas, such as mine and quarry rehabilitation, forestry and non-contact agricultural use.

7.2.2 Collection configuration

There is no change to the current approach. The collection configuration to service the region is summarised in Table 15.

Table 15: Collection configuration for 2 bin compost (mixed waste)

PARAMETER	MIXED WASTE	RECYCLABLES	ORGANIC (GARDEN WASTE)
Bin size	240L	240L	240L
Collection frequency	Weekly	Fortnightly	Fortnightly (voluntary)
North	Compost facility for mixed waste at Sustainability Park, Caloundra South	Nambour MRF	Noosa landfill (for processing)
Central		Nambour MRF	Nambour landfill (for processing)
South		Nambour MRF	Caloundra landfill (for processing)

The implications for the collection system is that mixed waste from the North area will need to be delivered to a transfer station at Noosa and bulk transported to Sustainability Park for processing. This may require a capital upgrade to the existing transfer station at the Noosa Landfill.

7.2.3 Implementation implications

Table 16 summarises the key implications of implementation of Scenario 1 on the collection and landfill assets of Council, as well as the community.

Table 16: Implications of 2 bin compost (mixed waste) AWT

PARAMETER	IMPLICATION
Collection frequency	No change
Landfills	All household kerbside waste will be transported to the AWT at Sustainability Park, Caloundra South. Residual waste from the AWT will be transported by bulk transport to one of the three existing landfills. It is expected that Caloundra and Nambour landfills would be preferentially filled to minimise the transportation costs.
Materials Recovery Facility (MRF)	Recovered plastics from the process may be supplied to the MRF for further processing. Forecast volume would be 5,000 – 10,000 tonnes in Year 1. This will need to be considered as part of the Recyclables Processing Request for Tender (RFT)
Support infrastructure required	Transfer station at Noosa landfill Transfer station at preferred AWT for residual management
Recovered product market	Compost (low quality). NSW experience indicates that compost product from mixed waste composting has higher contamination rates, particularly from glass fines. This makes it unsuitable for use in public places/landscaping and restricts the market to mine site/quarry and landfill rehabilitation (i.e. restricted access locations) Ferrous and non-ferrous steels – established markets in Brisbane for recycling. Lower price due to product quality

PARAMETER	IMPLICATION
	Plastics – established markets in Brisbane for recycling. Lower price due to product quality. Paper – established markets in Brisbane for recycling. Lower price due to product quality.
Education	No significant change to the education approach
Contamination management	No need for contamination management as the AWT process sorts mixed waste

7.3 SCENARIO 2 – 2 BIN THERMAL (MIXED WASTE)

7.3.1 Description

This system retains the current bin configuration and collection frequency, with the mixed waste bin transported to a thermal treatment facility located at Sustainability Park, Caloundra South. Incoming waste would go through a mechanical pre-sort to separate some recyclables contained within the waste stream. The remaining waste stream would be introduced to a thermal treatment facility may be either one of the following thermal technologies:

- gasification
- pyrolysis, or
- mass burn incineration

All of these technology types operate on the basis of the thermal destruction of mixed waste, to produce energy, heat and/or steam. Pyrolysis and gasification plants operate on a limited commercial scale in Europe and Japan. Mass burn incineration is the oldest and most prevalent energy from waste technology and is commercially proven and used extensively in Europe and the USA. There appears to be increasing interest in energy from waste technology by local and state government in Australia, although to date, no such technology operates in Australia for mixed household waste. The Eastern Metropolitan Regional Council (EMRC) group in Perth WA, after a 3 year review process, has recently restricted technology assessment for an AWT to Anaerobic Digestion and gasification. A final decision on technology is expected to be made after a tender process in late 2013.

Queensland Treasury Corporation (QTC) completed a feasibility review of thermal treatments in July 2011, on behalf of Council. The scope of work included a technical review of thermal treatment technology types and financial modelling of the technology options. A summary of the key recommendations from the QTC report, not listed in priority order, are listed below:

- A thermal treatment facility for the Sunshine Coast region would represent a high-cost waste management option, with high technology risks, complex procurement and significant regulatory and community perception risks. Council should carefully consider these costs and risks in its evaluation of any future plans.

- Council should defer further scoping work on an thermal treatment facility until it has completed the comparative assessments below:
- Compare the NPV of the preferred thermal treatment option (Pyrolysis – Scenario 1 MSW kerbside) with alternative options that may achieve Council's landfill diversion targets. This includes establishment of a third bin and organics processing facility.
- Compare the NPV of the preferred thermal treatment option (Pyrolysis – Scenario 1 MSW kerbside) to the Base Case disposal option of green field landfill development and/or bulk transport to SEQ landfill.
- Review Alternative Waste Technology (AWT) that may be retrofitted to existing transfer stations for a relatively lower capital and operating cost and contribute to achieving waste diversion targets. Examples of this include the Anaeco technology currently used in Western Australia.

Appendix B contains the complete QTC report.

Figure 12 provides a schematic of the process operation.

Figure 12: Thermal treatment facility schematic

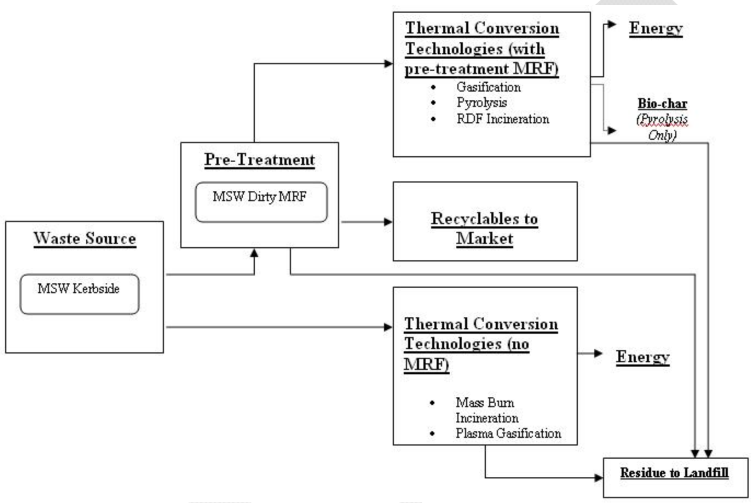


Table 17 summarises the key features of the 2 bin thermal (mixed waste) AWT.

Table 17: Key features of 2 bin thermal (mixed waste) AWT

TECHNOLOGY	CAPACITY (TONNES PER ANNUM)	RECOVERED PRODUCTS	RECOVERED PRODUCT MARKETS	RECYCLING RATE (%)	CONTRACT TERM
2 bin thermal energy from waste	115,000 (2014) 140,000(2024) 180,000 (2034)	Energy (electricity) Heat Biochar (pyrolysis only) Recyclables (gasification and pyrolysis only)	Energy – National grid Heat – would require co-located industrial user of heat Biochar – agriculture (would require market establishment) Recyclables – regional MRF	Mass burn incineration – 80 Pyrolysis – 70 Gasification – 85	25 years

The 2 bin mixed waste thermal approach has the advantages of;

- achieving higher diversion rates than the 2 bin mixed waste enclosed compost and 3 bin source separated organics enclosed compost options
- provides significant extension of Council's landfill airspace
- flexibility for Council to "mothball" an existing landfill
- flexibility to receive other waste streams currently going to landfill.
- reducing the education 'burden' of introducing a third bin
- reducing the extent of change management required in Council's own operations

The relative disadvantage of the two bin mixed waste thermal is that it represents the highest cost solution and requires a 25 year contract commitment. This solution requires a high risk appetite from Council, due to the limited status of commercialisation of the gasification and pyrolysis technology, as well as the potential public and political risk associated with thermal treatments. This approach will require a longer procurement timeframe and is not likely to be operational until 2018-2020.

The management of residual wastes (in the form of ash) and air pollutants will be a critical issue for approval. Consideration of these issues would be undertaken by the Department of Environment and Resource Management (DERM) as part of the development approval and conditioned appropriately as part of the operating licence.

7.3.2 Collection configuration

There is no change to the current approach. The collection configuration to service the region is summarised in Table 18.

Table 18: Collection configuration for 2 bin thermal (mixed waste)

PARAMETER	MIXED WASTE	RECYCLABLES	ORGANIC (GARDEN WASTE)
Bin size	240L	240L	240L
Collection frequency	Weekly	Fortnightly	Fortnightly (voluntary)
North	Thermal treatment facility at Sustainability Park, Caloundra South	Nambour MRF	Noosa landfill (for mulching)
Central		Nambour MRF	Nambour landfill (for mulching)
South		Nambour MRF	Caloundra landfill (for mulching)

The implications for the collection system is that mixed waste from the North area will need to be delivered to a transfer station at Noosa and bulk transported to Sustainability Park for processing. This may require a capital upgrade to the existing transfer station at the Noosa Landfill.

7.3.3 Implementation implications

Table 19 summarises the key implications of implementation of Scenario 2 on the collection and landfill assets of Council, as well as the community.

Table 19: Implications of 2 bin thermal (mixed waste) AWT

PARAMETER	IMPLICATION
Collection frequency	No change
Landfills	All household kerbside waste will be transported to the AWT at Caloundra South. Residual waste from the AWT will be transported by bulk transport to landfills. Residual waste may be classified as hazardous waste and may need to be transported to a licensed regulated waste landfill. It is expected that Caloundra and Nambour landfills would be preferentially filled to minimise the transportation costs.
Materials Recovery Facility (MRF)	Recovered plastics from the process may be supplied to the MRF for further processing. Forecast volume would be 5,000 – 10,000 tonnes in Year 1. This will need to be considered as part of the Recyclables Processing Request for Tender (RFT)
Support infrastructure required	Transfer station at Noosa landfill Transfer station at preferred AWT site for residual management
Recovered product market	Electricity. High demand for electricity. Feed into transmission grid. Will need to enter into supply agreement with energy retailer. Heat. Utilisation of heat would require suitable co-location with an industrial user

PARAMETER	IMPLICATION
	Biochar (pyrolysis only). Agricultural soil amendment. Will require market establishment. Recyclables. Direct supply to local MRF. Product may be low quality, with corresponding low value
Education	No significant change to the education approach
Contamination management	None required.

7.4 SCENARIO 3 – 3 BIN COMPOST (ORGANICS BINS ONLY)

7.4.1 Description

This approach requires a change to the current bin configuration and collection frequency. A third bin would be introduced for the collection of garden and food waste. The proposed bin configuration would be:

- garden + food – weekly
- recycling – fortnightly (as current)
- waste – fortnightly

The third bin (garden + food) would be transported to an enclosed compost facility located at Sustainability Park, Caloundra South. The collected material would be received in an enclosed building to minimise odour. On receival of the feedstock, gross contaminants are removed prior to tub grinding to produce a uniform raw product size. This product is then placed into enclosed tunnels using a front end loader. The composting process takes place within the enclosed tunnel over a 3-4 week period, with the moisture and oxygen content monitored and able to be controlled. Following the composting process, product is screened to remove smaller contaminants and screened to a range of sizing specifications (soil conditioner, mulch, coarse mulch).

The mixed waste bin would continue to be landfilled at the landfill of closest proximity. This also offers the flexibility for Council to process the waste bin with an additional AWT process in the future, further increasing the household recycling rate.

Figure 13 provides a schematic of the process operation.

Figure 13: Compost facility (household separated) schematic

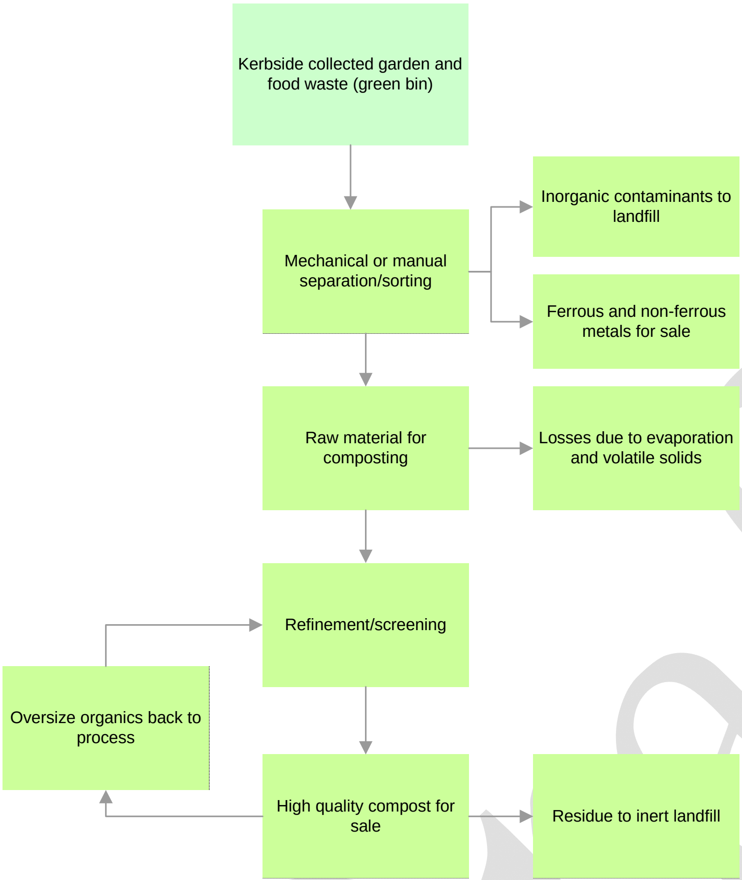


Table 20 summarises the key features of the 3 bin compost (organics only) AWT.

Table 20: Key features of 3 bin compost (organics only) AWT

TECHNOLOGY	CAPACITY (TONNES PER ANNUM)	RECOVERED PRODUCTS	RECOVERED PRODUCT MARKETS	RECYCLING RATE	CONTRACT TERM
3 bin compost (organics only)	40,000 (2014) 45,000(2024) 55,000 (2034)	High quality compost (AS4454)	Compost – landscaping, horticulture, agriculture (suitable for public contact)	30-35 per cent	15 years

The system has the following identified advantages:

- gate fees are lower and therefore the waste utility rate is the lowest of each option
- enclosed composting of household separated organics is well proven, tried and tested (lower risk)
- produced compost is clean and of high quality
- unlimited market for clean compost (including in agriculture), and

- very competitive market for tunnel composting construction and operation

The relative disadvantages of this approach are:

- the 3 bin household separated organics system diverts less material overall (in the long term) from landfill than the 2 bin mixed waste compost system.
- the overall increase in kerbside waste removal capacity (240 litres per fortnight) may facilitate increases in the domestic waste stream.
- premises that generate limited organic waste or have bin storage problems will not be willing participants in the service (i.e. Multi-unit dwellings/rural residential).
- the introduction of a third collection fleet operating within the region

7.4.2 Collection configuration

The garden and food organics bin would be collected weekly, due to the putrescible nature of food waste. The mixed residual would alter from a weekly service to fortnightly. The collection configuration to service the region is detailed in Table 21:

Table 21: Collection configuration for 3 bin compost (organics only) AWT

PARAMETER	MIXED WASTE	RECYCLABLES	ORGANIC WASTE (GARDEN + FOOD)
Bin size	240L	240L	240L
Collection frequency	Fortnightly	Fortnightly	Weekly (mandatory)
North	Noosa landfill	Nambour MRF	Sustainability Park composting facility
Central	Nambour landfill	Nambour MRF	Sustainabilty Park composting facility
South	Caloundra landfill	Nambour MRF	Sustainabilty Park composting facility

The implications of the collection approach are as follows:

- Establishment of a centralised composting facility at Sustainability Park will require the development of a transfer station at the Noosa landfill to enable bulk transport of green waste to Sustainability Park for processing.

7.4.3 Implementation implications

Table 22 summarises the key implications of the implementation of Scenario 3 on the collection and landfill assets of Council, as well as the community.

Table 22: Implications of 3 bin compost (organics only) AWT

PARAMETER	IMPLICATION
Collection frequency	Garden and food bin will be collected weekly. The collection cycle would be: Week 1 – garden + food, mixed residual Week 2 – garden + food, recyclables
Landfills	No change from current for disposal of mixed residuals
Materials Recovery Facility (MRF)	Nil impact
Support infrastructure required	Transfer station at Noosa landfill (if a centralised compost operation is preferred at Sustainability Park)
Recovered product market	Compost (high quality). established local and regional markets for product in landscaping, horticulture, agriculture and retail.
Education	Significant and ongoing education campaign will be required.
Contamination management	Contamination management will be required to remove gross contaminants from the garden and food bin.

7.5 SCENARIO 4 – 3 BIN COMPOST (MIXED WASTE AND ORGANICS BIN)

7.5.1 Description

This scenario combines the processing approach of Scenario 1 and 3.

The kerbside garden and food waste would be collected weekly. The kerbside collected mixed waste would be collected fortnightly. The incoming waste streams would be kept separate in designated waste receival areas, as well as throughout the processing, maturation and final refinement process. Some common infrastructure could be used for both waste streams.

The proposed bin configuration would be:

- garden + food – weekly
- recycling – fortnightly (as current)
- waste – fortnightly

Table 23 summarises the key features of the 3 bin compost (mixed waste and organics) AWT.

Table 23: Key features of 3 bin compost (mixed waste and organics) AWT

TECHNOLOGY	CAPACITY (TONNES PER ANNUM)	RECOVERED PRODUCTS	RECOVERED PRODUCT MARKETS	RECYCLING RATE	CONTRACT TERM
3 bin source separated garden and food and mixed waste compost	Garden + food line 40,000 (2014) 45,000(2024) 55,000 (2034) Mixed waste line 80,000 (2014) 100,000(2024) 125,000 (2034)	High quality compost (AS4454) Specific use compost (low quality) Ferrous metals (low quality) Non-ferrous metals (low quality) Mixed plastics (low quality)	High quality compost – landscaping, horticulture, agriculture (suitable for public contact) Low quality compost - Mine site, quarry rehabilitation, feedstock for energy from waste plant Metals – recycled Mixed plastics - recycled	60-65 per cent	20 years

7.5.2 Collection configuration

The garden and food organics bin would be collected weekly, due to the putrescible nature of food waste. The mixed residual would alter from a weekly service to fortnightly. The collection configuration to service the region is detailed in Table 25.

Table 24: Collection configuration for 3 bin compost (mixed waste and organics) AWT

	MIXED WASTE	RECYCLABLES	ORGANICS (GARDEN + FOOD)
Bin size	240L	240L	240L
Collection frequency	Fortnightly	Fortnightly	Weekly (mandatory)
North	Sustainability Park composting facility	Nambour MRF	Sustainability Park composting facility
Central	Sustainabilty Park composting facility	Nambour MRF	Sustainabilty Park composting facility
South	Sustainabilty Park composting facility	Nambour MRF	Sustainabilty Park composting facility

The implications of the collection approach are as follows:

- development of a transfer station at the Noosa landfill to enable bulk transport of green and mixed residual waste to Sustainability Park for processing.

7.5.3 Implementation implications

Table 25 summarises the key implications of the implementation of Scenario 4 on the collection and landfill assets of Council, as well as the community.

Table 25: Implications of 3 bin compost (mixed waste and organics) AWT

PARAMETER	IMPLICATION
Collection frequency	The collection cycle would alternate as detailed below: Week 1 – garden + food, mixed residual Week 2 – garden + food, recyclables
Landfills	There will be no direct disposal of household kerbside waste to landfill. All waste will be transported to the AWT at Caloundra South. Residual waste from the AWT will be transported by bulk transport to landfills. It is expected that Caloundra and Nambour landfills would be preferentially filled to minimise the transportation costs.
Materials Recovery Facility (MRF)	Recovered plastics from the mixed waste line may be supplied to the MRF for further processing. Forecast volume would be 5,000 – 10,000 tonnes in Year 1. This will need to be considered as part of the Recyclables Processing Request for Tender (RFT)
Support infrastructure required	Transfer station at Noosa landfill Transfer station at preferred AWT site for residual management
Recovered product market	Compost (high quality). established local and regional markets for product in landscaping, horticulture, agriculture and retail. Compost (low quality). NSW experience indicates that compost product from mixed waste composting has higher contamination rates, particularly from glass fines. This makes it unsuitable for use in public places/landscaping and restricts the market to mine site/quarry and landfill rehabilitation (i.e. restricted access locations) Ferrous and non-ferrous steels – established markets in Brisbane for recycling. Lower price due to product quality Plastics – established markets in Brisbane for recycling. Lower price due to product quality. Paper – established markets in Brisbane for recycling. Lower price due to product quality.
Education	Significant and ongoing education campaign will be required.
Contamination management	Garden and food line – Contamination management will be required to remove gross contaminants from the garden and food bin. Mixed waste line – No need for contamination management as the AWT process sorts mixed waste

7.6 SCENARIO 5 – 2 BIN COMPOST AND THERMAL (MIXED WASTE)

7.6.1 Description

This scenario combines the processing approach of Scenario 1 and 2.

The kerbside mixed waste would be collected weekly. The incoming waste stream would be mechanically separated, with the organic fraction removed for enclosed composting. The residual waste from the process would be treated thermally treated to recover energy from waste.

The proposed bin configuration would be:

- mixed waste – weekly (as current)
- recycling – fortnightly (as current)

Table 26 summarises the key features of the 2 bin compost and thermal (mixed waste) AWT.

Table 26: Key features of 2 bin compost and thermal (mixed waste) AWT

TECHNOLOGY	CAPACITY (TONNES PER ANNUM)	RECOVERED PRODUCTS	RECOVERED PRODUCT MARKETS	RECYCLING RATE	CONTRACT TERM
2 bin mixed waste compost and thermal energy from waste	115,000 (2014) 140,000(2024) 180,000 (2034)	Electricity Heat/steam (subject to plant configuration) Specific use compost (low quality) Ferrous metals (low quality) Non-ferrous metals (low quality) Mixed plastics (low quality)	Energy – National grid Heat – would require co-located industrial user of heat Compost - Mine site, quarry rehabilitation, feedstock for energy from waste plant Metals – recycled Mixed plastics - recycled	80-85 per cent	25 years

7.6.2 Collection configuration

There is no change to the collection configuration. The collection configuration to service the region is detailed in Table 27.

Table 27: Collection configuration for 2 bin compost and thermal (mixed waste) AWT

	MIXED RESIDUALS	RECYCLABLES	GREEN (GARDEN WASTE)
Bin size	240L	240L	240L
Collection frequency	Weekly	Fortnightly	Fortnightly (voluntary)
North	Mixed waste enclosed composting facility at Sustainability Park, Caloundra South	Nambour MRF	Noosa landfill (for processing)
Central		Nambour MRF	Nambour landfill (for processing)
South		Nambour MRF	Caloundra landfill (for processing)

The implications for the collection system is that kerbside mixed residuals from the North area will need to be delivered to a transfer station at Noosa and bulk transported to Sustainability Park for processing.

7.6.3 Implementation implications

Table 28 summarises the key implications of the implementation of Scenario 5 on the collection and landfill assets of Council, as well as the community.

Table 28: Implications of 2 bin compost and thermal (mixed waste) AWT

PARAMETER	IMPLICATION
Collection frequency	No change
Landfills	All household kerbside waste will be transported to the AWT at Caloundra South. Residual waste from the AWT will be transported by bulk transport to landfills. It is expected that Caloundra and Nambour landfills would be preferentially filled to minimise the transportation costs.
Materials Recovery Facility (MRF)	Recovered plastics from the process may be supplied to the MRF for further processing. Forecast volume would be 5,000 – 10,000 tonnes in Year 1. This will need to be considered as part of the Recyclables Processing Request for Tender (RFT)
Support infrastructure required	Transfer station at Noosa landfill Transfer station at preferred AWT for residual management
Recovered product market	Electricity. High demand for electricity. Feed into transmission grid. Will need to enter into supply agreement with energy retailer. Heat. Utilisation of heat would require suitable co-location with an industrial user Compost (low quality). NSW experience indicates that compost product from mixed waste composting has higher contamination rates, particularly from glass fines. This makes it unsuitable for use in public places/landscaping and restricts the market to mine site/quarry and landfill

PARAMETER	IMPLICATION
	rehabilitation (i.e. restricted access locations) Ferrous and non-ferrous steels – established markets in Brisbane for recycling. Lower price due to product quality Plastics – established markets in Brisbane for recycling. Lower price due to product quality. Paper – established markets in Brisbane for recycling. Lower price due to product quality.
Education	No significant change to the education approach
Contamination management	No need for contamination management as the AWT process sorts mixed waste

8| IMPACT OF AWT ON LANDFILL CAPACITY

While the primary drivers of an AWT are resource recovery and waste diversion from landfill, the secondary impact of an AWT is to extend the operational life of the existing landfills and defer the need for a new Greenfield landfill within the region.

Landfill airspace modeling has been completed for each AWT scenario, to indicate the capacity exhaustion of the current landfill airspace. The modeling has been completed based on the following assumptions:

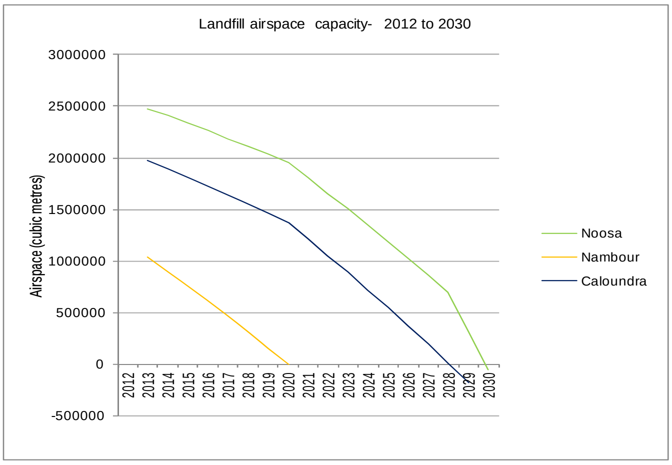
- Population growth based on Planning and Forecasting Unit population growth estimates (medium series)
- Per capita waste generation is assumed to remain constant at current levels.
- Planned landfill capacity sourced from AWA report
- Compaction ratio of 900kg/m3
- Day cover – 11,667m3/annum/landfill
- On capacity exhaustion of a landfill, the waste flow is directed 50/50 to the remaining landfills, until only one landfill remains, at which time 100 per cent of waste flow is directed to the remaining landfill.

8.1 BASE CASE (DO NOTHING)

Figure 14 indicates the landfill capacity exhaustion of the three landfills currently used within the region. The estimated closure year of each landfill, ranked in order of closure is:

1. Nambour landfill (Central) – FY2019
2. Caloundra landfill (South) – FY2027
3. Noosa landfill (North) – FY2029

Figure 14: Base case for landfill capacity exhaustion



8.2 AWT SCENARIOS

Landfill capacity exhaustion was modeled for each of the AWT Scenarios. The assumptions used to perform the modeling included:

- AWT facilities only process kerbside household waste. All other waste streams are assumed to be disposed directly to landfill.
- Compost AWT commences operation in financial year ending 2016
- Thermal AWT commences operation in financial year ending 2021
- Nambour landfill will not receive residual waste from the AWT, due to its limited airspace. Residual waste from an AWT will be preferentially disposed in equal proportions to Caloundra and Noosa. When the Caloundra capacity is reached, all waste will be transported to Noosa.
- Waste diversion from AWT scenarios are:
  - 2 bin compost (mixed waste) – 50 per cent
  - 2 bin thermal (mixed waste) – 80 per cent
  - 3 bin compost (organics only) – 30 per cent
  - 3 bin compost (mixed waste and organics) – 65 per cent
  - 2 bin compost and thermal (mixed waste) – 80 per cent

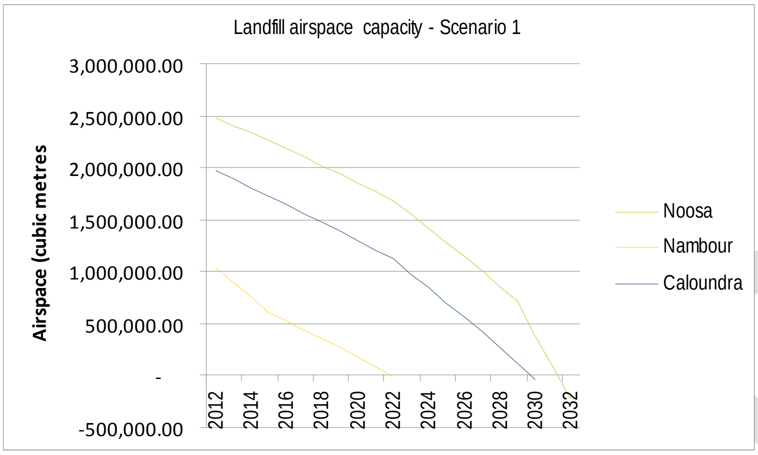
8.2.1 Scenario 1 – 2 bin compost (mixed waste)

Figure 15 indicates the landfill capacity exhaustion of the three landfills currently used within the region, based on the introduction of a 2 bin compost (mixed waste) AWT with a 50 per cent waste diversion waste from household waste only. The estimated closure year of each landfill, ranked in order of closure is:

1. Nambour landfill (Central) – FY2022 (3 year extension from base case)
2. Caloundra landfill (South) – FY2030 (3 year extension from base case)
3. Noosa landfill (North) – FY2032 (3 year extension from base case)

This scenario delivers an additional two years of airspace, at which time an alternative final waste disposal solution will need to be commenced.

Figure 15: landfill airspace capacity – Scenario 1. 2 bin compost (mixed waste)



8.2.2 Scenario 2 – 2 bin thermal (mixed waste)

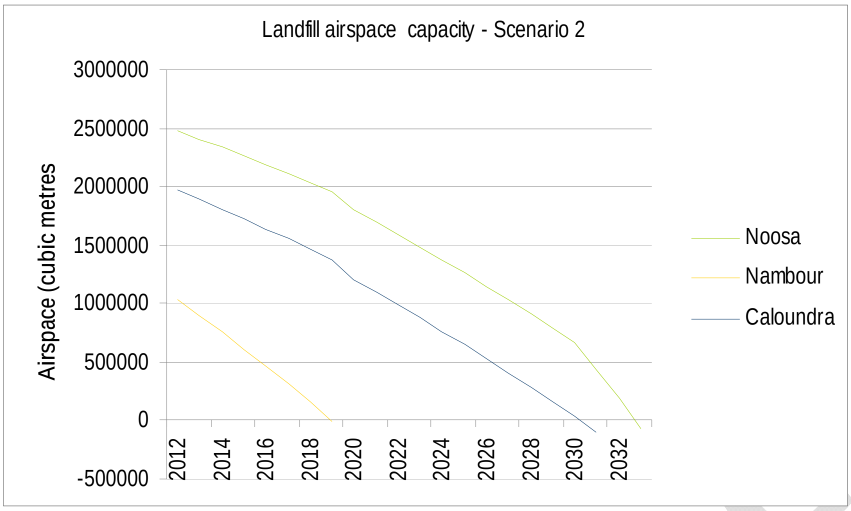
Figure 16 indicates the landfill capacity exhaustion of the three landfills currently used within the region, based on the introduction of a 2 bin thermal (mixed waste) AWT with an 80 per cent waste diversion waste from household waste only. The modeling assumes that thermal treatment does not commence until 2020, due to the complexity of the procurement, design and construction process.

The estimated closure year of each landfill, ranked in order of closure is:

1. Nambour landfill (Central) – FY2019 (same as base case)
2. Caloundra landfill (South) – FY2031 (4 year extension from base case)
3. Noosa landfill (North) – FY2033 (4 year extension from base case)

This scenario extends the total operational life of the existing landfills by 4 years. This is primarily due to the current rate of airspace consumption continuing until 2020. Delivery of the thermal treatment facility earlier than 2020 would further extend the landfill life beyond 2033. Additionally, a thermal treatment AWT could be designed to accept other waste streams, including commercial waste or sorted construction wastes. This would further extend the operational life of the landfills.

Figure 16: landfill airspace capacity – Scenario 2. 2 bin thermal (mixed waste)



8.2.3 Scenario 3 – 3 bin compost (organics only)

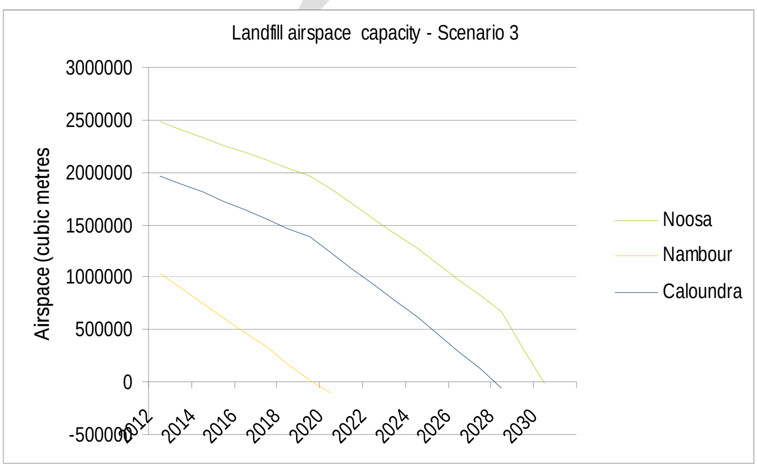
Figure 17 indicates the landfill capacity exhaustion of the three landfills currently used within the region, based on the introduction of a 3 bin compost (organics only) AWT with a 30 per cent waste diversion waste from household waste only.

The estimated closure year of each landfill, ranked in order of closure is:

1. Nambour landfill (Central) – FY2020 (1 year extension from base case)
2. Caloundra landfill (South) – FY2028 (1 year extension from base case)
3. Noosa landfill (North) – FY2030 (1 year extension from base case)

This scenario extends the operational life of the total current airspace by one year from the baseline.

Figure 17: landfill airspace capacity – Scenario 3. 3 bin compost (organics only)



8.2.4 Scenario 4 – 3 bin compost (mixed waste and organics)

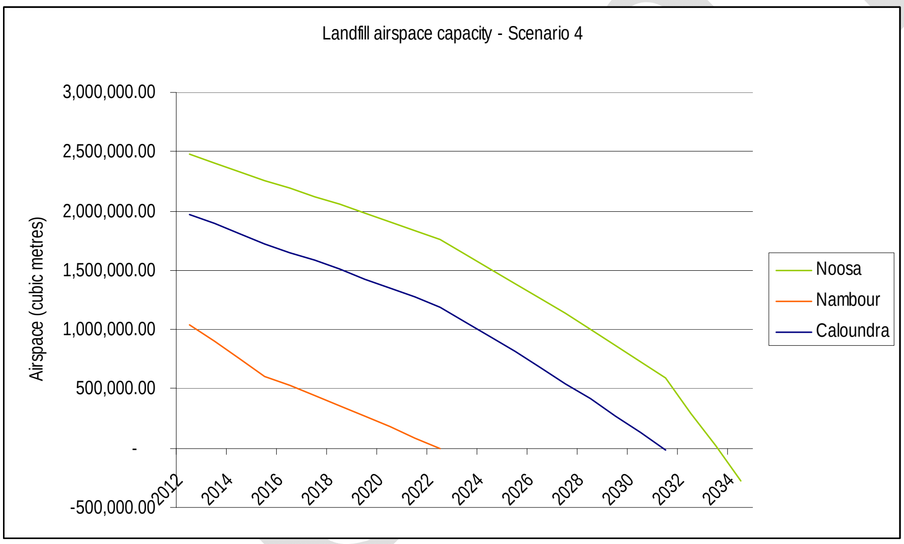
Figure 18 indicates the landfill capacity exhaustion of the three landfills currently used within the region, based on the introduction of a 3 bin compost (mixed waste and organics) AWT with a 65 per cent waste diversion waste from household waste only.

The estimated closure year of each landfill, ranked in order of closure is:

1. Nambour landfill (Central) – FY2022 (3 year extension from base case)
2. Caloundra landfill (South) – FY2031 (4 year extension from base case)
3. Noosa landfill (North) – FY2034 (5 year extension from base case)

This scenario extends the operational life of the total current airspace by five years from the baseline.

Figure 18: landfill airspace capacity – Scenario 4. 3 bin compost (mixed waste and organics)



8.2.5 Scenario 5 – 2 bin compost and thermal (mixed waste)

Figure 19 indicates the landfill capacity exhaustion of the three landfills currently used within the region, based on the introduction of a 2 bin compost and thermal (mixed waste) AWT. This assumes the introduction of a compost AWT in 2016, followed by a thermal facility in 2020.

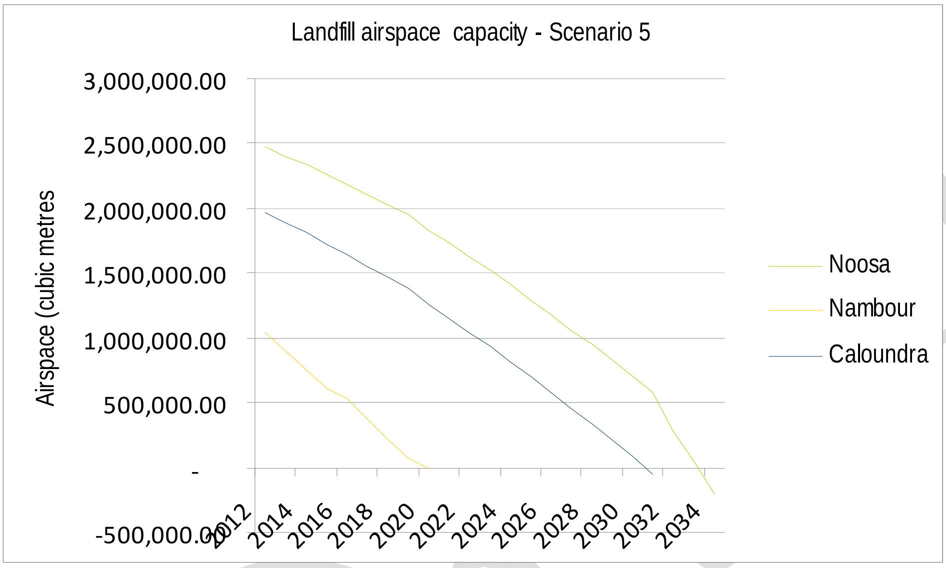
The estimated closure year of each landfill, ranked in order of closure is:

4. Nambour landfill (Central) – FY2020 (1 year extension from base case)

5. Caloundra landfill (South) – FY2031 (4 year extension from base case)
6. Noosa landfill (North) – FY2034 (5 year extension from base case)

This scenario extends the operational life of the total current airspace by five years from the baseline.

Figure 19: landfill airspace capacity – Scenario 5. 2 bin compost and thermal (mixed waste)



9| FINANCIAL ANALYSIS

A financial model was used to determine the waste utility rate that may be charged to ratepayers for the domestic waste collection service that includes an AWT. The model was developed by Aurecon and incorporates waste collection, AWT processing costs and landfill disposal costs and enables comparison of the AWT scenarios.

9.1 KEY ASSUMPTIONS

In preparing each of the scenarios for modeling, a range of inputs were collated and are summarized below:

- The modelling period is 25 years
- No of households is 140,000
- Population growth is 2.2 per cent per annum
- Waste and Resource Management WACC – 10.24 per cent
- AWT only processes the domestic kerbside waste stream, including public place bins. No commercial waste is processed at the AWT.
- Residual waste from AWT is exempt from the waste levy.

9.2 COLLECTION COSTS

Collection costs were determined by Aurecon in May 2011 as part of a Domestic Waste Collection System Model. Collection costs were estimated from existing Council costs and are detailed in Table 29.

Table 29: Collection cost bin rate estimates

		COST PER BIN LIFT ($)			
SCENARIO	BIN CONFIGURATION	MIXED WASTE	RECYCLE	ORGANICS	ORGANICS FREQUENCY
1	2 bin	1.09	1.00	N/A	N/A
2		1.09`	1.00	N/A	N/A
5		1.09	1.00	N/A	N/A
3	3 bin	0.98	1.00	1.37	Weekly
4		0.98	1.00	1.37	Weekly

9.3 AWT PROCESSING COSTS

Three AWT process gate fees have been included in the modelling, reflecting the different AWT processes. The AWT gate fees were selected for:

- Enclosed compost facility for mixed waste

- Enclosed compost facility for organics waste only
- Enclosed compost facility for mixed waste and organics waste
- Thermal treatment facility (Assumes Pyrolysis)

SCENARIO	AWT TYPE	GATE FEE ($ PER TONNE)
1	Enclosed compost	$ 165
2	Thermal treatment	$ 208
3	Compost (gore covered)	$ 140
4	Enclosed compost	$190
5	Enclosed compost and thermal treatment	Further modelling required

The compost gate fees were sourced from the market sounding completed by Council in October 2011. The thermal treatment gate fee was based on the QTC Energy from Waste Feasibility Review break-even gate fee for Pyrolysis and represents the lowest cost thermal treatment process from the QTC report.

9.4 WASTE VOLUMES

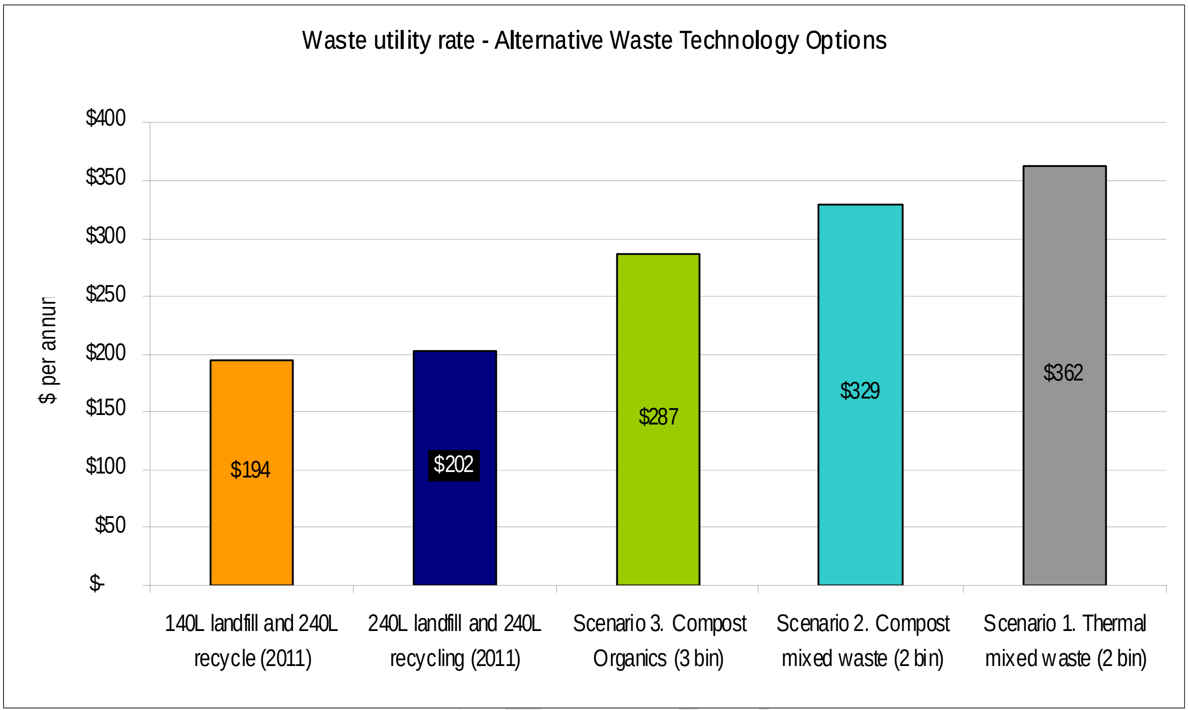
Waste volumes modeled were based on household kerbside waste volumes from FY2011. Waste volumes for each scenario are detailed in Table 29.

Table 30: Scenario waste volumes

SERVICE TYPE	SCENARIO				
	1	2	3	4	5
Mixed waste bin	105,142	105,142	72,686	72,686	105,142
Recycling bin	35,973	35,973	35,973	35,973	35,973
Organics bin			32,456	32,456	
Additional organics			3,000	3,000	
Total	141,115	141,115	144,115	144,115	141,115

9.5 RESULTS

Figure 20: Waste utility rate for AWT Scenario



10| RISK ANALYSIS AND MANAGEMENT

A comparative risk assessment of scenario 1–5 was completed in November 2011 to identify the different risk profiles of each technology and collection configuration. The risk assessment was completed with Project team members using the approach adopted within the AS/NZS ISO31000:2009 Risk Management Standard.

Table 31 summarises the risk profile and highest risk score of each scenario.

Scenario 3 – 3 bin compost (organics only) has the lowest risk profile. The scenario risk profile, ranked in order of highest risk to lowest risk are:

- Scenario 5 – 2 bin compost and thermal (mixed waste)
- Scenario 2 – 2 bin thermal (mixed waste)
- Scenario 4 – 3 bin compost (mixed waste and organics)
- Scenario 1 – 2 bin compost (mixed waste)

Table 31: Risk profile of scenario 1 - 5

SCENARIO	RISK PROFILE	DESCRIPTION OF HIGHEST RISKS
Scenario 1 Compost of sorted mixed waste (2 bin collection system)	Extreme – Nil High – 1 Moderate – 3 Low – 3	High – Recovered products (low quality compost) not capable of being used in a long-term market
Scenario 2 Thermal treatment of mixed waste (2 bin collection system)	Extreme – Nil High – 2 Moderate – 5 Low – 1	High – 1. Plant performance does not achieve design capacity, recovery rates or air pollution discharge criteria High – 2. Public objection to formal approval process
Scenario 3 Compost of organics bin only (3 bin collection system)	Extreme – Nil High – Nil Moderate – 3 Low – 4	Moderate – Feedstock input composition not suitable to reliably operate process as designed and produce outputs to specification.
Scenario 4. Compost of sorted mixed waste and organics bin (3 bin collection system)	These scenarios were not individually assessed. This scenario is a combination of Scenario 1 and 3.	High – Recovered products (low quality compost) not capable of being used in a long-term market.
Scenario 5. Compost of sorted mixed waste and thermal treatment of residual waste (2 bin collection system)	These scenarios were not individually assessed. This scenario is a combination of Scenario 1 and 2.	High – Recovered products (low quality compost) not capable of being used in a long-term market. High – Plant performance does not achieve design capacity, recovery rates or air pollution discharge criteria High – Public objection to formal approval process

Based on research and an assessment of anaerobic digestion technology in Australia, Council officers have excluded anaerobic digestion technology from the technology risk assessment due to the history of poor performance of these plants in Australia. Three large scale Anaerobic Digestion plants processing mixed waste have been commissioned in Australia and one has been mothballed (Atlas in Perth), and one has experienced poor performance (UR3R). A third plant (Arrowbio in Sydney) cost $50 million to develop and is still operating but it has required ongoing modification and additional plant has been retrofitted, increasing the initial investment. It does not yet perform according to plan. Anaeco in Perth, WA are currently constructing a 55,000 tonne per annum Anaerobic Digestion plant, however, this plant is not commercially proven and based on Council's risk appetite, it was prudent to eliminate Anaerobic Digestion from the technology risk assessment.

11| PROCUREMENT STRATEGY

Delivery of the selected AWT will require commencement of a detailed and complex procurement process. There are also extensive considerations that need to be undertaken to ensure integration and flexibility are established between the collection contract and the AWT contract. The procurement challenges facing Council include:

- balancing Council's waste management vision with securing an efficient and viable waste management solution using a value for money framework
- attracting the best technical solution and competitive market response for a "best in class" technology within Australia
- delivering a reliable solution that can support the waste disposal requirements for Council over the next 15-25 years, and
- fitting the waste solution into the existing waste supply chain network managed by Council and maximizing local economy expansion.

11.1 PROCUREMENT MODELS CONSIDERED

There are a range of procurement and contract models that can be applied to an AWT, with the main approaches including:

- Construct only
- Design and construction (D&C) only
- Design, construct, operate and maintain (DCOM)
- Alliance, and
- public private partnership (PPP)

The market sounding indicated that a Design, Construct, Operate and Maintain (DCOM) contract model is most attractive to AWT operators. Execution of a DCOM contract model is likely to achieve significant benefits to Council:

- integration of D&B with O&M through a single provider is likely to achieve an optimal balance of cost drivers to minimise whole-of-life project costs.
- integration of operation and maintenance with design and construct would minimise interface risks and project cost over the long term.
- transfers market development for plant output to the contractor

11.2 MARKET SOUNDING AND ANALYSIS

The project team sought inputs from the private sector through a market sounding process to assist in the project development and ascertain the market's interest and capacity in the project delivery. The participants were current international or domestic operators of AWT technology and included:

- Thiess Services
- Sita
- Transpacific Industries
- Anaeco

- Phoenix Energy
- Veolia Environmental Services

The feedback from the market sounding is detailed in Table 32.

Table 32: Market sounding feedback

CATEGORIES	QUESTIONS	MARKET SOUNDING RESPONSES
Project scope	Project scope and timeframe	▪ The procurement phase for this project could take up to 12 months. ▪ The environmental approvals for the selected AWT may take 12 to 18 months. ▪ Construction likely to take 12 to 18 months
	Boundaries and responsibilities	▪ Council should be responsible for obtaining the necessary development approval and service infrastructure prior to tender release ▪ Council best to manage community relationship (eg, advertising and media). It should also participate in the design and develop ongoing relationship with the contractor.
	What collection system or education can be implemented to improve output product marketing	▪ 3 bin garden or garden + food system delivers the highest end product quality ▪ 2 bin mixed waste AWT delivers outputs of low product quality and value ▪ Energy from waste process is not as reliant on incoming product quality ▪ Collection contract needs to include provisions for contamination identification and notification to Council.
	What information is critical for project scoping	▪ Waste volume, forecast waste volumes. ▪ Waste composition and seasonal variations in waste ▪ Site specific details including geotechnical report
	Three highest environmental impacts requiring management	▪ Odour/Air emissions ▪ Dust ▪ Noise
Project Costs	Major cost drivers	▪ Major fixed costs are civil works, processing technology and plant and equipment ▪ Major operating costs include labour, residual waste disposal, maintenance and energy/fuel ▪ Decision on whether to whether to 'unbundle' household or process source separated organics, and technology selection will be the greatest determinants in optimizing whole of life costs.
	Gate fee range payable by Council to process waste at an AWT	▪ Enclosed composting of source separated organics : $130–150 per tonne ▪ Enclosed composting of mixed household – $180-200 per tonne ▪ Anaerobic digestion – Unknown ▪ Energy from Waste – $130 - $200 per tonne (Note. No energy from waste incinerator are operational in Australia)
Delivery	Procurement models	▪ The majority of the participants considered a single contract for design, build, operation and maintenance would provide the best whole-of-life outcomes for Council.
	Lessons learned	▪ Planning approval tends to be a big risk. ▪ Establish the right commercial model, know what you are trying to achieve. ▪ Contract should be performance based rather than prescriptive. ▪ Council and contractor need to work in a good cooperative, problem solving environment. ▪ Risks should be allocated to the party best able to manage them.
	Market interest	▪ There is a high level of market interest and capacity to deliver this project.
	Tender response	▪ EOI response – two to three months ▪ RFT response – three to four months ▪ Participants would require as much information as possible to prepare for the tender ▪ Consider payment to contractors for participating in the ECI process
Terms and conditions	Contract terms	▪ Enclosed composting of source separated organics – 15 years ▪ Enclosed composting of mixed household – 20 years ▪ Energy from waste – 25 years

12| COMMUNITY ENGAGEMENT

Community engagement conducted as part of the Waste Strategy involved participation from 511 community members. In conjunction with the community feedback, the Waste Taskforce developed the Waste Strategy 2009-2014 with the highest priorities being:

- strong support in achieving the waste goal of 70 per cent diversion
- technology selection to follow the waste hierarchy to maximize the highest and best uses for waste streams
- recovering the resources of organic waste from domestic residents that can’t be utilised at home
- Sustainability Park, Caloundra South to be the preferred location for establishing an AWT.
- decisions on an AWT to be finalized in 2012 to enable linkages with the new collection contract that will be released to the market in 2012.

In November 2011, Council has conducted two community engagement programs to generate and seek broad feedback on community attitudes towards AWT. The engagement approach consisted of:

- “Garbo-dialogue” – 3 separate scenario based workshops were held with the same group of 25-30 residents to generate a conversation about the key objectives of the project. The participants have been a representative group reflecting the diverse demographic of the region, and
- online forums have complimented the focus group, with a print, radio and online advertising campaign commencing on 3 November and directing the community to participate and respond to a series of questions relating to waste diversion, AWT and 2 bin versus 3 bin waste collection systems.

The report on this process is attached in Appendix C

Key themes emerging from the focus group and online forum include:

- A large proportion of the community has limited knowledge or exposure to AWT. There will need to be clear communication of what an AWT is, its role and the level of community behavioural change required.
- Reducing waste, recycling and reducing landfill all ranked above high in importance and commitment.
- There is a belief in some sections of the community that AWT will be a revenue generator for Council. (This will need to be addressed in future communication as the revenue from the sale of processed material does not cover the operating costs.)
- Changes in bin systems are likely to impact household behaviour which will require a systematic and ongoing promotion and education campaign.
- Different household types prefer different collection systems. For some households, cost will be a major consideration.
- Cost influenced the community preference for a 2 or 3 bin collection system. The more expensive 2 bin system was less popular when considering cost.
- Willingness for a mandatory 3 bin system ranged between “probably not” to “would strongly consider it”. There was no clear community wide preference for a 3 bin system

- Workshop participants, given the background on Sustainability Park, understood why it had been chosen as the preferred site. Workshop participants were less sure the wider community would be supportive. Particular care will be required when engaging residents in the neighbouring areas

APPENDIX A – TECHNOLOGY REVIEW

There is no "silver bullet" for waste processing. No single technology provides solutions to all waste management issues. Each technology has its own performance characteristics, environmental and social considerations and end products which must be sold to market.

The following section reviews the available technology suite available in Australia and overseas. It is not an attempt to document each and every facility, but to describe at least one representative sample of the technology, its costs, benefits, risks and operating experience in the Australian context.

Each technology requires a different and specific input waste stream. As a consequence, any discussion of technology requires an examination of the waste streams which are being fed into them.

12.1 TYPICAL WASTE STREAMS

12.1.1 Source Separated Streams

Source separated streams arrive at the given technology in a clean stream, with prior sorting having been done by the householder or the company which generated the waste. The primary streams for the purposes of this review are Food, Green and Green/Food mix waste streams from a third bin at households.

The highest rates of recovery and the lowest contamination rates are achieved through source separated systems.

In the past 5 years private waste contractors have commenced extensive training and education programs with waste generators to ensure that source separated schemes operate effectively. Without such education and training the separation may be less than adequate, resulting in contaminated waste streams.

12.1.2 Mixed Residual Streams

Mixed residual streams are either the left over streams after source separation or the combined stream where no pre-sorting has occurred. They are the most complex streams, are generally heterogeneous and therefore, require particularly robust technologies for sorting and processing.

Common approaches to dealing with heterogeneous mixed residual streams are mechanical sorting at the front end of the plant, drum technologies to masticate the whole of the input stream into a mixed homogenous stream, shredding, autoclaving in steam or percolation, for the same purpose.

Typical examples include:

- Mechanical separation – SAWT Liverpool line sorting, SITA Resource Co Sydney;
- Drums – Mindarie and Bedminster drums at Cairns and Port Stephens;
- Shredding – SITA Resource Co Adelaide;
- Autoclaving – SITA Camellia Sydney; and
- Percolation – GRL UR3R Sydney.

Most of these systems also include a mechanical sorting or pre-preparation phase wherein particular products are either recovered from the material stream or unsuitable materials are removed.

Often known as dirty MRF's or C+I MRF's, sorting equipment is located at the front end of the process and is designed to separate different grades and types of materials. Most common technologies include trommels, magnets, eddy currents, cabins, bounce conveyors, vibrating screens and wind sifters. Most materials are either graded by size, shape or specific gravity (density). In this way, heterogeneous streams can be partially homogenised into a range of different streams.

The most common materials separated in this way include cardboard, plastic, glass steel and aluminium.

Typical front end sorting can be seen on the SITA SAWT Liverpool line, the VISY MRFs and Thiess MRF's. There are no large scale commercial C+I MRF's yet operating in Australia.

12.2 SUMMARY OF TREATMENT OPTIONS

Typical technologies used for processing MSW waste around the world include:

- Biological Mechanical
- Landfill
- Traditional landfill
- Bioreactor landfill
- Mechanical / Biological Treatment MBT
- Mechanical sorting
- Aerobic composting
- Mulching
- Windrow composting
- Aerated static pile composting
- Enclosed tunnel composting

- Vertical composting
- Vermi-composting
- Anaerobic Digestion
- Anaerobic Digestion AD
- Thermal

d. Incineration

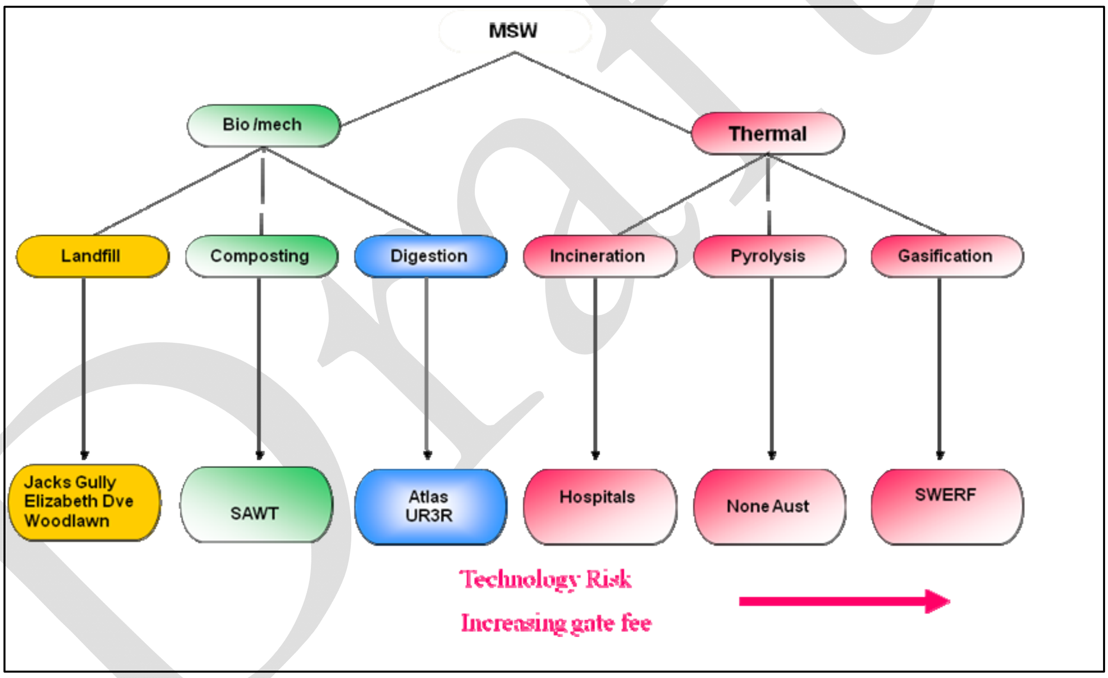
- Mass burn and moving grate incineration

e. Advanced Thermal

- Pyrolysis
- Gasification including Plasma Arc.

These are summarised in the Figure 21.

Figure 21: Treatment options and mix - Australian experience



Each of these technologies has a unique cost and risk profile.

The Australian experience in waste technology implementation has been mixed. The following sections summarises the technologies under these headings particularly as experienced in the Australian context.

12.2.1 Traditional Landfill

Australians landfill 21 million tonnes of waste per year. Landfills in Australia range in size from the local tip to 1 million tonnes per year. Most new landfills involve clay or synthetic liners to capture leachate.

The quality and operating standards of landfills is extremely variable. The Waste Management Association of Australia estimates there are some 650 licensed and operating landfills in Australia (excluding local dumps) (WMAA Landfill Division, Landfill Audit 2009). Of these, 90% do not capture their methane gas.

Across Australia landfills produce 15,604,000 tonnes of CO_2e via methane of which 11,104,000 escapes to the atmosphere as greenhouse gases. Only 29% of methane produced by landfills is captured (National Waste Report 2010).

12.2.2 Bioreactor Landfill

Bioreactor landfills involve the recirculation of leachate in order to facilitate the rapid decomposition of organic matter via methanogenic bacteria within the landfill voids. Methanogenic bacteria require anaerobic conditions (in the absence of oxygen) to flourish. The acceleration of methanogenic processes increases the rate of landfill gas generation (methane) which can be captured for renewable energy in the form of electricity and heat. It also accelerates the rate of stabilisation of the landfill allowing for earlier decommissioning of the gas capture system.

12.2.3 Aerobic Windrow Composting

Aerobic composting involves the use of microbial decomposition of organic waste in the presence of air. Input materials generally include green waste, grease trap waste, sludges, commercial organic material and biosolids. Food waste, sludges and biosolids are only used in open windrow facilities which are remote and isolated from adjoining neighbours as these products tend to be highly odorous. Windrow composting does not involve any odour capture or treatment.

In the compost piles, microbes progressively break down the organic material (in the presence of oxygen) creating heat and releasing nutrients. Oxygen levels are maintained by use of compost turners to keep the heap aerated. Moisture is also required and most windrows have some sort of sprinkler system.

Windrow composting generally takes 8-12 weeks. The organic matter is heated to above 65^{o}C to ensure pathogen and seed kill.

Windrow composting is the simplest and most widely practiced composting system in Australia. More than 3 million tonnes of organic material are processed in this way each year.

12.2.4 Aerated Static Pile Composting

There are only a few static pile composting facilities in Australia. They involve placing the organic material (food, green waste, biosolids, sludges, etc) onto an aerated floor in a biocell. Air is then sucked through the compost to encourage microbial activity. Temperature is controlled by the rate of air movement through the compost. Because air is being drawn through the material there is no need for turning of the waste.

The air is then processed through a biofilter or other odour controlling system before being discharged back to the atmosphere. Once the significant biological processes are completed (usually 6 weeks) air can be blown through the waste direct to atmosphere without creating significant odour risks.

One of the largest source separated waste stream, static pile systems in Australia is Biowise in Perth. It is an outdoor facility with each Biocell measuring 8m x 8 m. There are 4 cells in total processing 30,000 tonnes of mixed organic wastes including biosolids, grease trap waste and green waste.
Once the active composting phase is completed the compost is matured in normal windrow piles for a further 4-8 weeks to ensure full maturation and stability.

The material is then screened, blended with other materials for “fit for purpose” products and is ready for sale.

Static pile composting can also be applied to mixed residual waste streams such as MSW. The Cairns, Port Stephens and Perth Bedminster plants and the Coffs Harbour Biomass plant all utilise static pile composting on an aerated floor (though in all these cases the facility is fully enclosed in an air managed building to control odour).

12.2.5 Enclosed Tunnel Composting

The most common odour controlled composting system, and the benchmark for operations in Australia, are fully enclosed tunnel composting facilities. These facilities deliver excellent odour control, high process control and are the system of choice for most new facilities in Australia.

Recent tunnel composting plants include the SAWT facility in Sydney with 28 tunnels, the Mindarie tunnel system, NRG in Melbourne and Remondis at Port Macquarie. Enclosed tunnel composting is an aerobic process with air pumped into the tunnels under pressure (usually through a perforated floor or sucked through a perforated floor). Temperature and moisture are also controlled.

The residence time in a tunnel can be as short as 3 weeks but 6-8 is common to ensure pathogen and seed kill. The newest plants utilise computerised systems to control moisture, temperature and oxygen levels.

Once the first phase composting is completed the product is matured, screened and where appropriate blended to create “fit for purpose” products.

The Remondis plant and the Penrith Line of SAWT process clean source separated organic waste streams including food, green waste, biosolids and grease trap waste. These produce high grade AS4454 compliant composts for an unrestricted market.

The Mindarie and SAWT Liverpool line process mixed residual MSW wastes and thus produce a lower grade compost which is used in a more restricted market application (mine site rehabilitation, forestry, limited agriculture and landfill remediation).

12.2.6 Anaerobic Digestion

Traditional AD

Commercial Anaerobic Digestion facilities are operating using MSW as feedstock in Europe, Asia and Israel. However, the most successful anaerobic plants use homogenous feedstocks such as sewage sludge or animal manure. Anaerobic Digestion of sewerage sludge has been common practice for 30 years.

AD has been developed to process source separated organic waste streams into methane gas for electricity and heat. Input streams are usually food, sludges and biosolids.

The Anaerobic Digestion process takes place in a large reactor vessel or digester which is purpose built to enable methanogenic bacteria to process the organic lignocellulosic wastes.

The digestion process takes around 15-25 days and results in methane production and a residual digestate pulp which can be subsequently composted.

Anaerobic Digestion (digestion in the absence of air) was introduced to Australia for the processing of clean stream organic wastes including sewage, biosolids and sludges. It is a commonly used system for the processing of food waste in Europe.

The first commercial scale plant processing mixed waste streams in Australia, was the Atlas facility in Perth. The digester was closed after several months of sporadic operation.

The EarthPower facility in Sydney processes source separated food wastes and other organic sludges. It has suffered from high levels of input contamination (refer EarthPower plant description later).

Two Anaerobic Digesters are now operating on mixed residual household waste. These are the GRL UR3R plant at Eastern Ck and the WSN ArrowBio plant at Jacks Gully. Both have suffered operational and commercial difficulties.

In-ground AD

One additional Anaerobic Digestion technology in the process of entering the Australian market is the simple “in ground” AD.

Thiess Services will this year introduce the first Australian first in-ground, horizontal Anaerobic Digester. The AD cell is designed to maximise the generation of methane gases which are then 100% captured for generation of electricity.

Thiess has designed a cheap, replicable and fully enclosed anaerobic digester that is built as a horizontal unit, is loaded with putrescible waste, covered and once all of the gas has been extracted is mined for the composts. Composts are then sold for rehabilitation purposes.

100% of the methane generated is expected to be captured and burnt to create electricity. The unit is intended to be cheap to build, easy to operate and operate at a much lower cost than traditional digesters.

The process is intended to be completely renewable and the AD Cell can be reused over and over as it is mined after each batch of waste has been digested.

There are no operating plants at this stage in Australia and as such this technology falls into the “wait and see” higher risk technology mix. However, it offers enormous potential for low cost energy generation with a much lower risk profile to traditional AD.

Transpacific Industries (Cleanaway) has a similar aerobic technology known as the GORE system. The key difference is the Thiess system is intentionally anaerobic and seeks to capture all of the process gases. The technology is scalable up to 150,000t/annum.

12.2.7 Thermal Conversion Technology

Thermal treatment options use heat to destroy waste molecular structures to generate heat. They produce an ash residue. There are three more widely used thermal technology options, these being:

- pyrolysis
- gasification

- RDF incineration, and
- mass burn incineration.

12.3 PYROLYSIS

Table 33 summarises the conventional pyrolysis process.

Table 33: Pyrolysis summary

Parameter	*Description*
General concept	Pyrolysis of waste in externally heated rotary drum Combustion of syngas in high temperature combustion chamber Separation of pyrolysis coke from inert ash
Status of commercialisation	First commercial plant operational in Burgau, Germany 11 plants with total throughput of 2360 tonnes per day in Japan
Temperature	Pyrolysis: 400^{0}C to 500^{0}C Combustion: 1100^{0}C to 1350^{0}C
Size (per line)	2.5 – 8.3 tonnes per hour
Size (per installation)	140,000 tonnes per annum
Energy recovery	580 to 650 kWh per tonne of waste

Pyrolysis of waste is applied in only a few commercial scale plants. Pyrolysis involves the thermal degradation of organic carbon-based materials through the use of an indirect, external source of heat, typically at temperatures of 400^{0}C to 500^{0}C, in the absence or almost complete absence of air. The residence time is typically 1-2 hours. This thermally decomposes and drives off the volatile portions of the organic materials, resulting in a syngas composed primarily of hydrogen, carbon monoxide, carbon dioxide and methane.

Most pyrolysis systems are closed systems and there are no air emissions (if the syngas is combusted to produce electricity, the power system will have air emissions through an air emission control system and stack). After cooling and cleaning in emission control systems, the syngas can be utilized in boilers, gas turbines, or internal combustion engines to generate electricity. A typical pyrolysis unit processing MSW can produce around 580 to 650 kWh per tonne of waste (average 615 kWh/ton).

The balance of the organic materials that are not volatile or liquid pass through a magnetic and eddy current separation step for metal recovery and an air classifier for separation of the pyrolysis coke from the mineral residue. The coke is burnt together with the gas, while the mineral fraction is either land filled or used as an aggregate.

12.4 GASIFICATION

Table 34 summarises the conventional gasification process.

Table 34: Gasification summary

Parameter	*Description*
General concept	Mainly multi-stage processes with gasification of waste in shaft or fluidized bed furnaces, in gasification chambers, in entrained flow systems or on grates Syngas can be used for chemical synthesis, fed into gas engines, directly burnt, or co-combusted in power plants All processes end up with molten solid residues
Status of commercialisation	In Japan, 95 plants with 195 lines and a total throughput of approx 17500 tonnes per day
Temperature	Gasification: 300^{0}C to 1400^{0}C Post combustion chamber: up to 1350^{0}C
Size (per line)	< 1 – 11 tonnes per hour
Size (per installation)	<10000 - 150000 tonnes per annum
Energy recovery	600 to 700 kWh per tonne of waste

Gasification involves the thermal conversion of organic carbon-based materials in the presence of internally produced heat, typically at temperatures of 300^{0}C to 1,400^{0}C, and in a limited supply of air/oxygen to produce a syngas composed primarily of hydrogen, carbon monoxide, carbon dioxide and methane. Inorganic materials are converted either to bottom ash (low-temperature gasification) or to a solid, vitreous slag (high-temperature gasification) which requires disposal. Some of the oxygen injected into the system is used in reactions that produce heat, so that pyrolysis (endothermic) gasification reactions can initiate; after which, the exothermic reactions control and cause the gasification process to be self-sustaining.

Like pyrolysis, most gasification systems are closed systems and do not generate air emissions during the gasification phase. After cooling and cleaning in emission control systems, the syngas can be utilised in boilers, gas turbines, or internal combustion engines to generate electricity. A typical gasification unit processing MSW can produce around 600 to 700kWh per tonne of waste processed (average 650 kWh/tonne).

12.5 MASS BURN INCINERATION

Table 35 summarises the mass burn incineration process.

Table 35: Mass burn incineration summary

Parameter	*Description*
General concept	Combustion of un-treated waste in air or oxygen enriched atmosphere on a grate Capable of burning waste with a lower heating value
Status of commercialisation	Oldest and prevailing EfW technology world wide Commercially proven, used in > 500 plants Many plants have been operational for 15-30 years
Temperature	> 850^{0}C – 1100^{0}C
Size (per line)	3 – 40 tonnes per hour
Size (per installation)	Very broad. Biggest installations treat 1.2 – 1.4 million tonnes per annum
Energy recovery	475 to 625 kWh per tonne of waste

Mass burn incineration, unlike the previous types of thermal conversion technologies, requires minimal pre-sorting of waste before it is subjected to thermal treatment. The only requirement for pre-treatment is removal of large bulky objects (such as household appliances) and non-combustibles such as concrete/brick from C&D, in order to maintain efficient fuel flow and remove potentially dangerous hazardous materials. Any mixing of the waste in a mass burning facility is limited to mixing in the storage pit during loading of the refuse into the combustion chamber. The technology involves the drying, devolatilisation and ignition of waste, similar to the combustion of fossil fuels.

In a mass burn incinerator, the waste is fed in via a feeding chute and then pushed into the combustion chamber by a hydraulic ram or a travelling grate. There are a number of different grate designs in operation but their prime function is the controlled transport of the waste through the combustion chamber. The design has to guarantee efficient mixing of the fuel bed and permanent coverage of the metal parts to protect them against over-heating. In all mass burn incinerators the primary air is injected from below, through the grate.

In Western industrialised countries, between 15 and 25 per cent of the waste feed by weight leaves the plant as bottom ashes. The bottom ash contains significant amounts of ferrous and non-ferrous metal scrap which is now routinely recovered using magnetic and eddy current separation. The amount of boiler ash (the ash deposited in the boiler) depends on the type of boiler and on the dust load of the flue gas leaving the combustion chamber. Mean figures in modern plants are 2 to 5 kg per tonne of waste. Boiler ashes should not be combined with the grate ash, but be treated together with the filter ash; this requirement has been enforced by legislative regulations in some countries. Consideration of these issues would be undertaken by DERM as part of the development approval and conditioned appropriately as part of the operating licence.

In terms of energy balance, many mass burn incinerators achieve a net energy output of 85 per cent, consisting of approximately net power export of 15-20 per cent and a heat output of 60-65 per cent.

In waste incineration, the removal of pollutants from the flue gas is one of the most important and most expensive process stages. This process is a regulatory requirement since the air emission limits applicable for waste incineration are the most stringent of all the industrial combustion processes. In the European Union (EU), the Waste Incineration Directive sets the standards in 2000 [European Parliament and Council 2000] and these have been adopted by legal regulations in the member countries. It is likely that regulators in Queensland would impose the most stringent air emission limits, which at this time, are the EU standards.

12.6 REFUSE DERIVED FUEL (RDF) INCINERATION

Table 36 summarises the RDF Incineration process.

Table 36: RDF Incineration summary

Parameter	*Description*
General concept	Combustion of pre-treated (shredded) waste in a bed of sand, fluidized by air injected through nozzles in the floor of the furnace. Preferentially used for Solid Refuse Fuel (SRF) Waste particle size < 200 mm
Status of commercialisation	For waste incineration facilities developed since 1970 Commercially proven, used in > 50 plants for MSW incineration Mainly used in Japan for smaller throughputs
Temperature	Bed temperature 800-850^{0}C Freeboard temperature > 850^{0}C – 1100^{0}C
Size (per line)	3 – 15 tonnes per hour
Size (per installation)	<10000 - 660000 tonnes per annum
Energy recovery	550 to 620 kWh per tonne of waste

RDF Incineration (also known as Process Engineered Fuel) involved the pre-treatment of waste before incineration occurs. Processing the waste allows materials suitable for recycling to be removed from the combustible residue, along with wet organic materials such as food and garden wastes for separate treatment. The combustible fraction (consisting of paper, card, plastic film, etc) may then either be burnt directly as a coarse flock (c-RDF) or compressed into dense pellets (d-RDF) for sale as a supplement fuel in industrial boilers. An advantage of the RDF over mass-burn incineration is that because the waste is sorted and shredded before combustion, the combustion equipment can be smaller, less robust and therefore less expensive.

RDF Incineration typically consists of a rectangular or cylindrical combustion chamber where finely grained fuels are burned in a fluidised sand bed, sometimes with the addition of dolomite for the capture of acid gases. They were initially developed for the combustion of sewage sludge and are today deployed mainly in Japan for the use of municipal waste. Currently, they are becoming more popular for the combustion of SRF and biomass.

The share of (waste) fuel in the sand bed is typically of the order of 2-10 per cent only, depending on the calorific value of the fuel.

All RDF Incinerators have the advantage of establishing a uniform distribution of the waste in the fluidised fuel bed, which enables a homogeneous and stable combustion. Another advantage is the wide range of heating value of the fuel that can be burnt in this type of furnace. The energy density in the fuel bed can be varied by controlling the share of fuel in the bed.

These advantages, however, have to be paid for by the need for pre-treatment of the fuel, as, for establishing fluidisation, the particle size of the fuel has to be limited. Another limitation is the fuel bed temperature, which is typically kept lower than 850°C to avoid melting of ash components and the collapse of the fluidised bed.

The different RDF incinerator units used include stationary, circulating, and revolving or internally circulating fluidised beds.

APPENDIX B – QTC ENERGY FROM WASTE FEASIBILITY REPORT

QUEENSLAND TREASURY CORPORATION

SUNSHINE COAST REGIONAL COUNCIL ENERGY FROM WASTE FEASIBILITY REPORT

PREPARED FOR

SUNSHINE COAST REGIONAL COUNCIL

JULY 2011

CONTENTS

1| EXECUTIVE SUMMARY

1.1 BACKGROUND

Queensland Treasury Corporation (QTC) was requested by Sunshine Coast Regional Council (Council) to assist in the preparation of a feasibility assessment for an Energy from Waste (EfW) facility for the Sunshine Coast region.

The primary objective of the feasibility assessment was to conduct a high-level financial analysis which considers the Net Present Value (NPV) of different Thermal Conversion Technology (TCT) and pre-treatment facilities which may be required as part of an EfW facility to treat waste streams generated within the Sunshine Coast region.

The primary driver for the review is the Council's Waste Minimisation Strategy 2009–2014, which aims to increase the recovery of wasted resources to over 70 per cent by 2014. Complementing Council's strategy is the State's recently released *Queensland's Waste Reduction and Recycling 2010-2020 Strategy* that aims to reduce waste disposal to landfill to 50 per cent by 2020. A more pressing constraint is capacity exhaustion of Council's current landfill airspace within the next 7-10 years based on the current levels of waste generation.

1.2 SCOPE OF WORK AND METHOD

The scope of the work involved:

- analysing Council's waste source, volume and composition to determine fuel volumes available for an EfW facility
- completing a technical review of TCT that may be suited to various waste streams
- financial modelling the NPV and break-even gate fee of four different TCTs across four different waste scenarios
- considering the regulatory framework governing the development and operation of TCTs, and
- identifying the general procurement timeframe and potential risks to the construction and operation of an EfW facility.

QTC engaged URS Australia Pty Ltd (URS) to develop the financial model used to complete the financial analysis. The approach developed by QTC and URS to develop the financial model is detailed below.

1.2.1 Feedstock analysis

QTC provided URS waste volume and source data for the Sunshine Coast region. URS used this information, in conjunction with waste characterisation data for the domestic Municipal Solid Waste (MSW) kerbside, transfer station MSW self-haul

(MSW self-haul), Commercial and Industrial (C&I) waste and Construction and Demolition (C&D) waste, to determine the potential feedstock available for a TCT within the region.

1.2.2 Scenario development

A workshop was held on 21 February 2011 with QTC, Council and URS representatives to review the potential waste streams available as fuel sources and the potential TCTs available for the treatment of these waste streams. Scenarios developed for the different waste streams included:

- Scenario 1 – MSW kerbside only
- Scenario 2 – MSW kerbside and MSW self-haul
- Scenario 3 – MSW kerbside, MSW self-haul and C&I waste, and
- Scenario 4 – MSW kerbside, MSW self-haul, C&I waste and C&D waste.

For each of the scenarios outlined above, the following TCTs were considered for modelling:

- gasification
- pyrolysis
- refuse derived fuel (RDF) incineration, and
- mass burn incineration.

Section 4 provides a detailed technical overview of the TCTs.

1.2.3 Financial modelling and sensitivity analysis

URS developed a high-level financial model to provide comparative NPVs for each Scenario and TCT combination. QTC developed break-even gate fees based on the discounted cash flows sourced from the URS model. QTC performed a Quality Assurance role in the model development.

1.3 KEY OBSERVATIONS

1.3.1 Financial appraisal

1. MSW kerbside would be the primary secure fuel source for an EfW and all investment decisions must be based on the associated waste quantity until Council can secure additional fuel sources from either other waste streams within the region, or from other surrounding councils.

2. Pyrolysis is the technology type that provides the lowest Net Present Cost (NPC) to Council, at $227 million (in 2012 dollars) over the project life of 25 years. This comprises the estimated capital cost (in real dollars) of $86 million, estimated operations and maintenance costs of approximately $173 million, and estimated residual waste disposal costs of $18 million.

3. Without grant or subsidy funding, Council would need to charge a gate fee of $208 per tonne (rising in line with inflation) to recover all capital and operating costs and provide an appropriate return on capital. Council currently budgets MSW kerbside waste at a gate fee of $100 per tonne for landfill disposal. The EfW break-even gate fee of $208 per tonne would represent a 108 per cent cost increase. It is likely that a private operator would seek a higher break-even gate fee to incorporate a profit margin.

4. Cleansing rates for a standard kerbside service (240L general waste bin weekly and 240L recycling bin fortnightly) would have to increase from $195 per annum to $292 per annum, representing a 50 per cent increase. This would enable payment of the break-even gate fee to the EfW facility operator for pyrolysis (Scenario 1 – MSW kerbside).

5. The project is likely to be best funded through a private financing arrangement by the preferred technology supplier and operator, although further analysis would be necessary to conform this. An operator is likely to have a higher rate of return than Council's weighted-average cost of capital (WACC). However, the risk transfer gained from private financing should outweigh the higher cost of capital.

6. The break-even gate fee and cleansing rate could be reduced through sourcing a capital funding subsidy. Energex and the Department of Environment and Resource Management (DERM) are potential funding contributors, however, the solution would need comprehensive technical, commercial and financial scoping to attract and secure funding contributions.

1.3.2 Strategic objectives

7. The proposed TCT options all achieve the State's and Council's strategic waste reduction targets, with residual waste ranging from 15 per cent to 30 per cent of the total waste input. *Queensland's Waste Reduction and Recycling 2010-2020 Strategy* has a target of reducing waste to landfill by 50 per cent by 2020. Council has its own target of 70 per cent diversion of MSW from landfill. The strategy outlines the States intention to make $120 million available between 2012 and 2016 to assist local government in target attainment.

8. A waste levy is anticipated to be introduced in Queensland on 1 December 2011. Under the proposed arrangements, MSW is exempt and the levy is payable on C&I, C&D and regulated wastes disposed to landfill. It is unclear if the levy would apply to these waste streams if they were used as a feedstock to an EfW.

1.3.3 Technology review

9. The majority of recent EfW plants have used gasification technology instead of pyrolysis, for example in Japan and the UK. Gasification and pyrolysis plants can still be considered to have limited proven commercial application.

10. Mass burn incineration has proven commercial application for MSW and is the technology of choice in much of the USA and Europe. However, it requires a higher degree of air pollution control due to less up-front pre-treatment.

1.3.4 Procurement

11. This project represents a complex and multi-faceted procurement challenge and would need to consider the collection contract, recyclables processing, transfer station, logistics and the EfW plant.

12. Domestic experience in EfW is limited and it is likely that the procurement approach would need to be international to source suitable suppliers.

13. A Design, Construct, Operate and Maintain (DCOM) contract is likely to achieve the best value for money for Council.

1.3.5 Timing

14. The collection tender (to be awarded by July 2013) and the landfill capacity constraints represent key factors for considering the planning and procurement of an EfW.

15. The delivery timeframe for a TCT is estimated to be a minimum of six years from the commencement of the business case approval, based on comparable experiences with Alternative Waste Technology in NSW.

1.3.6 Regulatory

16. There is a significant history of high levels of community concern relating to thermal treatment facilities.

17. QTC is aware of only one EfW facility in Queensland, the Rocky Point facility which utilises timber waste for energy generation. On this basis, it is understood that DERM has limited experience in approving EfW projects. Given the scarcity of precedents, there would in all probability be a rigorous and lengthy approvals process and significant conditions attached to the formal operating licence.

1.3.7 Risk management

18. A project risk review has not been completed for the project.

19. QTC has identified potential key risks for the project as follows:

    - The complexity and uniqueness of the project is such that design, construction and operation may not be satisfactory and may not meet the contractual requirements, resulting in negative performance of cost outcomes.
    - Regulatory approval of the project may be prolonged.
    - Waste stream composition may not be suitable for the plant, resulting in operational complexity and cost.
    - The contractor may not be able to source sufficient debt and/or equity to fund project development.
    - Project delays could result in additional pressure on existing landfill capacity.

1.4 RECOMMENDATIONS

A summary of key recommendations, not listed in priority order, are listed below:

- An EfW facility for the Sunshine Coast region would represent a high-cost waste management option, with high technology risks, complex procurement and significant regulatory and community perception risks. Council should carefully consider these costs and risks in its evaluation of any future plans.
- Council should defer further scoping work on an EfW facility until it has completed the comparative assessments below:
    - Compare the NPV of the preferred TCT option (Pyrolysis – Scenario 1 MSW kerbside) with alternative options that may achieve Council's landfill diversion targets. This includes establishment of a third bin and organics processing facility.
    - Compare the NPV of the preferred TCT option (Pyrolysis – Scenario 1 MSW kerbside) to the Base Case disposal option of green field landfill development and/or bulk transport to SEQ landfill.
- Review Alternative Waste Technology (AWT) that may be retrofitted to existing transfer stations for a relatively lower capital and operating cost and contribute to achieving waste diversion targets. Examples of this include the Anaeco technology currently used in Western Australia.

1.5 LIMITATIONS OF ADVICE

The following limitations of our analysis should be noted:

1. QTC has relied on the financial and operating performance information of the Thermal Conversion Technologies provided by URS. QTC's work did not include commenting on the validity of the financial or operational information provided. Accordingly, we cannot be certain that all the necessary adjustments to reflect the true capital and operating costs have been made.

2. QTC's financial assessment of the project did not include:

   - provision of advice in respect of accounting, audit, legal or taxation matters
   - auditing or independently verifying Council supplied information
   - any review or assessment of community or regulatory acceptance of TCT, or
   - guaranteeing that the review of planning and environmental approvals required for a TCT facility will identify all approvals that may be required by local, state and federal government authorities.

3. The development of the financial model by URS (including the methodology used) was based on information and assumptions provided largely by Council, or sourced by QTC on Council's behalf. However, in all cases, Council's acceptance of the final model developed by URS confirms Council's acceptance of the information, assumptions and methodology included in the model as Council's own.

1.6 INFORMATION SOURCES

The following information was supplied by Council or sourced by QTC to provide background information necessary for the feasibility assessment:

- Waste data for financial year 2008-09 and 2009-10
- Waste to landfill assessment 2009 – construction and demolition waste stream
- Waste to landfill assessment 2009 – domestic kerbside waste stream
- Waste to landfill assessment 2009 – transfer station waste stream
- International Energy Agency (IEA) Bioenergy Task 36: Integrating Energy Recovery into Solid Waste Management Systems (2007-2009), and
- Municipal Solid Waste Incineration – A decision makers guide (2000).

2| WASTE GENERATION AND CHARACTERISATION

This section summarises the waste types and quantities of waste generated in the Sunshine Coast region. This information is critical to determine the potential feedstock which may be available for a proposed TCT and to ensure the TCT facility being considered is of a suitable scale to effectively treat that waste volume.

2.1 WASTE FLOWS 2008-09 TO 2009-10

Council provided QTC with weighbridge waste data for the financial years 2008-09 and 2009-10. To provide a clear understanding of waste flows to landfill from the main waste streams, the waste volumes were categorised as follows:

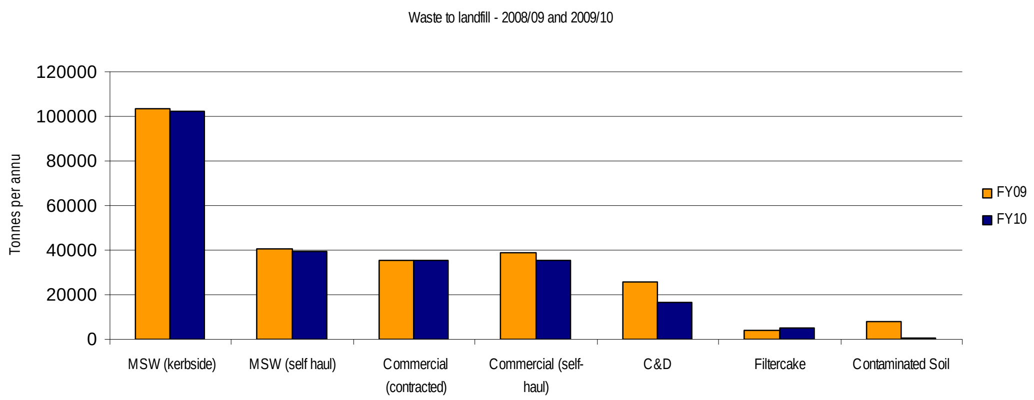
- MSW kerbside
- MSW self-haul
- C&I contracted
- C&I self-haul, and
- C&D.

Table 1 and Figure 1 summarises the waste volumes to landfill by category for financial year 2008-09 and 2009-10. These waste streams are potentially available as a fuel source for a TCT.

Table 1: Summary of waste to landfill 2008-09 to 2009-10[1]

Waste stream	*2008-09 (tonnes)*	*2009-10 (tonnes)*
MSW kerbside	103 492	102 420
MSW self-haul	40 750	39 560
C&I contracted	35 554	35 597
C&I self-haul	38 746	35 507
C&D	25 763	16 649
Filter cake	3 810	5 021
Contaminated soil	7 893	830
Total	256 010	235 585

Figure 1: Summary of waste to landfill



[1] Sourced from Council transfer station and landfill weighbridge data

2.2 MUNICIPAL SOLID WASTE AS CRITICAL FUEL SOURCE

Council has perpetual responsibility for the management and disposal of MSW, under the statutory powers conferred by the DERM, the *Environmental Protection (Waste Management) Regulation 2000* and the *Local Government Act 2009*.

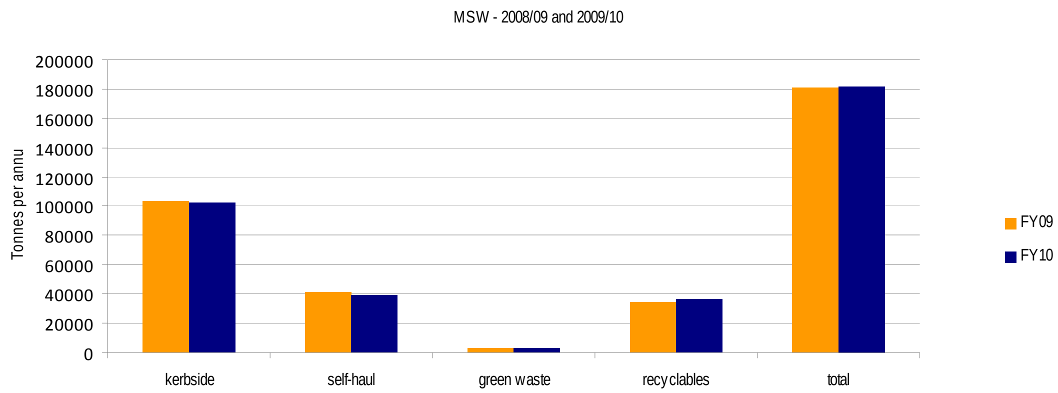
Security of fuel supply is critical to the development and operation of a TCT facility and MSW collected either from kerbside or delivered by self-haul to Council waste infrastructure assets should provide a secure fuel source for a TCT facility. It is likely that if a TCT facility was established and set a gate fee higher than other commercially operated waste disposal facilities, natural market dynamics would prevail and commercial and C&D wastes would flow to the waste disposal facilities offering the lowest gate price.

MSW is derived from the following sources, as illustrated in Figure 2:

- MSW kerbside
- MSW self-haul
- green waste (kerbside), and
- recyclables (kerbside).

Consistent with the waste and resource management hierarchy, green waste and recyclables would continue to be reused and recycled within the current established markets for these waste categories, reflecting their highest and most valuable use. The residual waste stream consisting of MSW kerbside and MSW self-haul that is currently landfilled, would be available as a potentia fuel source for a TCT facility.

Figure 2: Summary of MSW waste



2.3 WASTE CHARACTERISATION

Waste to landfill characterisation audits were carried out at Council landfills located at Caloundra, Nambour and Eumundi in 2010 (EnviroCom, 2010). The waste streams assessed were:

- domestic kerbside waste (MSW)
- transfer station domestic self-haul waste (MSW self-haul)
- C&I, and
- C&D.

Based on the waste characterisation data provided, URS undertook an assessment of the suitability of these streams as potential feedstock for the TCTs. The waste characterisation enabled waste types and volumes to be determined for pre-treatment infrastructure and TCTs, for each waste stream. This information is critical to determine the name plate capacity of pre-treatment and TCT facilities. The waste characterisation percentages used for each waste stream are summarised in Table 2 below:

Table 2: Waste characterisation (as a percentage of each waste stream)[2]

Waste Type	*MSW Kerbside %*	*MSW self-haul %*	*C&I %*	*C&D %*
Organics to thermal	54	9	30	6
Organics non-recyclable to thermal	5	21	20	14
Organics recyclable	0	17	3	10
Paper/cardboard to thermal	3	1	24	0
Plastic to thermal	10	11	10	3
Dry recycling (plastic, glass, paper, cardboard) to existing markets	18	11	2	4
Metal to existing markets	2	1	1	1
Inert / hazardous to landfill	8	29	10	62
Total	100	100	100	100

2.4 FORECAST WASTE GROWTH

Forecast waste volumes were determined based on the Council weighbridge data for financial year 2008-09 and 2009-10 to determine residual waste disposed to landfill from the following sources:

[2] EnviroCom 2010. Waste characterisation audits

- MSW (kerbside)
- MSW (self-haul)
- C&I (contracted and self-haul), and
- C&D (self-haul).

The planning horizon has been assumed at 25 years to be consistent with the modelling period. Population estimates are based on the Planning Information and Forecasting Unit (PIFU) Medium series 2008 – 2033. The waste volume forecast assumes no change to the current per capita waste generation rate. The forecast residual waste generation, based on expected population growth in the region, as supplied by QTC, is illustrated in Table 3.

Table 3: Forecast waste growth for waste to landfill 2010-11 to 2034-35

Year	*Growth rate (%)*	*MSW (kerbside) (tonnes)*	*MSW (self-haul) (tonnes)*	*C&I (tonnes)*	*C&D (tonnes)*	*Total (tonnes)*
FY11	2.30	105 324	41 079	74 375	21 694	242 472
FY12	2.30	107 747	42 024	76 085	22 193	248 049
FY13	2.30	110 225	42 990	77 835	22 704	253 754
FY14	2.30	112 760	43 979	79 625	23 226	259 590
FY15	2.30	115 354	44 991	81 457	23 760	265 561
FY16	2.30	118 007	46 026	83 330	24 306	271 669
FY17	2.00	120 367	46 946	84 997	24 792	277 102
FY18	2.00	122 774	47 885	86 697	25 288	282 644
FY19	2.00	125 230	48 843	88 431	25 794	288 297
FY20	2.00	127 734	49 820	90 199	26 310	294 063
FY21	2.00	130 289	50 816	92 003	26 836	299 944
FY22	1.80	132 634	51 731	93 659	27 319	305 343
FY23	1.80	135 022	52 662	95 345	27 811	310 840
FY24	1.80	137 452	53 610	97 061	28 312	316 435
FY25	1.80	139 926	54 575	98 809	28 821	322 130
FY26	1.80	142 445	55 557	100 587	29 340	327 929
FY27	1.70	144 866	56 501	102 297	29 839	333 504
FY28	1.70	147 329	57 462	104 036	30 346	339 173
FY29	1.70	149 834	58 439	105 805	30 862	344 939
FY30	1.70	152 381	59 432	107 603	31 387	350 803
FY31	1.70	154 971	60 443	109 433	31 920	356 767
FY32	1.60	157 451	61 410	111 184	32 431	362 475
FY33	1.60	159 970	62 392	112 963	32 950	368 275
FY34	1.60	162 530	63 391	114 770	33 477	374 167
FY35	1.60	165 130	64 405	116 606	34 013	380 154
FY36	1.60	167 772	65 435	118 472	34 557	386 236

3| STRATEGIC WASTE MANAGEMENT OBJECTIVES

Council adopted a Waste Minimisation Strategy 2009–2014 in 2010 to provide a clear strategic direction for future waste management within the region. Subsequent to Council's strategy, DERM released *Queensland's Waste Strategy 2010-2020: Waste Avoidance and Recycling consultation draft* in July 2010. This strategy sets the platform for waste management in Queensland over the next decade.

3.1 STATE DRIVERS

Queensland's Waste Reduction and Recycling 2010-2020 (Waste Strategy) was released in February 2011. It is anticipated that waste legislation will be passed by Government in 2011 that embodies key principles outlined in the strategy, and that the collection of a waste levy will commence in December 2011.

It is expected the implementation of the Waste Strategy will be empowered through the development of a new Bill, the *Waste Reduction and Recycling Bill 2011*. The key components contained in the strategy that need to be considered in conjunction with the evaluation of TCT are outlined below.

3.1.1 Targets and priorities

Recycling targets for 2020 detailed in the current Waste Strategy are:

- reduce waste disposal to landfill (compared to business-as-usual) by 50 per cent
- increase recycling of MSW by 65 per cent
- increase recycling of C&I waste by 60 per cent
- increase recycling of C&D waste by 75 per cent
- increase recycling of regulated waste by 45 per cent
- target 150: increase recycling of household waste to 150kg per person per year, and
- reduce waste generation by 15 per cent.

3.1.2 Levy

The Queensland Government intends to introduce a waste levy as a price signal to drive behaviour change in waste management. The levy will apply at the disposal point and will be paid in addition to the normal waste disposal gate fee. Table 4 summarises the anticipated levy amount for each waste stream.

Table 4: Levy amount by waste stream

Waste stream	*Disposal levy amount ($ per tonne)*
MSW	0
C&I	35
C&D	35
Contaminated and acid sulphate soils	35
Lower hazard regulated waste	50
Higher hazard regulated waste	150

MSW, which includes household kerbside waste and self-haul waste, is not expected to attract a levy payment. It is likely that the residual waste from a TCT that would require final disposal at a landfill would attract a levy. The levy amount applied to the residual waste would be dependent on its chemical properties, specifically, its ability to meet Toxicity Characteristic Leaching Procedure (TCLP) criteria consistent with landfill licence conditions. The best case scenario would be categorisation as C&I waste. The worst case would be categorisation as lower level regulated waste.

3.1.3 Actions

The *Waste Strategy* contains no specific actions relating to TCT. Broader actions that may encompass the implementation of TCT are summarised in Table 5.

Table 5: Summary of actions detailed in the Queensland Waste Strategy 2010–2020

Sector	*Description*
Business and industry	Support for research and development programs to identify and commercialise opportunities for innovative waste technologies, processes and products
Local government	Assistance for local government/regional strategic waste management planning
Local government	Incentive scheme for improved resource recovery practices
Local government	Assistance for alternative waste technologies

3.2 LOCAL STRATEGY

Council endorsed a Waste Minimisation Strategy 2009–2014 in 2010 to provide a clear strategic direction for future waste management within the region.

Council has set a goal to increase the recovery of wasted resources to over 70 per cent by 2014. Council intends to follow the waste hierarchy[3] to maximize the highest and best use of waste resources. The targets summarised in Table 6 are Council's goals for specific waste streams.

[3] The **waste hierarchy** refers to the 3 (or 4) Rs of reduce, reuse, recycle, (and recover) which classify waste management strategies according to their desirability

Table 6: Reduction targets (by weight)

Waste stream	*Recovery target (%)*
MSW	70 by 2014
C&I	70 by 2014
C&D	70 by 2012

Council currently achieves a diversion rate from landfills of approximately 32 per cent.

Council has acquired Sustainability Park, a parcel of land located adjacent to the existing Pierce Avenue Landfill at Caloundra South. The site is strategically located in the Caloundra South area which is forecast to be a significant growth centre within the Sunshine Coast region. The site is zoned appropriately for waste management activities. The site offers Council a unique hub to develop an integrated resource recovery precinct that could co-locate the entire necessary infrastructure for an EfW facility. Commercial development of the precinct may also enable by-products (ie, heat, steam, energy) from an EfW facility to be used for appropriately developed industrial enterprises.

4| TECHNOLOGY OVERVIEW

The thermal processes that were considered potentially suitable for the thermal treatment of waste streams include:

- pyrolysis
- gasification
- RDF incineration, and
- mass burn incineration.

The following section provides a brief overview of these TCTs. The information provided was sourced from the URS report and International Energy Agency reports on integrating energy recovery into solid waste management systems.

4.1 PYROLYSIS

Table 7 summarises the conventional pyrolysis process.

Table 7: Pyrolysis summary

Parameter	*Description*
General concept	Pyrolysis of waste in externally heated rotary drum Combustion of syngas in high temperature combustion chamber Separation of pyrolysis coke from inert ash
Status of commercialisation	First commercial plant operational in Burgau, Germany 11 plants with total throughput of 2360 tonnes per day in Japan
Temperature	Pyrolysis: 400^{0}C to 500^{0}C Combustion: 1100^{0}C to 1350^{0}C
Size (per line)	2.5 – 8.3 tonnes per hour
Size (per installation)	140,000 tonnes per annum
Energy recovery	580 to 650 kWh per tonne of waste

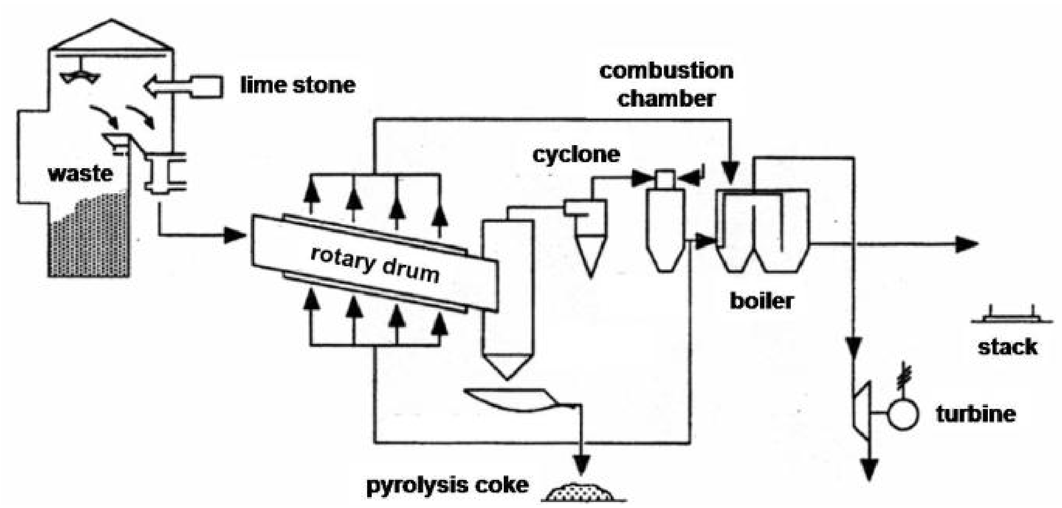
Pyrolysis of waste is applied in only a few commercial scale plants. Pyrolysis involves the thermal degradation of organic carbon-based materials through the use of an indirect, external source of heat, typically at temperatures of 400^{0}C to 500^{0}C, in the absence or almost complete absence of air. The residence time is typically 1-2 hours. This thermally decomposes and drives off the volatile portions of the organic materials, resulting in a syngas composed primarily of hydrogen, carbon monoxide, carbon dioxide and methane.

Most pyrolysis systems are closed systems and there are no air emissions (if the syngas is combusted to produce electricity, the power system will have air emissions through an air emission control system and stack). After cooling and cleaning in emission control systems, the syngas can be utilized in boilers, gas turbines, or internal combustion engines to generate electricity. A typical pyrolysis unit processing MSW can produce around 580 to 650 kWh per tonne of waste (average 615 kWh/ton).

The balance of the organic materials that are not volatile or liquid pass through a magnetic and eddy current separation step for metal recovery and an air classifier for separation of the pyrolysis coke from the mineral residue. The coke is burnt together with the gas, while the mineral fraction is either land filled or used as an aggregate.

Figure 3 illustrates the conventional pyrolysis process.

Figure 3: Flow diagram of the Burgau pyrolysis plant in Germany



4.2 GASIFICATION

Table 8 summarises the conventional gasification process.

Table 8: Gasification summary

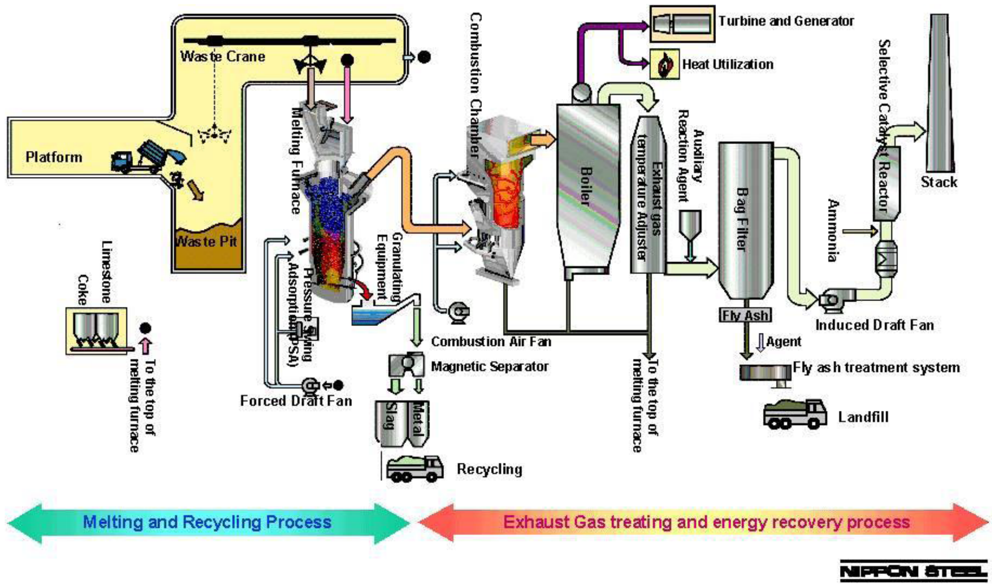
Parameter	*Description*
General concept	Mainly multi-stage processes with gasification of waste in shaft or fluidized bed furnaces, in gasification chambers, in entrained flow systems or on grates Syngas can be used for chemical synthesis, fed into gas engines, directly burnt, or co-combusted in power plants All processes end up with molten solid residues
Status of commercialisation	In Japan, 95 plants with 195 lines and a total throughput of approx 17500 tonnes per day
Temperature	Gasification: 300^{0}C to 1400^{0}C Post combustion chamber: up to 1350^{0}C
Size (per line)	< 1 – 11 tonnes per hour
Size (per installation)	<10000 - 150000 tonnes per annum
Energy recovery	600 to 700 kWh per tonne of waste

Gasification involves the thermal conversion of organic carbon-based materials in the presence of internally produced heat, typically at temperatures of 300^{0}C to 1,400^{0}C, and in a limited supply of air/oxygen to produce a syngas composed primarily of hydrogen, carbon monoxide, carbon dioxide and methane. Inorganic materials are converted either to bottom ash (low-temperature gasification) or to a solid, vitreous slag (high-temperature gasification) which requires disposal. Some of the oxygen injected into the system is used in reactions that produce heat, so that pyrolysis (endothermic) gasification reactions can initiate; after which, the exothermic reactions control and cause the gasification process to be self-sustaining.

Like pyrolysis, most gasification systems are closed systems and do not generate air emissions during the gasification phase. After cooling and cleaning in emission control systems, the syngas can be utilised in boilers, gas turbines, or internal combustion engines to generate electricity. A typical gasification unit processing MSW can produce around 600 to 700kWh per tonne of waste processed (average 650 kWh/tonne).

Figure 4 illustrates the conventional gasification process.

Figure 4: Typical gasification process for electricity generation[4]



4.3 MASS BURN INCINERATION

Table 9 summarises the mass burn incineration process.

Table 9: Mass burn incineration summary

Parameter	*Description*
General concept	Combustion of un-treated waste in air or oxygen enriched atmosphere on a grate Capable of burning waste with a lower heating value
Status of commercialisation	Oldest and prevailing EfW technology world wide Commercially proven, used in > 500 plants Many plants have been operational for 15-30 years
Temperature	> 850^{0}C – 1100^{0}C
Size (per line)	3 – 40 tonnes per hour
Size (per installation)	Very broad Biggest installations treat 1.2 – 1.4 million tonnes per annum
Energy recovery	475 to 625 kWh per tonne of waste

[4] Sourced from Nippon Steel gasification plant in Japan

Mass burn incineration, unlike the previous types of thermal conversion technologies, requires minimal pre-sorting of waste before it is subjected to thermal treatment. The only requirement for pre-treatment is removal of large bulky objects (such as household appliances) and non-combustibles such as concrete/brick from C&D, in order to maintain efficient fuel flow and remove potentially dangerous hazardous materials. Any mixing of the waste in a mass burning facility is limited to mixing in the storage pit during loading of the refuse into the combustion chamber. The technology involves the drying, devolatilisation and ignition of waste, similar to the combustion of fossil fuels.

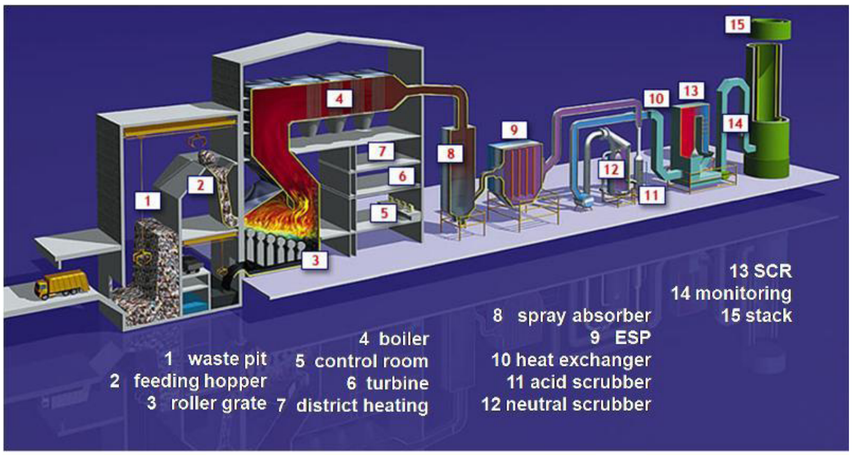
In a mass burn incinerator, the waste is fed in via a feeding chute and then pushed into the combustion chamber by a hydraulic ram or a travelling grate. There are a number of different grate designs in operation but their prime function is the controlled transport of the waste through the combustion chamber. The design has to guarantee efficient mixing of the fuel bed and permanent coverage of the metal parts to protect them against over-heating. In all mass burn incinerators the primary air is injected from below, through the grate.

In Western industrialised countries, between 15 and 25 per cent of the waste feed by weight leaves the plant as bottom ashes. The bottom ash contains significant amounts of ferrous and non-ferrous metal scrap which is now routinely recovered using magnetic and eddy current separation. The amount of boiler ash (the ash deposited in the boiler) depends on the type of boiler and on the dust load of the flue gas leaving the combustion chamber. Mean figures in modern plants are 2 to 5 kg per tonne of waste. Boiler ash should not be combined with the grate ash, but be treated together with the filter ash; this requirement has been enforced by legislative regulations in some countries. Consideration of these issues would be undertaken by DERM as part of the development approval and conditioned appropriately as part of the operating licence.

In terms of energy balance, many mass burn incinerators achieve a net energy output of 85 per cent, consisting of approximately net power export of 15 to 20 per cent and a heat output of 60 to 65 per cent.

In waste incineration, the removal of pollutants from the flue gas is one of the most important and most expensive process stages. This process is a regulatory requirement since the air emission limits applicable for waste incineration are the most stringent of all the industrial combustion processes. In the European Union (EU), the Waste Incineration Directive sets the standards in 2000 [European Parliament and Council 2000] and these have been adopted by legal regulations in the member countries. It is likely that regulators in Queensland would impose the most stringent air emission limits, which at this time, are the EU standards.

Figure 5: Flow diagram of a MSW mass burn incinerator (grate)[5]



4.4 REFUSE DERIVED FUEL (RDF) INCINERATION

Table 10 summarises the RDF Incineration process.

Table 10: RDF Incineration summary

Parameter	*Description*
General concept	Combustion of pre-treated (shredded) waste in a bed of sand, fluidized by air injected through nozzles in the floor of the furnace. Preferentially used for Solid Refuse Fuel (SRF) Waste particle size < 200 mm
Status of commercialisation	For waste incineration facilities developed since 1970 Commercially proven, used in > 50 plants for MSW incineration Mainly used in Japan for smaller throughputs
Temperature	Bed temperature 800-850^{0}C Freeboard temperature > 850^{0}C – 1100^{0}C
Size (per line)	3 – 15 tonnes per hour
Size (per installation)	<10000 - 660000 tonnes per annum
Energy recovery	550 to 620 kWh per tonne of waste

RDF Incineration (also known as Process Engineered Fuel) involved the pre-treatment of waste before incineration occurs. Processing the waste allows materials suitable for recycling to be removed from the combustible residue, along with wet organic materials such as food and garden wastes for separate treatment. The combustible fraction (consisting of paper, card, plastic film, etc) may then either be burnt directly as a coarse flock (c-RDF) or compressed into dense pellets (d-RDF) for sale as a supplement fuel in industrial boilers. An advantage of the RDF over mass-burn incineration is that because the waste is sorted and shredded before combustion, the combustion equipment can be smaller, less robust and therefore less expensive.

[5] Mass burn incinerator located in Offenbach, Germany

RDF Incineration typically consists of a rectangular or cylindrical combustion chamber where finely grained fuels are burned in a fluidised sand bed, sometimes with the addition of dolomite for the capture of acid gases. They were initially developed for the combustion of sewage sludge and are today deployed mainly in Japan for the use of municipal waste. Currently, they are becoming more popular for the combustion of SRF and biomass.

The share of (waste) fuel in the sand bed is typically of the order of 2 to10 per cent only, depending on the calorific value of the fuel.

All RDF Incinerators have the advantage of establishing a uniform distribution of the waste in the fluidised fuel bed, which enables a homogeneous and stable combustion. Another advantage is the wide range of heating value of the fuel that can be burnt in this type of furnace. The energy density in the fuel bed can be varied by controlling the share of fuel in the bed.

These advantages, however, have to be paid for by the need for pre-treatment of the fuel, as, for establishing fluidisation, the particle size of the fuel has to be limited. Another limitation is the fuel bed temperature, which is typically kept lower than 850°C to avoid melting of ash components and the collapse of the fluidised bed.

The different RDF incinerator units used include stationary, circulating, and revolving or internally circulating fluidised beds.

Figure 6 illustrates the conventional RDF incineration process.

Figure 6: Flow diagram of the Berlin-Ruhleben Fluidised bed RDF incineration plant

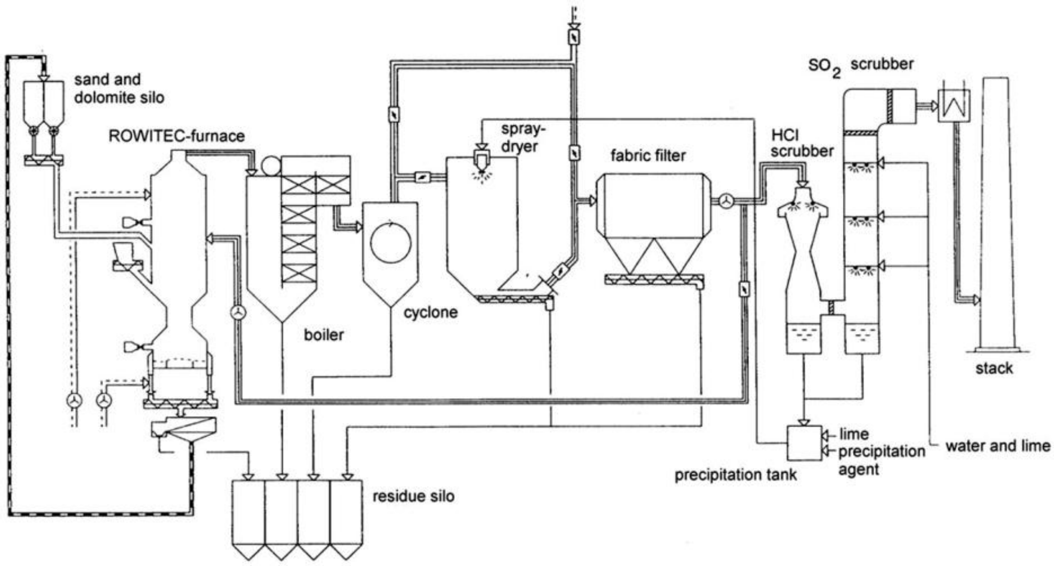


Table 11: Indicative comparative summary of TCT options

Technology	*Pre-treatment required*	*Outputs*	*Potential products*	*Energy output*	*Residual waste (%)*	*Air emissions*	*Status of commercialisation*	*Risk issue*
Pyrolysis	Yes	Syngas	Electricity Heat Biochar	580 to 650kWh per tonne of waste	5 (high quality bio char) 30 (low quality bio char)	Nil during pyrolysis phase Low during combustion phase	Limited (mainly Japan)	Technology design – high Operating systems – high Feedstock quality – moderate Env management – moderate
Gasification	Yes	Syngas	Electricity Heat	600 to 700 kWh per tonne of waste	15	Nil during gasification phase Low during combustion phase	Limited (mainly Japan)	Technology design – high Operating systems – high Feedstock quality – moderate Env management – moderate
Mass Burn Incineration	No		Electricity Heat	475 to 625 kWh per tonne of waste	20	High	Proven, and wide scale	Technology design – low Operating systems – low Feedstock quality – low Env management – moderate
RDF Incineration	Yes	RDF Pellet	Electricity Heat	550 to 620kWh per tonne of waste	15	Moderate during combustion phase	Proven and limited scale	Technology design – moderate Operating systems – moderate Feedstock quality – moderate Env management – moderate

5| SCENARIO DEVELOPMENT

Scenarios were developed to ascertain what materials from the waste stream would be potentially available for an EfW facility, taking into consideration fuel security of supply, quantity and quality. Scenario development was completed during a joint workshop involving QTC, Council and URS in February 2011.

The crucial components that underpin the development and operation of an EfW facility are fuel supply security, the nature of waste and its calorific value (ie, degree of energy that can be derived). Currently, Council owns and manages the majority of waste disposal infrastructure within the region and as such, receives the majority of waste generated within the region. The exception to this is C&D waste, which private operators transport to C&D landfills in South-East Queensland due to market conditions.

Broadly, the waste streams which Council currently receives include:

- MSW kerbside
- MSW self-haul
- C&I contracted and self-haul, and
- C&D self-haul.

Of these waste streams, Council has long-term security of supply of the MSW (kerbside) due to its statutory responsibility for MSW kerbside collection and the long-term nature (10 years) of these contracts. If a TCT facility was established, it is likely that the net cost of an EfW facility would be significantly higher than for a landfill. Market economics would suggest that MSW (self-haul), C&I and C&D wastes would flow to waste disposal facilities offering the lowest gate price and these waste flows could not be relied upon as a secure fuel source unless an EfW facility could offer a comparable gate fee.

To provide a comprehensive financial analysis of all potential waste streams and understand the impact of size and scale on the NPV and break-even gate fee, the following scenarios were developed:

- Scenario 1 – MSW kerbside only
- Scenario 2 – MSW kerbside and MSW self-haul
- Scenario 3 – MSW kerbside, MSW self-haul and C&I waste, and
- Scenario 4 – MSW kerbside, MSW self-haul, C&I waste and C&D waste.

For each scenario, the volume forecasts for each waste stream (detailed in Section 2.4) were totalled together to provide the total volume of feedstock waste for each Scenario. These volume forecasts govern the size of the initial and additional pre-treatment infrastructure, nameplate design capacity for the TCT infrastructure, and associated capital and operating costs.

Figure 7 illustrates the volume growth for each scenario throughout the modelling period.

Figure 7: Scenario volume growth

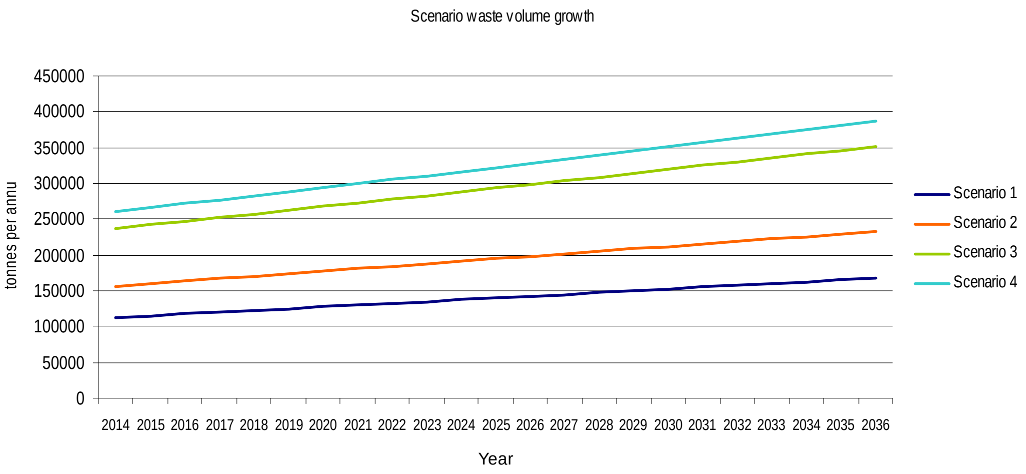


Figure 8 to 11 illustrate the scenarios. For each of the scenarios outlined above, the following TCTs were modelled to provide comparative NPVs and break-even gate fees:

- gasification
- pyrolysis
- RDF incineration, and
- mass burn incineration.

Figure 8: Scenario 1 – MSW kerbside

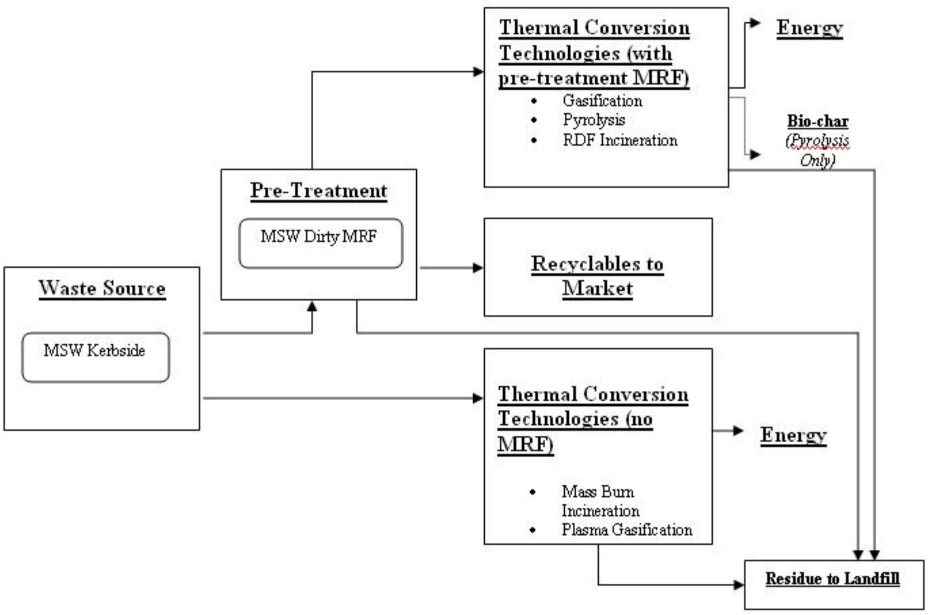


Figure 9: Scenario 2 – MSW kerbside and MSW self-haul

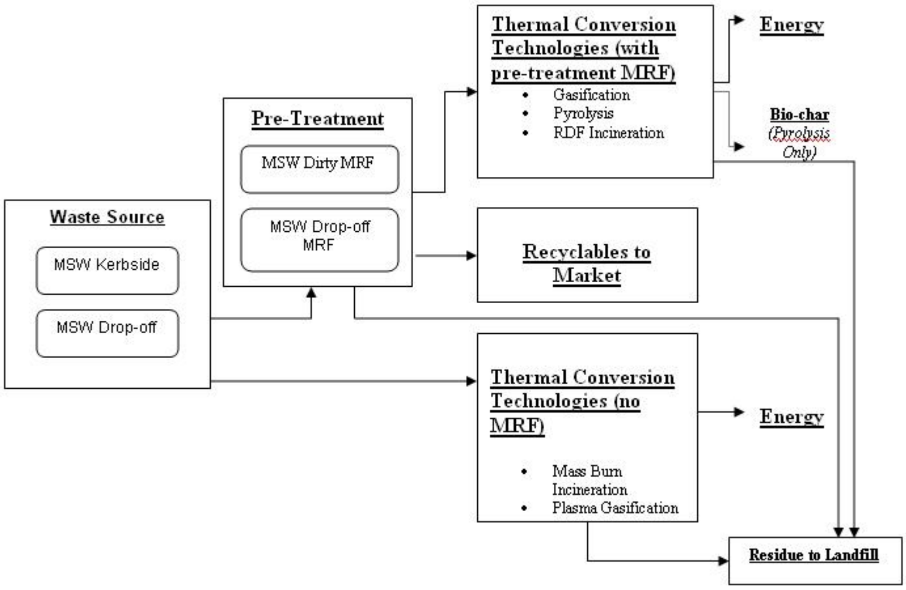


Figure 10: Scenario 3 – MSW kerbside, MSW self-haul and C&I

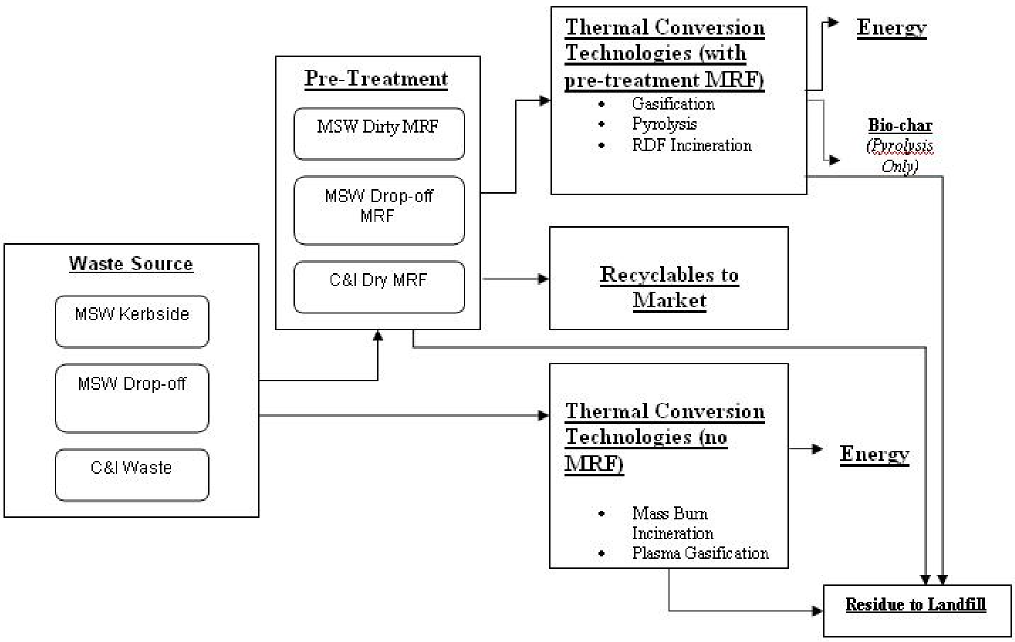
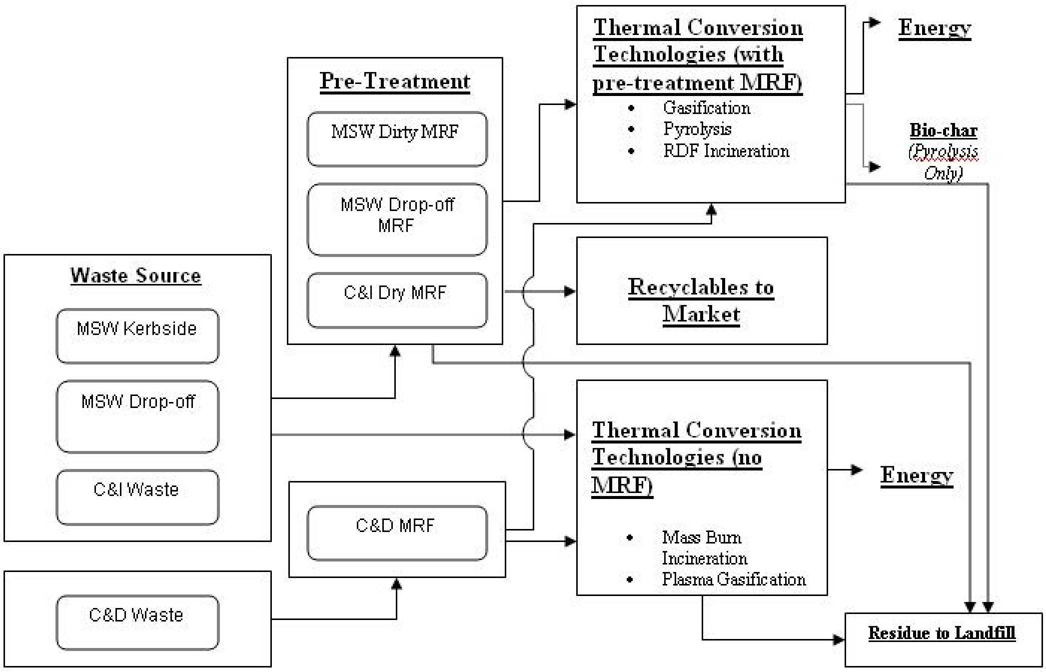


Figure 11: Scenario 4 – MSW kerbside, MSW self-haul, C&I and C&D



6 | FINANCIAL ANALYSIS

QTC was commissioned to develop a financial model for the purpose of comparing the NPV and break-even gate fee of TCT options for the scenarios outlined in Section 5. QTC engaged URS to develop the financial model and provided project oversight and quality assurance. The primary objectives of the model were to compare each TCT option to identify the lowest cost technology type and to determine the break-even gate fee that Council would need to set to meet capital and operational costs of the facility.

6.1 KEY ASSUMPTIONS

In preparing each of the scenarios for modelling, a range of input assumptions were collated. Key assumptions used in the models were.

- The modelling period is 25 years, reflecting the asset's useful life.
- Construction commences in Financial Year 2012 for a two-year period.
- Operations commence on 1 July 2014.
- Pre-tax real discount rates have been used.
- Transport costs to transport the waste from current receival locations (i.e. transfer stations and/or landfills) to the proposed facility are excluded from the modelling, and

- Residual waste is to be disposed in existing Council landfills and categorised as putrescible commercial waste with the waste levy payable.

Capital and operating costs used were based on information supplied by URS from work previously completed for the ACT Government in 2010. Costs were sourced in United States Dollars (USD) and converted to Australian Dollars (AUD) based on an exchange rate of $0.98 AUD/USD. Costs provided are in 2012 dollars unless otherwise indicated.

A detailed list of assumptions used to model the scenarios is summarised in Appendix B. These assumptions have been based on information provided largely by Council, URS or sourced by QTC on Council's behalf. QTC has not independently verified these assumptions for completeness or reasonableness.

6.2 CAPITAL COSTS

6.2.1 TCT capital costs

Capital costs have been estimated on a per unit (tonne) cost basis, depending on the size of the facility. The initial investment amount was determined based on the quantities of waste assumed to be processed by the pre-treatment facility and/or TCT facility. When the initial facility reaches capacity, it has been assumed that an additional module is added, typically a 50,000 wet tonne per year module. This investment is assumed to occur one year prior to the time when the additional capacity is required.

Table 12: TCT capital cost summary

Plant capacity (wet tonne/year)	*Gasification (AUD M)*	*Pyrolysis (AUD M)*	*RDF Incineration (AUD M)*	*Mass burn incineration (AUD M)*
50 000	35.7	47.4	48.5	47.2
100 000	61.2	81.6	91.8	89.3
150 000	89.5	118.6	137.8	126.3
200 000	116.3	153.0	183.7	158.2
250 000	140.3	178.6	216.8	184.9
300 000	162.2	206.6	252.6	220.4
350 000	185.7	233.9	289.3	255.4
400 000	208.2	263.3	202.0	289.8
450 000	229.6	293.9	358.2	323.7
Further modules (50 000 wet tonne per year)	29.8	39.5	45.9	42.0
Replacement cost	25% of capital	25% of capital	50% of capital	50% of capital
Replacement timing	10 years	10 years	10 years	10 years

6.2.2 Material Recovery Facility (MRF) capital costs

MRFs are necessary to complete pre-treatment of the incoming waste stream for the technology types of gasification, pyrolysis and RDF Incineration. No pre-treatment is required for mass burn incineration.

Table 13: MSW Kerbside (Dirty) MRF

	Initial investment	*Additional module*
Capacity (t/year)	100 000	50 000
Capital cost ($M)	10.0	5.0

Table 14: MSW drop-off MRF

	Initial investment	*Additional module*
Capacity (t/year)	100 000	50 000
Capital cost ($M)	4.0	2.0

Table 15: C&I MRF

	Initial investment	*Additional module*
Capacity (t/year)	50 000	50 000
Capital cost ($M)	5.0	4.5

Table 16: C&D MRF

	Initial investment	*Additional module*
Capacity (t/year)	50 000	50 000
Capital cost ($M)	3.0	3.0

The following assumptions have been made with regard to replacement cost and timing:

- replacement cost – 25 per cent of capital cost, and
- replacement timing – every 10 years.

6.3 OPERATIONAL COSTS

Operation and maintenance costs have been included in the financial modelling based on a cost per tonne of waste processed and vary depending on the plant capacity and throughput. Operation and maintenance costs were sourced from URS, based on the work recently completed for the ACT Government.

Unit costs are multiplied by the annual plant throughput to obtain the annual operational and maintenance costs.

6.3.1 TCT operational costs

Table 17: TCT operational costs summary

Plant capacity (wet tonne/year)	*Gasification (AUD per tonne)*	*Pyrolysis (AUD per tonne)*	*RDF Incineration (AUD per tonne)*	*Mass burn incineration (AUD per tonne)*
50 000	120	85	80	100
100 000	80	70	70	95
150 000	73	65	68	90
200 000	65	60	65	85
250 000	60	55	60	80
300 000	55	50	58	79
350 000	53	47	56	78
400 000	51	45	54	77
450 000	49	43	51	76

6.3.2 MRF operational costs

Table 18: MRF operational costs per tonne of capacity

MRF type	*Cost per tonne of capacity (AUD per tonne)*
MSW kerbside (dirty) MRF	35
MSW Drop-off MRF	20
C&I MRF	35
C&D MRF	20

6.4 CO_2-EQUIVALENT (CO_2-E) EMISSIONS

All TCT options produce CO_2-e emissions from the combustion process. However, the process avoids methane production that is associated with the decomposition of waste from traditional disposal facilities and produces electricity. As such, it may be that CO_2-e emissions will attract a reduced or nil cost under a carbon tax. The financial model has assumed that CO_2-e emissions are an externality and will attract the cost associated with the proposed carbon tax.

Table 19: CO_2-e emissions from electricity generation

Emissions from TCT	*Value*[6]
Emission factor	1.8
Energy content (GJ/t)	12.2
Total emissions/tonne waste processed	0.02196

6.5 ELECTRICITY, RECS AND CARBON PRICING

One of the benefits of the TCT options will be the sale of electricity generated from gas recovered during the waste treatment process. In the northern hemisphere, TCT facilities also generate heat and/or steam and these product outputs are on-sold to industrial and/or domestic users. The potential value of heat and/or steam is difficult to quantify within the Australian context and would require co-located industrial users. For these reasons, the potential value attributed to these outputs was excluded from the financial modelling.

Renewable Energy Certificates (RECs), are a form of renewable energy currency that is used to encourage industry investment in renewable energy generation technology. The Australian Government has established a renewable energy target (RET) of sourcing 20 per cent of electricity from renewable sources by 2020. Implemented through the *Renewable Energy (Electricity) Act 2000* and the accompanying *Renewable Energy (Electricity) Regulations 2001*, the scheme aims to:

- encourage the additional generation of electricity from renewable sources
- reduce emissions of greenhouse gases in the electricity sector, and
- ensure that renewable energy sources are ecologically sustainable.

Eligible renewable energy sources are credited with RECs based on the amount of electricity generated in megawatt hours (MWh). A TCT would be eligible for large-scale generation certificates (LGCs) which can be traded on the RECs registry to provide a revenue source in addition to the TCT's sale of electricity to the grid. Being a market-based instrument, the LGC price will vary with supply and demand.

[6] Emission factor and energy content sourced from Table 1 National Greenhouse Accounts (2009)

QTC provided URS with prices for wholesale electricity ($/MWh), carbon prices ($ per tonne of CO_2-e) and RECs ($/MWh), based on three cases, these being:

- Base Case – low price on carbon
- Sensitivity 1 – medium price on carbon, and
- Sensitivity 2 – no price on carbon.

QTC sourced the prices for electricity, carbon and RECs from an Australian Energy Market Operator (AEMO) report[7] completed in December 2010. Table 20 summarises AEMO's forecast pricing over the modelling period.

Table 20: Electricity, carbon and REC pricing

	FY2015	*FY2025*	*FY2035*
Wholesale electricity ($/MWh)			
Base Case – low carbon price	43.3	48.7	46.8
Sensitivity 1 – medium carbon price	52.0	61.3	63.6
Sensitivity 2 – no carbon price	17.5	30.1	23.0
Carbon price ($ per tonne of CO_2-e)			
Base Case – low carbon price	27.7	34.8	37.9
Sensitivity 1 – medium carbon price	38.6	49.2	53.0
Sensitivity 2 – no carbon price	0.00	0.00	0.00
RECS ($/MWh)			
Base Case – low carbon price	33.4	46.1	0.00
Sensitivity 1 – medium carbon price	33.4	0.00	0.00
Sensitivity 2 – no carbon price	50.1	48.8	0.00

6.6 RESULTS – BASE CASE

The Base Case of modelling relied upon following assumptions:

- Carbon Price: low carbon price for CO2-e emissions and corresponding wholesale electricity and REC prices
- Discount Rate: 9.54 per cent, and
- Waste Volumes: as detailed in Section 2.4.

The results have been presented using Net Present Cost (NPC) and the break-even gate fee price (commencing 2014). NPC is the value of all capital and operating costs associated with each option over the 25 year period, discounted at an appropriate WACC to the start of the project. The lowest NPC represents the best financial option for Council. The break-even gate fee price represents the price Council would have to charge users of the facility to ensure that the NPC of the revenue equals the NPC of the costs.

[7] http://www.aemo.com.au/planning/scenarios.html

Table 21 summarises the results for each TCT option and scenario for the Base Case.

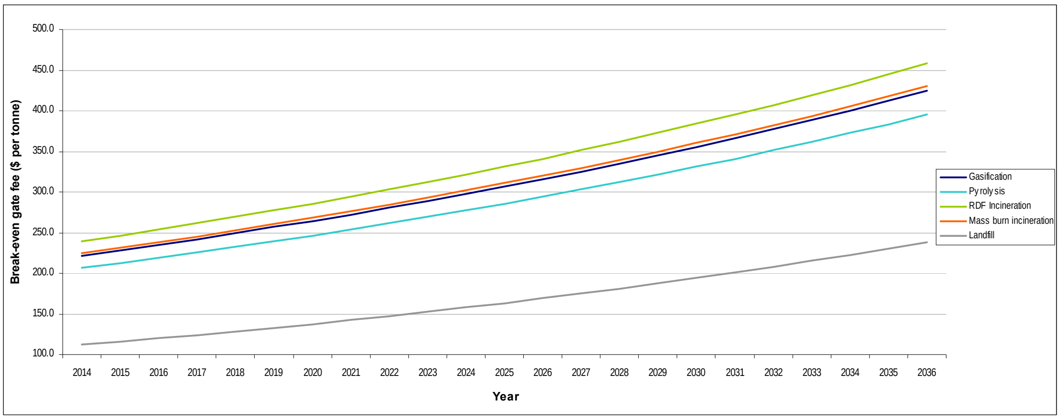
Table 21: NPC – Base Case

TCT Option	*Scenario 1 MSW kerbside ($M)*	*Scenario 2 MSW kerbside and self haul ($M)*	*Scenario 3 MSW kerbside, self haul and C&I ($M)*	*Scenario 4 MSW kerbside, self haul, C&I and C&D ($M)*
Gasification	243.3	314.6	435.0	475.3
Pyrolysis	226.6	269.1	369.8	412.5
RDF Incineration	262.5	373.9	527.6	585.7
Mass burn incineration	246.8	327.3	422.1	692.4

Table 22: Break-even gate fee – Base Case[8]

TCT Option	*Scenario 1 MSW kerbside ($ per tonne)*	*Scenario 2 MSW kerbside and self haul ($ per tonne)*	*Scenario 3 MSW kerbside, self haul and C&I ($ per tonne)*	*Scenario 4 MSW kerbside, self haul, C&I and C&D ($ per tonne)*
Gasification	223.0	209.8	194.3	193.9
Pyrolysis	207.7	179.4	165.2	168.3
RDF Incineration	240.5	249.3	235.7	238.9
Mass burn incineration	226.1	218.3	188.5	282.5

Figure 12: Comparison of break even gate fees for Scenario 1 – MSW kerbside only[9]



[8] Break even gate fees are effective from 2014.

[9] Council's landfill gate fee is $100 per tonne in 2012 indexed at 4 per cent per annum.

6.6.1 Key observations

- Scenario 1 – MSW kerbside, pyrolysis has the lowest NPC at $227M. Council would need to charge a gate fee of $208 per tonne in 2014 to establish break-even for the operation. The gate fee represents a 46 per cent premium to the forecast landfill disposal gate fee payable in 2014.
- Scenario 3 – MSW kerbside, self-haul and C&I provide the lowest break-even gate fee for Council, at $165 per tonne. There is considerable uncertainty over the long-term fuel security of the C&I waste streams and this scenario may not be achievable. The exclusion of C&I as a fuel source, leaving only MSW kerbside and self haul as a fuel source would increase the gate fee to $179 per tonne.
- Scenario 4 - MSW kerbside, self-haul, C&I and C&D result in an increase in the break-even gate fee from Scenario 3. This is counter-intuitive, in that typically unit costs per tonne would be expected to reduce with increasing volume. The increase reflects the shorter periods between the need for additional module capacity and associated capital expenditure to service the additional waste volume growth.

6.7 SENSITIVITY ANALYSIS

Sensitivity analysis was carried out to test the modelling results to key parameters that may have the most significant impact on the NPC and break-even gate fee. The sensitivity analysis was completed by varying one parameter at a time to determine how the results change in different circumstances. The sensitivity of the model was tested for:

- Discount Rate: Low rate (7.54 per cent) and High rate (11.54 per cent)
- Waste Volumes: Low volume (10 per cent below forecast), High Volume (10 per cent above forecast), and
- Carbon Price: Zero price on Carbon and Medium Carbon Price and corresponding wholesale electricity and REC prices.

The following section of the report presents only the results of the sensitivity analysis for Scenario 1 – MSW kerbside only. This scenario was selected as MSW kerbside only is the most secure fuel source for Council and is likely to be the waste stream on which Council would make an investment decision on an EfW facility. Appendix C summarises the sensitivity analysis results for all other Scenarios.

6.7.1 Discount rate sensitivity

The Base Case discount rate was based on the current risk premium and equity beta of listed waste conglomerates that have TCT assets as a component of their businesses. TCT can be considered a higher risk asset than traditional waste assets and this is reflected in the Base Case discount rate.

Table 23 summarises the results for Scenario 1 – MSW kerbside only for each TCT option for each discount rate sensitivity.

Table 23: Scenario 1 - Gate fee pricing and NPC for discount rate sensitivity

	Break-even gate price ($ per tonne - 2014)			*NPC ($M)*		
Option	*7.54 %*	*9.54 % (Base Case)*	*11.54 %*	*7.54 %*	*9.54 % (Base Case)*	*11.54 %*
Gasification	220.4	223.0	225.9	288.3	243.3	209.4
Pyrolysis	202.2	207.7	213.5	264.6	226.6	197.9
RDF Incineration	233.6	240.5	247.7	305.6	262.5	229.6
Mass burn incineration	218.2	226.1	234.8	285.5	246.8	217.6

Key observations

- When considering the sensitivity to discount rates, pyrolysis remains the most favourable option, regardless of whether the low or high discount rate is applied.
- When a lower discount rate is used, the range between gasification and mass burn incineration is reduced.
- Mass burn incineration is most sensitive to variations of the discount rate.

6.7.2 Waste volume

Population growth and waste consumption per capita is a key driver to the volume of waste generated. The Base Case assumes population growth based on PIFU forecasts and no change in waste consumption per capita. The trend over the past five years has been for increasing waste generation per capita. To address this, *Queensland's Waste Reduction and Recycling 2010-2020* has set a target of reducing waste generation per capita by 15 per cent by 2020. To test the sensitivity of the model to variations in the waste volume, the Base Case waste volume was varied by plus and minus 10 per cent.

Table 24 summarises the results for Scenario 1 – MSW kerbside only for each TCT option for plus and minus 10 per cent.

Table 24: Scenario 1 - Gate fee pricing and NPC for waste volume generation sensitivity

	Break-even gate price ($ per tonne - 2014)			*NPC ($M)*		
Option	*Minus 10 (%)*	*Base Case*	*Plus 10 (%)*	*Minus 10 (%)*	*Base Case*	*Plus 10 (%)*
Gasification	229.5	223.0	222.8	225.4	243.3	267.4
Pyrolysis	214.4	207.7	207.8	210.6	226.6	249.4
RDF Incineration	246.6	240.5	241.8	242.3	262.5	290.2
Mass burn incineration	259.3	226.1	216.8	254.7	246.8	260.2

Key observations

- Considering the NPC, the results indicate that NPC is most sensitive to waste volume, reflecting the sensitivity of operating costs and revenues to waste volume.
- A reduction in waste volume results in an increase in the break-even gate fee for all TCT options. This increase ranges from 2.2 to 2.5 per cent for pyrolysis, gasification and RDF incineration, and up to 12 per cent for mass burn incineration.
- For pyrolysis, gasification and RDF incineration, an increase in waste volume has no or negligible impact on the break-even gate fee. For mass burn incineration, the gate fee decreases by 4 per cent.

6.7.3 Electricity, carbon and RECS price sensitivity

Domestic electricity price is influenced by many different drivers, although key drivers are growth in energy demand, which is correlated to population and economic growth. The uncertainties surrounding carbon prices, RECS, new technologies and demand side management add to the pricing complexity. For the purposes of sensitivity analysis, QTC reviewed electricity, carbon and RECS pricing for various scenarios formulated for the Australian Energy Market Operator (AEMO)[10] in December 2010. The sensitivities assumed that carbon prices, electricity prices and RECS were correlated and influenced by the CO_2-e price options.

The sensitivities modelled ($ per tonne) included:

- zero carbon price, and
- medium carbon price.

Table 25 summarises the results for each TCT option for medium and zero carbon sensitivities.

Table 25: Scenario 1 - Gate fee pricing and NPC for zero and medium carbon pricing

	Break-even gate price ($ per tonne)			*NPC ($M)*		
Option	*Zero Carbon price*	*Base Case low carbon price*	*Medium Carbon price*	*Zero Carbon price*	*Base Case low carbon price*	*Medium Carbon price*
Gasification	225.8	223.0	221.5	246.4	243.3	241.7
Pyrolysis	210.3	207.7	206.3	229.5	226.6	225.1
RDF Incineration	243.0	240.5	239.2	265.2	262.5	261.0
Mass burn incineration	229.2	226.1	224.5	250.1	246.8	245.0

[10] http://www.aemo.com.au/planning/scenarios.html

Key observations

- Pyrolysis remains the lowest cost option under the Base Case, zero carbon price and medium carbon price. A medium carbon price scenario improves the results for pyrolysis, but not significantly.
- The impact of zero or medium carbon pricing on the NPC is negligible, and does not favourably or unfavourably alter the project economics.

6.8 AFFORDABILITY

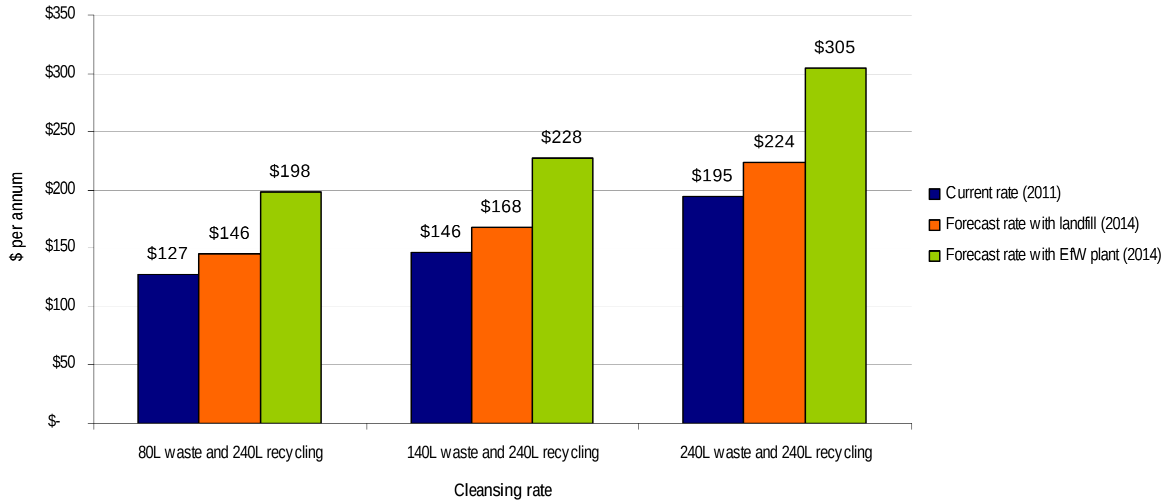
6.8.1 Pricing implications

Council's current cleansing rate is calculated using a long term waste model developed by the AECgroup. The current cleansing rate is determined using a full cost pricing approach, which calculates the revenue Council should be able to achieve based on recovering:

- return on capital – the business should be able to earn a commercial rate of return on its assets to cover financing costs and provide for a commercially acceptable profit
- return of capital – the business should be able to recoup from customers sufficiently to build reserves to cover depreciation expense
- operational expenditure, and
- taxation.

The waste disposal cost is a crucial cost component used to determine the cleansing rate. In this way, the break-even gate fee calculated in the financial analysis can be substituted with the current landfill disposal cost to compare how cleansing rates would change with the introduction of an EfW plant. Figure 13 compares domestic cleansing rates for the typical rateable property service types that rely on landfill disposal, with the forecast cleansing rate based on the use of an EfW facility. The forecast cleansing rate is based on the break-even gate fees calculated for Pyrolysis under Scenario 1 – MSW kerbside only.

Figure 13: Comparison of current and forecast cleansing rates



6.8.2 Council financial sustainability

QTC completed a Credit Review for Council in November 2010 to determine Council's financial capacity. It is recommended that any decision to approve the development and construction of a TCT plant should be based on an updated credit review to better understand if and how a TCT may financially impact Council's broader financial goals and objectives.

6.8.3 Funding considerations

Waste infrastructure development (ie, landfills, waste transfer stations) for Council has typically been funded through operating cash flows or debt funding secured from QTC, as these asset types are typically lower capital amounts and represent a low risk to Council. The development of an EfW facility incorporating pre-treatment infrastructure and a TCT plant represents a step change in technological complexity and capital expenditure requirements. Accordingly, the skills, resources and issues involved in delivering large and complex EfW facilities would be expected to exceed Council's current internal capability, particularly in light of the fact that local government has no track record in EfW within Australia. For these reasons, private financing is likely to be the most appropriate method of funding for an EfW facility.

While the optimal delivery option would require more detailed analysis, factors which would suggest that private financing of an EfW facility is likely to result in better value for money for Council, include:

1. Viability – Investment objectives and desired project outcomes can be translated into outputs that are measurable, "contractable" and can be agreed. A private supplier will be responsible (including financially) for solution delivery, meeting changing regulatory targets and achieving diversion targets.

2. Risk transfer outweighs higher cost of capital – Private financing has the potential to bring sufficient benefits to outweigh the higher cost of capital through:

- contracting through a Design Construct Operation and Maintain (DCOM) contract which ensures that design, construction and operational risks and benefits are linked and allocated to the contractor
- certainty of service delivery throughout the contract term, and
- risk transfer of future performance and costs which could be subject to fluctuation.

The need to limit the financial impact on the operating budget and the rates payable by ratepayers will be critical to Council's investment decision. Council may achieve this through providing a capital contribution up-front, the effect being to reduce the gate fee from the level at which it would otherwise be set. The options available to Council include:

- a council contribution from operating cash flows or borrowings
- a funding contribution from Energex, and/or
- a "waste levy" fund contribution from DERM.

Energex

Energex has indicated that demand for electricity on the Sunshine Coast is rising at an unprecedented rate, with population increases well above national trends. The increasing population, coupled with rising average household energy consumption is putting pressure on the existing power supply within the region. The planned development of Caloundra South by the Urban Land Development Authority has the potential to deliver an additional 50,000 people to the region over the next 25 years, creating additional demand for electricity and associated generation and transmission capacity.

The development of an EfW facility capable of supplying electricity to the local network represents an embedded generation solution. Commercially viable embedded generation has the potential to defer capital expenditure on bulk generation capacity and network augmentation. Energex has indicated that commercially viable embedded generation projects may attract a funding contribution of $0.1 to $0.25 million per MWh. For the TCT options under Scenario 1 – MSW kerbside, this represents a one-off potential capital funding contribution ranging from $5 to $12.5 million.

Whether an EfW facility is capable of delivering reliable and consistent electricity generation and supply is critical. Energex, the electricity retailer within the Sunshine Coast region, operates under the *Electricity Act 1994* and the National Electricity Rules and relies upon generators to provide supply on demand in accordance with the contractual conditions contained within its network agreements. An EfW facility would need to demonstrate reliability and continuity of supply and an ability to meet the contractual conditions to justify a funding contribution from Energex.

DERM

The planned introduction of a waste levy in December 2011 as part of the *Queensland's Waste Reduction and Recycling Strategy 2010-2020* will generate funds to be directed for improvement in waste management infrastructure within Queensland. The *Waste Reduction and Recycling Strategy 2010-2020* indicates that funds will be distributed as follows over the first four years:

- $159 million towards targeted programs to help business and industry reduce the amount of waste they generate, and to encourage industry investment in recycling technologies, particularly in regional areas, and
- $120 million for local governments to spend on environmental projects, focusing on better waste management facilities and practices.

Council would need to apply for funding and demonstrate how an EfW contributes towards the achievement of targets and actions contained within the *Waste Reduction and Recycling Strategy 2010-2020.*

7| RISK ANALYSIS AND MANAGEMENT

A project risk review of the TCT options has not been completed as part of this feasibility review.

However, to assist Council's consideration, QTC has identified some risks that would require consideration when evaluating project delivery.

Risk type	*Description*	*Risk Mitigation*
Design risk	The risk that the design of the TCT is such that, even if it is constructed satisfactorily, it will not meet the requirements of the contract	Procurement evaluation process Selection of commercially proven technology for comparable waste volumes
Construction risk	Construction risk encompasses the issues that may be encountered during the construction of the project, such as budget overruns, material defects, project delays, technical deficiencies, latent defects, workplace health and safety and catastrophic events	Performance incentives and liquidated damages for time and cost efficiency/overrun
Planning risk	The risk that the planned use of the site is not approved by regulators (ie, DERM)	Site is zoned appropriately for TCT use Early engagement of DERM to secure operating (ERA) licence
Demand risk	The risk that the demand (output) for the infrastructure will be less than predicted or expected and that supply cannot be delivered consistently to service demand	Operational risk management Contract management Auxiliary supply contracts
Operational risk	This risk encompasses a broad range of risk once the TCT is operational, including labour cost increases, input material shortages, costs relating to deferring maintenance and	Risk transfer through payment mechanism linked to output specification

Risk type	*Description*	*Risk Mitigation*
	obsolescence	
Financial risk	Risk that proponent cannot source sufficient debt/equity to fund project development Risk that contractor does not generate sufficient revenue to fund project debt	Public/private funding Due diligence as part of contractor selection

8 | PROCUREMENT STRATEGY

The procurement of TCT infrastructure provides Council with a unique and complex procurement opportunity. The procurement challenges facing Council include:

- balancing Council's waste management vision with securing an efficient and viable waste management solution using a value for money framework
- attracting the best technical solution and competitive market response for a "first in class" technology within Australia
- delivering a reliable solution that can support the waste disposal requirements for Council over the next 25 years, and
- fitting the waste solution into the existing waste supply chain network managed by Council, and maximising local economic expansion.

8.1 PROJECT SCOPE

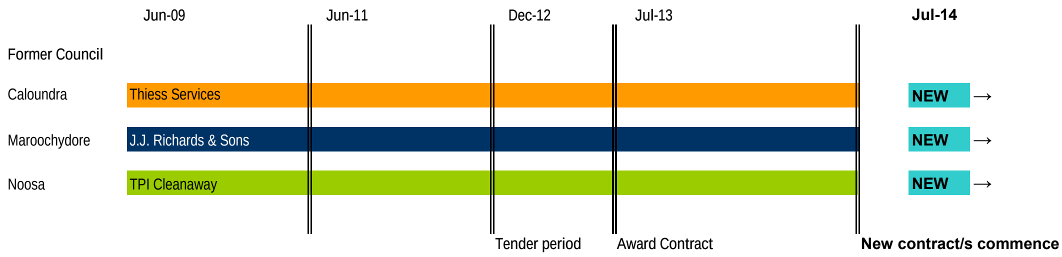
The key issues relating to the scope of the procurement program are provided in more detail below and include:

- waste collection
- recyclables processing capacity
- transfer stations, and
- TCT infrastructure.

8.1.1 Waste collection

QTC understands Council operates a contractual model for kerbside waste and recyclables collection and currently administers three different contracts performed by three contractors, as indicated by the contract expiry timeframes indicated in Table 26.

Table 26: Waste collection contract end dates



Council intends to commence a new waste collection and processing contract in July 2014. Consideration and finalisation of the waste disposal solution is critical to ensure that Council achieves the most competitive outcome from the procurement process. It is likely that if Council proceeds with a TCT, it will be delivered within the contract period of the new collection contract. It is essential that Council considers the commercial implications of changing the waste disposal facility within the collection contract term, and minimises the potential financial risks to Council in this circumstance.

8.1.2 Recyclables processing capacity

Council currently delivers kerbside recyclables to two Material Recovery Facilities (MRFs). The Nambour MRF receives material from the former Noosa and Maroochydore Shires, and the Petrie MRF receives material from the former Caloundra Shire.

Consideration of processing capacity and location for kerbside recyclables collected as part of the new collection contract has not yet been determined. There are two privately operated MRFs in the greater Brisbane area that could provide future high-quality MRF capacity, however it is not clear if these facilities have sufficient capacity to receive Council's kerbside recyclables.

The scenarios developed for TCT options included varying levels of pre-sorting, involving either a Dirty MRF or Wet MRF. From a procurement perspective, the following issues need to be considered:

- Pre-treatment infrastructure is likely to function most effectively if co-located on the same site as the TCT.
- To manage the construction and site management interface risk, the design, construction and operation of the pre-treatment and TCT facility are best managed by one entity.
- The most appropriate entity to operate a TCT plant may not have core expertise in pre-treatment and/or commodity sales, and marketing and sub-contracting arrangements and/or Joint Ventures may be structured in response to the procurement process.

8.1.3 Transfer station and logistics

The planned site for a TCT plant is located adjacent to the existing Pierce Avenue Landfill at Caloundra South. The site is strategically located near the Caloundra South Urban Development Area (UDA) a residential development with a projected future population of approximately 50,000 people. Current indications are that the Caloundra area will continue to be the highest growth area within the Sunshine Coast region and therefore generate the highest growth in waste volumes.

The geographical nature of the Sunshine Coast region, with distinct population centres in the Noosa and Nambour areas, results in significant waste volumes arising from these areas. Council would need to determine the most logistically efficient approach to transporting MSW kerbside from these areas to the TCT plant, and factor any cost differentials that could arise into the overall cost calculations. It is likely that direct transfer of waste from these areas to the TCT using kerbside collection trucks would not present the most economical solution.

An alternative may be to bulk-haul waste from the Noosa and Nambour areas to a centrally located TCT plant. Existing transfer stations would need to be upgraded to facilitate the use of bulk waste haulage containers that maximise logistics efficiency (ie, 90m^3 walking floor).

There would need to be careful consideration of the scheduling of waste transport to the TCT plant to ensure continuity of fuel supply, especially during non-scheduled and scheduled maintenance periods. For these reasons, it may be appropriate for a TCT plant operator to be responsible for the operation of bulk waste haulage operations.

8.1.4 TCT infrastructure

The development of an EfW facility represents the implementation of a new approach to waste management within Australia. While there are examples of thermal conversion approaches being used for the disposal of clinical and hazardous wastes in Queensland and Australia, there are no existing EfW plants established for MSW, C&I and C&D waste streams within Australia. The development would represent a shift from the traditional disposal approach towards a more complex technical approach consistent with the power generation industry.

Procurement of an EfW facility would likely be most successful if the procurement strategy encourages domestic and international market participants. While there is limited domestic expertise with EfW, several of the larger domestic waste companies have parent companies located in Europe, with long experience in the design, construction and operation of EfW plants.

The evaluation of a suitable technology type for an EfW facility would need detailed assessment criteria in the performance evaluation, and ensure that Council procures a plant capable of meeting its strategic, environmental, regulatory and financial objectives. Table 27 summarises potential evaluation criteria that could be developed as part of the procurement assessment.

Table 27: Possible technology options appraisal criteria

Objective		*Assessment criteria*
Sustainability	1	Minimise human health impact
	2	Minimise impact on climate change
	3	Minimise air quality impact (includes treatment facility and transport)
	4	Minimise resource depletion
Nuisance	5	Minimise local transport impact
	6	Minimise risk of noise and odour
Cost	7	Minimise cost of total waste management
Deliverability/risk	8	Deliverability with respect to planning
	9	Risk of future markets for outputs
	10	Bankability
Proven technology	11	Status of technology (how proven is solution)
	12	Reliability of technology; flexibility and adaptability to changes in composition and volume
Performance	13	Landfill diversion

8.2 POTENTIAL PROCUREMENT MODELS

The range of procurement approaches available to Council will be influenced by the following considerations:

- What is the local and international market capacity to design, construct and operate a TCT?
- What is the risk appetite for localised renewable energy generation plants?
- What do potential bidders perceive as the key challenges?
- What issues does Council need to address to attract interest from the market and provide confidence in the procurement process?
- What is the scale and scope of the final procurement offering?

The range of procurement models typically applied to infrastructure type projects include:

- construction only (Council manages design)
- design and construction (D&C)
- design, construct, operate and maintain (DCOM) (with or without private finance)
- early contractor involvement (ECI), and
- alliancing.

Given that the project would involve significant costs and risks in both D&C and O&M phases, a DCOM arrangement is likely to provide the best whole-of-life outcomes for Council. The asset life of a TCT plant is such that the operations and maintenance (O&M) component of the contract should be up to 25 years to deliver value for money for Council, and provide appropriate incentives for the project company to optimise the integrity and operational efficiency of the plants.

8.2.1 DCOM

By outsourcing and integrating the design, construct, operate and maintain elements of the project, Council is likely to achieve significant benefits. These benefits are listed below and explained in the following sections.

1. By integrating D&C with O&M through a single provider from the project's commencement, an optimal balance of cost drivers can be achieved to minimise the whole-of-life project costs.
2. The risk to Council of being unable to attract, train, retain and support highly skilled operators for the new TCT plant will be greatly reduced.
3. Council will be assured that its assets will be maintained to contracted standards through robust asset management plans, policies and systems.
4. The political and legal risks to Council of operating a TCT plant can be substantially transferred to the private sector.
5. Given the uniqueness of the asset and operational skill requirements, it is likely that outsourcing of O&M will result in cost efficiencies for Council over the project life.
6. Integration of operation and maintenance with design and construct would minimise interface risks and project cost over the long term.

8.2.2 Output specification

There are two broad approaches that Council could take in identifying its preferred solutions. First, it could invite the market to tender for the provision of a tightly prescribed set of technologies and processes. While this approach would provide certainty to tenderers, it would leave Council with significant design risk and limit the level of innovation that could be proposed.

The alternative is for Council to develop an output specification that would enable tenderers to consider the best technology available to meet the specification. This approach does not exclude the proponent from developing an innovative design approach, providing that the overall design intent in maintained.

An indicative output specification is detailed below in Table 28

Table 27: Output specification

	Contract assumptions	*Performance parameters*
1.1	Contract structure	Procured on the basis of a defined output specification and risk transfer on the technology provided and the design, construction and operation of the facility Payment on the basis of a monthly payment linked to the volume received and/or processed
1.2	Contract scope	Treatment of a minimum of 80,000T/annum of waste Key service outputs include: ▪ Waste receipt and treatment ▪ Residual waste disposal
1.3	Contract term	Up to 25 years
1.4	Asset transfer	Ownership of the asset transferred to Council on completion of the contract
1.5	Addresses medium and long term diversion targets	Facility modularised to enable additional capacity to be created to achieve medium to long term landfill diversion targets
1.6	Secure market for outputs	Risk transfer to operator to establish and maintain markets for the sale or disposal of outputs (i.e. electricity, heat, residual waste, biochar)
1.7	Flexibility to adapt to changes in waste volumes, composition, collection arrangements, regulation	Contractor is responsible for cost-effective utilisation of spare capacity in plant Process is flexible and robust to ensure compliance with changing environmental regulations

9| DELIVERY

9.1 TIMING

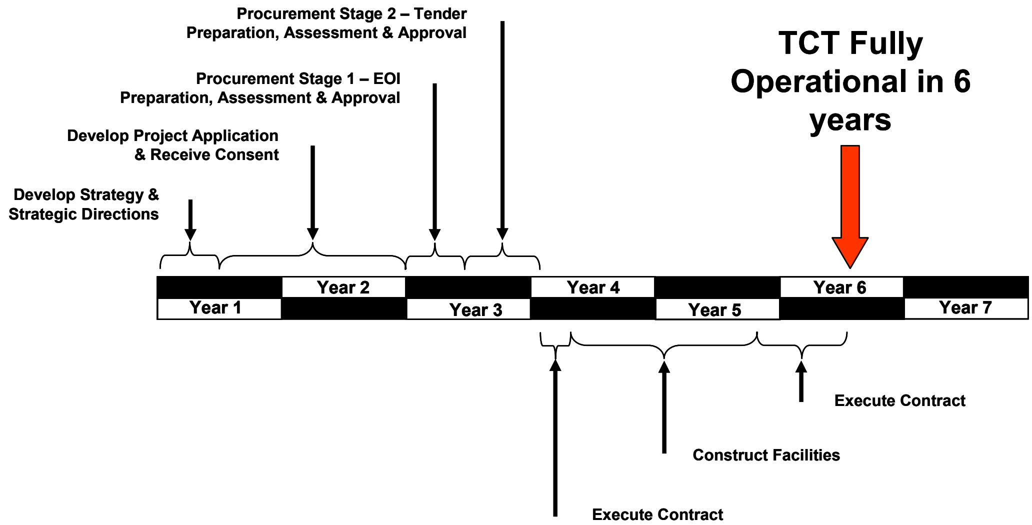
The key timing constraints related to an EfW facility are:

- Council collection tender – the contract award will need to be finalised by July 2013 and a decision on waste disposal is critical to achieving value for money in the collection tender, and
- Landfill capacity constraints – Council has a combined landfill capacity of 7-10 years.

These factors will need to be considered in the planning and procurement phase for a TCT plant. Industry experience with the delivery of Alternative Waste Technology (AWT) in New South Wales (NSW) indicates that this type of infrastructure has prolonged delivery timeframes.

Figure 14 provides an indicative timeframe for the delivery of a TCT plant.

Figure 14: Procurement delivery timeframe for a TCT facility



The timeframe is conditional upon Council committing to the following objectives:

- endorsing the development of a business case to proceed with the project, including future funding commitment, and
- development of sufficient internal and external resources for the project.

Significant timetabling risks for this project include:

- need for completion of more detailed feasibility reviews detailing the business case, project risks, funding avenues and procurement plan
- local government elections in 2012
- regulatory review and approval timeframes
- timeframe required for an effective competitive procurement process
- community consultation
- execution of contract, and
- construction delays and proving period.

9.2 REGULATORY AND ENVIRONMENTAL CONSIDERATIONS

9.2.1 Zoning

The proposed site is zoned "Industrial" under the Council Planning Scheme. Any development of an EfW would trigger an Impact Assessable application. This would require Council (as applicant) to make an application for a development permit, that would be assessed against the whole of the planning scheme, including all applicable codes, and the Desired Environmental Outcomes.

9.2.2 Environmentally relevant activity

Historically, there has been a high level of community concern of thermal treatment facilities in all jurisdictions within Australia. Together with DERM's limited experience with the approval of EfW facilities, lack of clear policy direction by DERM, and first-mover status of an EfW facility in Queensland, this is likely to result in a rigorous and lengthy approvals process and significant conditioning of the formal operating licence.

Development of an EfW facility will require approval of an Environmentally Relevant Activity (ERA) by DERM. An EfW facility may be approved and operated under the following ERAs:

- ERA 61 – waste incineration and thermal treatment, and/or
- ERA 14 (2) (a) – electricity generation by using fuel, other than gas, at a rated capacity of 10MW to 150MW.

These ERAs are defined under Schedule 2 of the *Environmental Protection Regulation 2008* and may only be conducted under the terms of a development approval and registration certificate.

9.2.3 Air quality

Management of air pollutants and residues would be a critical component of further technical review of an EfW facility. The community sensitivity to these aspects of EfW facilities is likely to trigger a high level of regulatory oversight and stringent licensing of an EfW facility.

There are no established emission standards governing EfW facilities in Queensland. The regulatory review completed by URS indicated that air quality standards which need to be established for an industrial facility would be based on emission standards set in the *Environmental Protection (Air) Policy 2008 (EPP Air)* and the *South East Queensland Regional Air Quality Strategy (SEQRAQ).*

The URS report provides a summary of existing air emission standards and a comparison to the EU Waste Incineration Directive (2006/76/EC), Commonwealth and other State jurisdictions.

9.3 COMMUNITY AND STAKEHOLDER SUPPORT

The current community perception of an EfW facility may be coloured by the history of waste incineration. Waste incineration has previously been viewed as an unacceptable method of treating waste, due to a perceived or actual lack of control of the emission and ash quality and the impacts of operations on the community. Development of an EfW facility would need to demonstrate a high level of engineering and technological control, and minimal environmental impact, to deliver a high level of public confidence.

The high profile of an EfW facility and its potential financial burden on ratepayers make it important to develop an integrated and targeted communications framework to foster broad–based community acceptance. Communication should include:

- regulators (local, state, federal)
- neighbouring residents, businesses and sensitive land uses such as schools, community centres and aged care facilities, and
- environmental Non Governmental Organisations (NGOs) (local, state, national).

Any communication strategy would need to ensure that the community is aware of:

- issues and context
- project specific details
- expected outcomes, impacts and benefits, and
- the process for project assessment and determination.

10 | RECOMMENDATIONS

The feasibility analysis concludes with the following recommendations:

- An EfW facility for the Sunshine Coast region would represent a high-cost waste management option, with high technology risks, complex procurement and significant regulatory and community perception risks. Council should carefully consider these costs and risks in its evaluation of any future plans.
- Council should defer further scoping work on an EfW facility until it has completed the comparative assessments below:
  - Compare the NPV of the preferred TCT option (Pyrolysis – Scenario 1 MSW kerbside) with alternative options that may achieve Council's landfill diversion targets. This includes establishment of a third bin and organics processing facility.
  - Compare the NPV of the preferred TCT option (Pyrolysis – Scenario 1 MSW kerbside) to the Base Case disposal option of greenfield landfill development and/or bulk transport to SEQ landfill.

- Review Alternative Waste Technology (AWT) that may be retrofitted to existing transfer stations for a relatively lower capital and operating cost and go some way to achieving waste diversion targets. Examples of this include the Anaeco technology currently used in Western Australia.

APPENDIX C – COMMUNITY ENGAGEMENT REPORT

Sunshine Coast Regional Council

Alternative Waste Technology and Waste Collection

Community Engagement Report
December 2011

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Date:	December 2011
Document Name:	SCC AWT Report
Version:	Final Draft

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Executive Summary

In November 2011, Engagement Plus, on behalf of Sunshine Coast Council, undertook engagement activities aimed at exploring the community's attitudes and values towards alternative waste technologies (AWT) and waste management.

A number of policy changes at the federal, state and local levels as well as Council's commitment to minimising waste and landfill have been the impetus for this project.

The objectives of the engagement were to generate conversation on:
- Attitudes, understanding and values towards waste management issues including reduction in landfill
- Attitudes, understanding and views towards alternative waste approaches
- Attitudes towards the proposed Sustainability Park and its perceived impacts
- Views and opinions on the two and three bin systems
- Understanding of price point tolerances

In order to achieve these objectives, two community engagement processes were designed. The first of which was 'Garbo Dialogues', a deliberative dialogue process that is a:

> *systematic dialogic process that brings people together as a group to make choices about difficult, complex public issues where there is a lot of uncertainty about solutions and a high likelihood of people polarising on the issue*

The Garbo Dialogues were held with a group of the same 30 people representative of a mix of socio-demographic characteristics across three weeks.

In addition to the Garbo Dialogues, an online forum 'Managing Future Waste' was run in parallel where the wider community had the opportunity to participate in short polls, a survey and online discussions.

Findings from the engagement activity presented in the report are themed under the following headings, which pertain to the engagement objectives:
- Waste Management Issues & Challenges
- Bin System Household Consideration
- Bin System Preference
- Bin System Preference and Price Tolerance
- Energy from Waste
- Waste Management Facility and AWT Perceived Impacts
- Sustainability Park
- Other Waste Management Considerations

The considerations which are presented in the report and collated below respond to the issues and challenges identified by the participants.

Considerations

- A large proportion of the community has limited knowledge or exposure to alternative waste technologies. When planning waste management systems for the future, clear communication of what AWT is, its role and how it works will be required and/or educative programs.

- Of those that participated in the online survey and those that participated in the Garbo Dialogues, reducing waste, recycling and reducing landfill all ranked above high in importance and commitment. This indicates that waste and landfill reduction is a community concern and the community is generally supportive of Council's aim to minimize waste and landfill.

- There are a number of people who already make use of their organic waste, particularly through composting, who may object to additional cost for a service they may not fully utilise.

- In order for the community to gain a sound understanding of AWT and different bin systems, there needs to be a period of explanation and discussion. Garbo Dialogues participants welcomed the opportunity to be involved in weighing up the advantages and disadvantages of the different options.

- There is a belief in some sections of the community that AWT will be a revenue generator for Council. This point would need to be clearly addressed in future engagement and communication.

- Changes in bin systems are likely to impact household behavior which will require promotion and education.

- A 3 bin garden only system is unlikely to be of use to unit dwellers which may have implications for pricing.

- Different household types are likely to prefer different systems, for some households, cost will be a major consideration.

- Willingness for community members to consider a third bin rates between 'probably not' to 'would strongly consider it' which does not indicate strong initial support for a three bin system.

- Although the Garbo Dialogues participants were demographically representative they are a small group. Their preferences indicate that cost is a consideration when choosing a preferred bin system, with the more expensive 2 bin system less popular when considering cost. Overall preferences are divided across the three options.

- The online forum discussions indicated price is a major consideration in any bin system changes. Many participants in this group suggested alternative ways forward to avoid cost increases.

- The concerns around waste management sites identified by participants are expected and the mitigation strategies innovative. Education and communication were common themes in this exercise and throughout the process.

- On the whole, Garbo Dialogues participants who were presented with information and given the opportunity to ask questions could understand why Sustainability Park has been chosen as the proposed site for an AWT facility. Participants were less sure the wider community would be supportive, presumably because they may not have the same opportunity for explanation and questions. Particular care will need to be given when engaging with residents in neighbouring areas.

1. Introduction

In November, 2011, Sunshine Coast Council engaged Engagement Plus to undertake community engagement activities with the aim of exploring the community's values towards alternative waste technologies (AWT) and waste collection.

1.1 Project Background

There are a number of factors that are likely to result in a change of how waste will be managed on the coast with implications for households. These are:

- Council's Waste Minimisation Strategy, which sets a target of 70% diversion from landfill by 2014
- State Government's Waste Minimisation Strategy, which sets a target of 50% diversion from landfill by 2020
- The need for Council to plan for new waste management facilities
- Preparation for the tender for Council's new waste management contract due in 2014
- Increase in landfill costs as a result of state government levies and the carbon tax

As a result of all these factors, engagement with the community is necessary to provide feedback and input into acceptable solutions to assist decision makers.

1.2 Engagement Objectives

The engagement objectives for this project were to generate conversation on:

- Attitudes, understanding and values towards waste management issues including reduction in landfill
- Attitudes, understanding and views towards alternative waste approaches
- Attitudes towards the proposed Sustainability Park and its perceived impacts
- Views and opinions on the two and three bin systems
- Understanding of price point tolerances

1.3 Report Structure

The report is structured as follows:

Section 2 outlines the methodology undertaken for the two main engagement processes .

Section 3 presents the demographic profiles of participants from the two processes as well as the findings from the actual engagement processes.

Section 4 presents the data collected in both processes.

Section 5 summarises the findings and considerations of the engagement.

The appendix contains the materials used during the activities.

2. Methodology

This section presents the engagement activities and their methodology.

2.1 Garbo Dialogues

In order to address the various engagement objectives, it was decided that a deliberative dialogue approach would be the most effective community engagement approach. The International Association for Public Participation defines deliberative dialogue as:

> *a systematic dialogic process that brings people together as a group to make choices about difficult, complex public issues where there is a lot of uncertainty about solutions and a high likelihood of people polarising on the issue. The goal of deliberation is to find where there is common ground.*

When this technique is used successfully, participants openly share different perspectives and end up with a broader view on an issue. An additional benefit of this approach is that people not only give input but they undertake a learning process, therefore making informed choices.

The Garbo Dialogues were held in three two-hour sessions over three consecutive weeks on 3, 9 and 17 November 2011. A group of 30 people were recruited to participate in all three sessions. The recruitment processes ensured that those participants were representative of the wider community, comprising a mix of ages, suburbs, sexes and household types. They were recruited through a market research firm and reimbursed for their participation to ensure their attendance. At the time of recruitment participants were unaware of the project topic.

An outline of the sessions and their activities is below.

Session 1

- Survey of waste management behavior and knowledge
- Presentation of waste management context including local, state and federal opportunities and challenges
- Interactive session discussing waste management challenges and opportunities as they relate to households
- Brainstorming session identifying concern factors of waste management facilities and possible mitigation strategies
- Presentation of the Triple Bottom Line as a framework to use in discussions when weighing up options of AWT and bin systems
- Individual reflection

Session 2

- AWT101 Question & Answer session with explanation of what can happen to waste and what AWT facilities exist
- Video of AWT 3 bin system
- Workshop of the Triple Bottom Line impacts of the different AWT and bin options
- Individual reflection

Session 3

- Clarification and summary of the different AWT and bin options
- Household scenario activity where participants were invited to consider the implications of waste from different household perspectives
- Consideration of acceptable cost increases for households, participants and the wider community
- 'The Pitch' where participants were invited to sell one of the options
- Question & Answer session on Sustainability Park with feedback collected
- Repeat of survey of waste management behavior and knowledge to benchmark changes
- Evaluation

Attendance remained high throughout and the evaluations of the content and process were positive, with many participants reporting increased knowledge, commitment and changes in behavior relating to waste management. Evaluation results can be found in Section 3.

2.2 Online Forum

In order to provide an opportunity for the wider community to give input into future waste solutions, an online website was established. The website, which utilised Bang the Table technology, had the following features:

- Online Forum Questions and Discussions which paralleled the Garbo Dialogues content
- Survey, also given to Garbo Dialogue participants
- A quick poll
- Links to related websites, documents and videos

The site was promoted from Council's homepage, facebook page, local radio and newspapers. A copy of the website content can be found in the appendix.

3. Participant Demographics & Engagement Process Findings

This section outlines the participant demographics, Garbo Dialogues process findings and the evaluation of Garbo Dialogues. Section 4 presents the findings as they relate to the project objectives.

3.1 Participant Profiles

A group of 30 people were recruited to attend all three weeks. The group was representative of different ages, locations, household types and dwelling types. A total of 24 attended the first week, 27 the second week and 26 the third and final week.

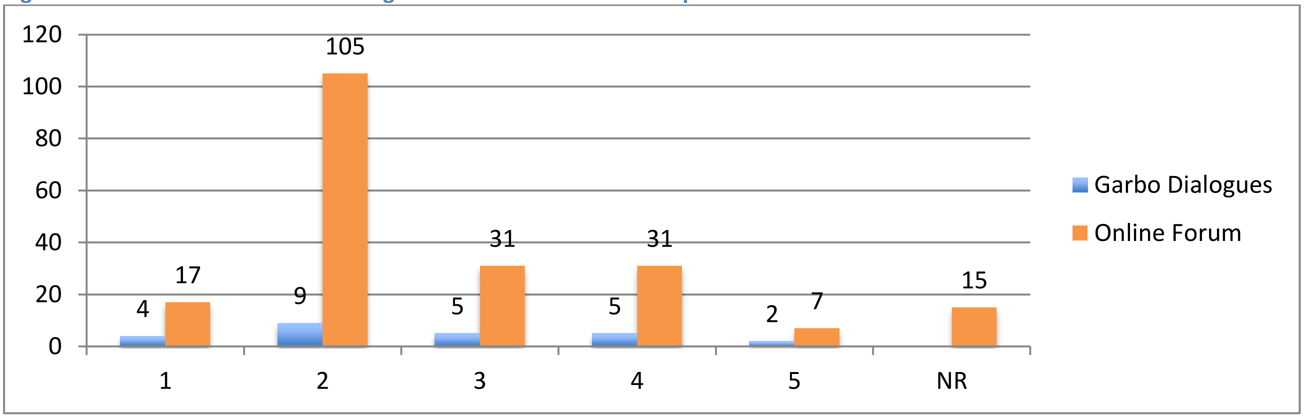
The Future of Waste Management Forum recorded the following statistics:

- 1,321 visitors
- 2,062 visits
- 159 forum comments
- 206 survey responses
- 308 users registered

A full copy of the Future of Waste Management activity report is available in the appendix.

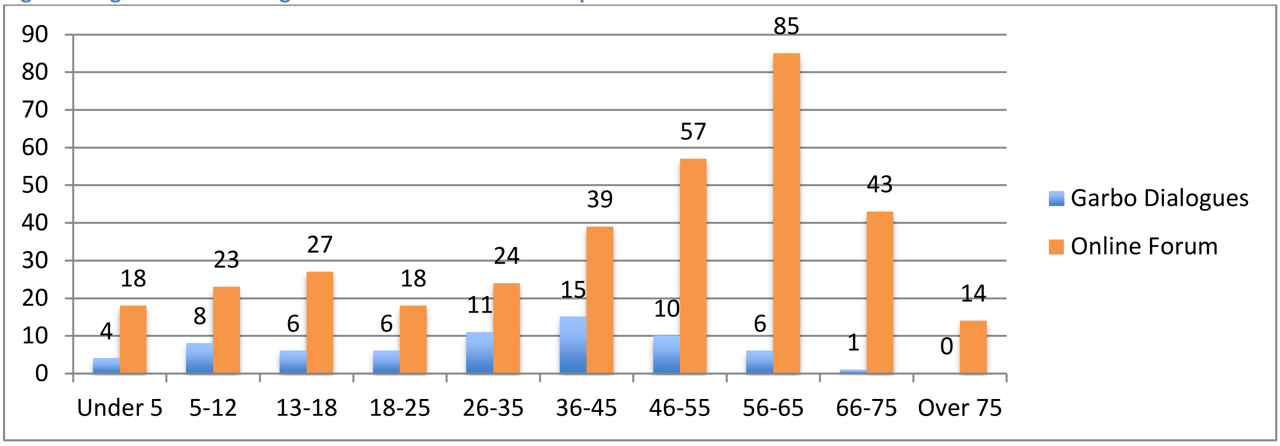
The following table shows the household size of dialogue and online forum participants. Two person households were the highest proportion in both activities, totaling 36% of dialogue participants and 51% of online forum participants. In the 2006 census, 40.1% of households were recorded as having two persons usually resident.

Figure 1: Household Size - Garbo Dialogues and Online Forum Participants



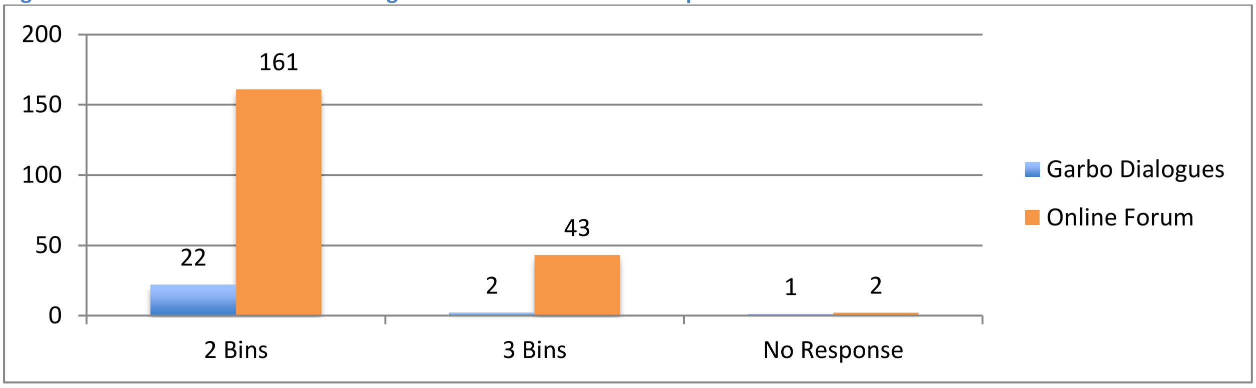
The figure below shows the ages of the household members of the participants. Overall the Garbo Dialogues participants were younger compared to online forum participants which spanned all ages but were dominated by those between 46 and 75 years.

Figure 2: Ages - Garbo Dialogues and Online Forum Participants



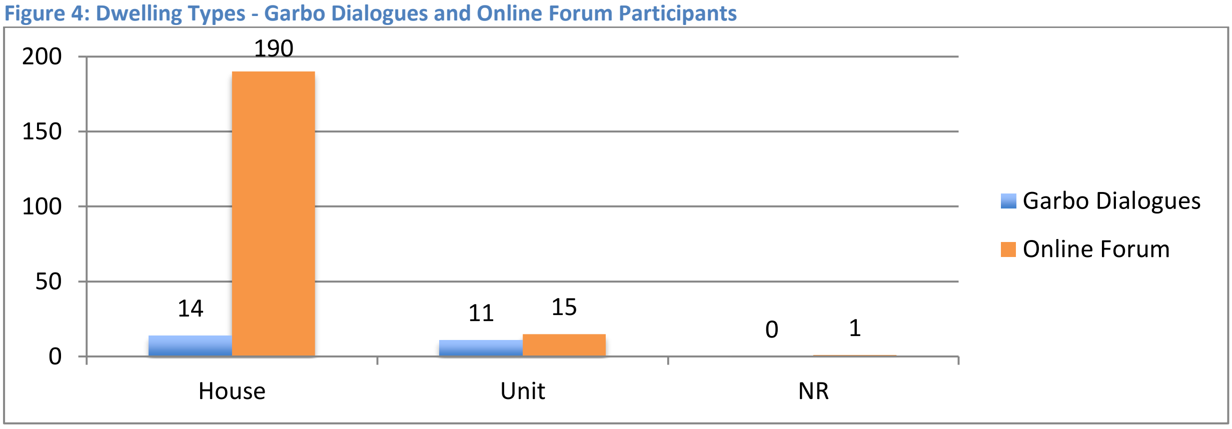
Participants in both activities were asked if they had already opted to have a green bin from Council and take up rates amongst Garbo Dialogue participants were lower compared to online forum participants, of which 20 per cent declared they already had a third green bin.

Figure 3: Number of Bins - Garbo Dialogues and Online Forum Participants



When asked what type of dwelling they currently resided in, 66% of Garbo Dialogue participants reported they lived in houses whereas 44% reported they lived in units. This is similar to the 2006 Census which revealed 61.6% of Sunshine Coast residents lived in houses and 22.1% lived in medium and high density housing. Online forum participants were more likely (93%) to reside in houses.

Figure 4: Dwelling Types - Garbo Dialogues and Online Forum Participants



The following two figures give an indication to the amount of general and recyclable waste produced by participants. As the comments show later, a number of residents called for higher frequency of collection for their recycle bin, which is indicated in Figure 6.

Figure 5: General Waste Bin - Garbo Dialogues and Online Forum Participants

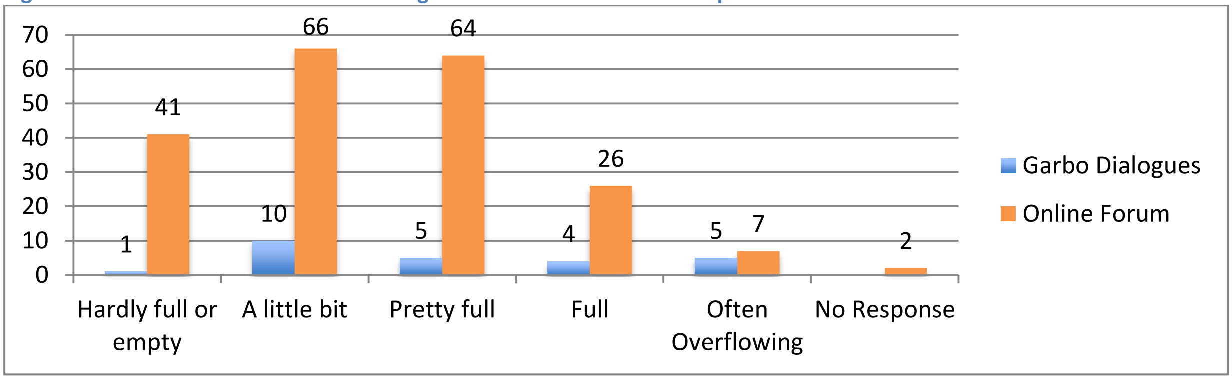
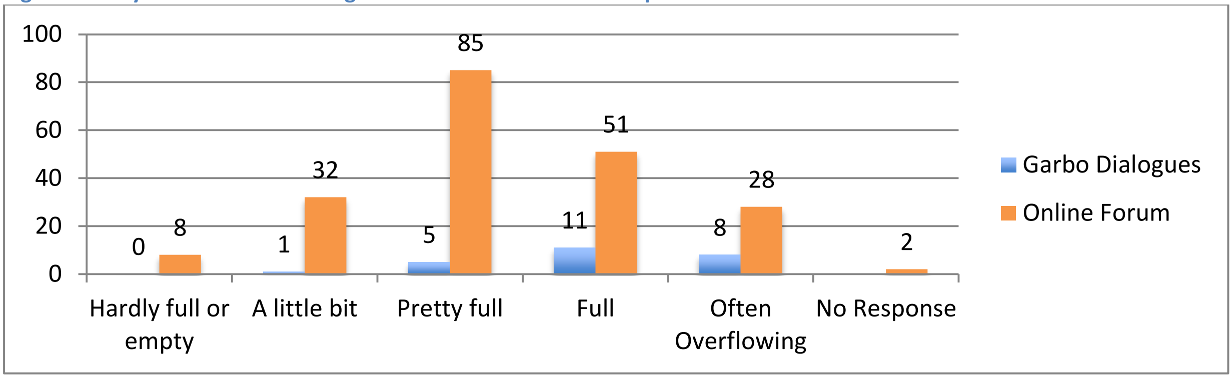


Figure 6: Recycle Bin - Garbo Dialogues and Online Forum Participants



3.2 Difference between the two groups

It is important to note at this stage that the data collected in the two different activities is indicative of the people who participated. It can be argued that the Garbo Dialogues participants are more representative of the general community given the recruitment method whereas those who registered to participate in the online forum are already motivated about waste management issues which is evident from their willingness to give input without incentives.

3.3 Dialogue Process & Reflections

This section provides reflection on the dialogue process. As previously mentioned, deliberative dialogue is an innovative community engagement method and as such, the process was integral to the outcomes.

Individual reflections were a regular feature of the Garbo Dialogue sessions with participants asked to jot down reflections at the beginning of sessions thinking back to thoughts, questions, actions or feelings and also being asked to respond to a set of questions on conclusion of each session. These reflections had a couple of purposes. Firstly, they allowed the facilitators to be responsive to questions and areas needing clarifications. Secondly, they supported the participants to gain more in-depth knowledge and learning.

Take home sheets with reflection questions and links to websites for more information were also distributed on conclusion of each session for those wanting more knowledge.

Below are reflections of people's experiences and how they relate to the process and the content.

Reflections on Session 1

Information that people intended to share	• General information about the project and approach (11 comments) • The need to sort rubbish and recycle including practical ideas (7 comments) • Information about waste minimisation, targets and landfill (6 comments)
Feelings during the session	• Comfortable/Happy (5 comments) • Excited/Enthusiastic/Interested (3 comment) • Keen to know more/motivated (2 comment) • Doubtful → Hopeful (1 comment) • Pleased to be contributing/ Cooperative (1 comment) • Suspicious (1 comment)
Questions that the content or processes has raised?	• Sorting rubbish better/ Composting/ Recycling (12 comment) • Other initiatives underway to meet target (2 comments) • Why Council is making using tip more expensive (2 comments) • Impacts on multi-unit dwellings (1 comment) • Wanting to learn about worm farms (1 comment) • Wanting to know where everything winds up (1 comment) • Having to consider profits as well as people and planet (1 comments) • How to change the behavior in the wider community (1 comment)
Possible changes in behavior after participation in the session	• 3rd bin in kitchen/compost bin/ better at sorting (13 comments) • Consider packaging and plastic bags (4 comments) • Talking to other people about the need to reduce waste (2 comments) • Talk to politicians (1 comment)

Reflecting on Session 1 at the beginning of Session 2

Participants were asked to list one thought, questions, action or feeling the session from the previous week had prompted. Responses were:

- Achievability of targets (4 comments)
- Have changed behaviors – sorting and packaging (4 comments)
- How to educate people (3 comments)
- Need for Council to provide incentives to minimize waste like compost bin from council (3 comments)
- Enormity of waste management (2 comments)
- Need to divert organic waste (2 comments)
- Council's commitment (1 comment)
- Excitement from ideas generated (1 comment)

Reflections at the end of Session 2

Information that people intended to share	• Solutions for treating waste and AWT options (19 comments) • Costs of different options (4 comments) • Christchurch video (2 comments) • Household waste management and sorting (2 comments)

Feelings during the session	• Changed opinion with more information (7 comments) • Confusion at complexity of options (6 comments) • Confusion → Clarity (3 comments) • Pleased and open to other opinions (3 comments)
Questions that the content or processes has raised?	• No one clear best option/Knowing what's best for the community (7 comments) • Cost for household (6 comments) • Household logistics (3 comments) • Educating the community and selling the new option and increased cost (3 comments) • Should the focus be in reduction first (1 comment)
Possible changes in behavior after participation in the session	• 3rd bin in kitchen/compost bin/ better at sorting (8 comments) • Consider packaging and plastic bags (6 comments) • Changed attitude towards Council (positive) (1 comment) • Talk to others about importance of reducing landfill (1 comment)

Reflecting on Session 2 at the beginning of Session 3

Once again participants were asked to list one thought, questions, action or feeling the session from the previous week had prompted. Responses were:

- Confused/Need further discussion (6 comments)
- Sorting waste/ Household behaviour (3 comments)
- Cost to ratepayers (3 comments)
- How to identify the best option and what's more important? (3 comments)
- Enjoyed the videos or websites (2 comments)
- Need for education (2 comments)
- Need to use green waste (2 comments)
- Can we have a large scale worm farm? (1 comment)
- Reducing packages and who is responsible (1 comment)
- Would like kerbside pickups reinstated (1 comment)

Reflections at end of Session 3 on whole process

Feelings during the session	Some respondents reported a variation from session to session and other comments can be summarized as: • Enjoyed the process and felt valued (9 comments) • Excitement and passion about waste management issues (4 comments) • Suspicious of Council intentions (1 comment)
Questions that the content or processes has raised?	• Importance of reducing household waste and sorting rubbish (6 comments) • Increased awareness of waste management issues (5 comments) • Importance of education around waste management (3 comments)

- Difficulty in making the right choice (2 comments)
- Costs for ratepayers (2 comments)
- Need for Council to confer with public on issues such as this (1 comment)

These reflections show the complexity of AWT and negotiating an acceptable option for the community.

3.4 Evaluation of Garbo Dialogues

Overall feedback from the sessions was very good. The figures below show the results of the evaluation participants were asked to complete at the final session. The average score relates to the number scale, therefore 3.78 below indicates between 'yes' and 'it was mostly enjoyable'.

Figure 7: I believe that the activities have been worthwhile and a good (Avg 3.78)

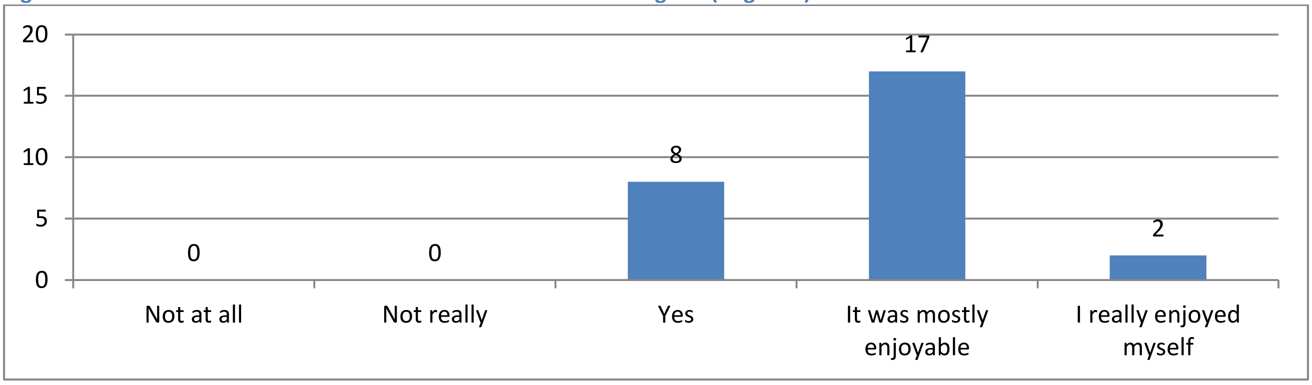


Figure 8: I felt my contributions were valued (Avg 4.04)

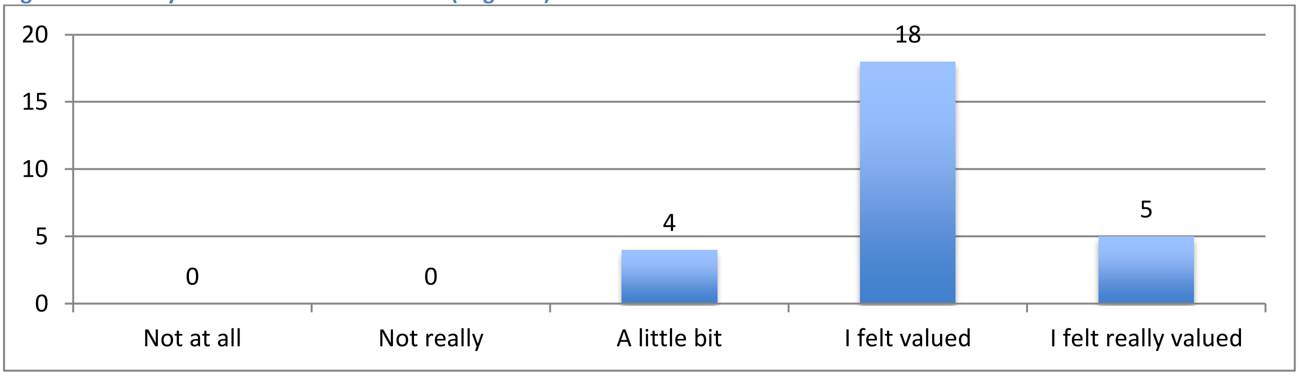


Figure 9: I believe I have a better understanding of the issues and

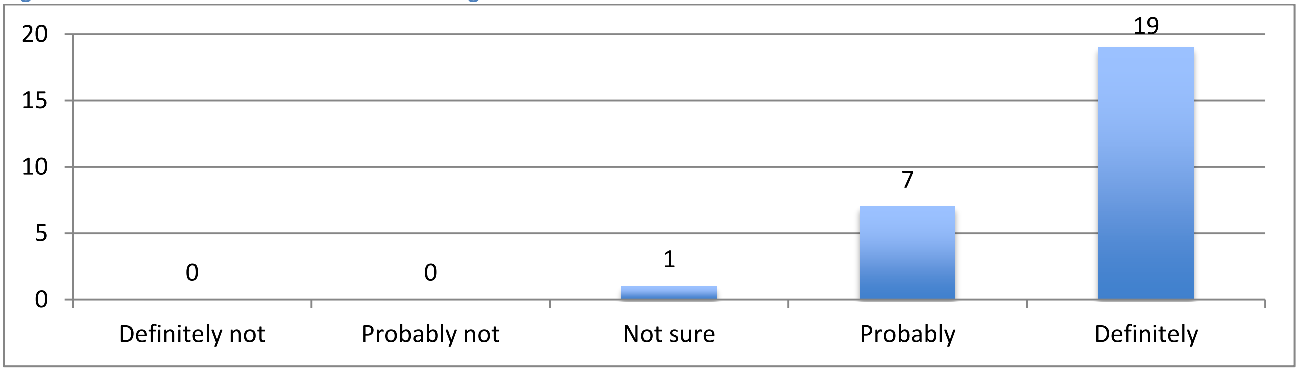


Figure 10: The format of the time allocations allowed me to contribute effectively (Avg 4.41)

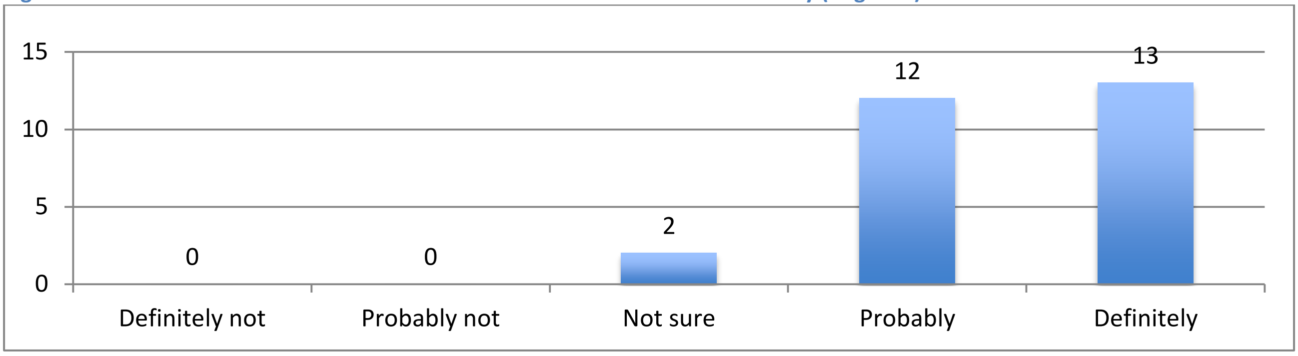


Figure 11: The venue and catering were satisfactory (Avg 4.26)

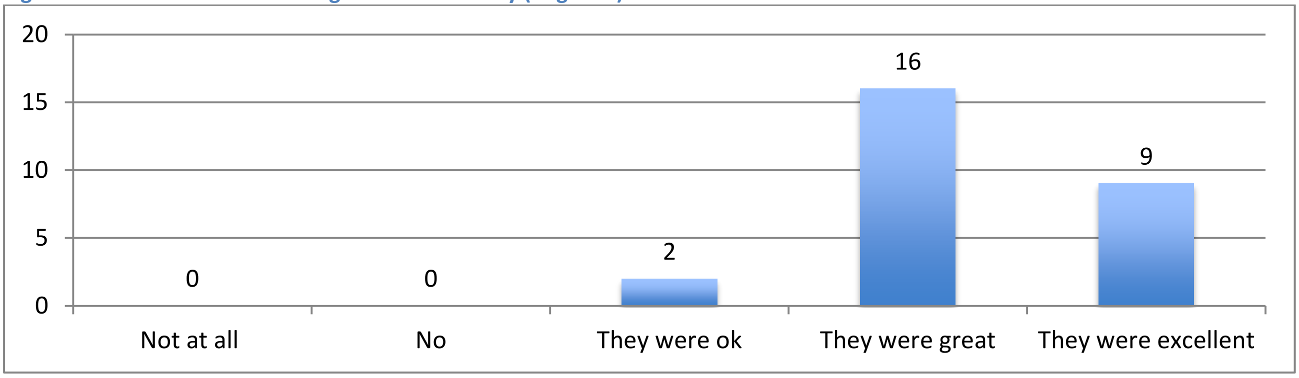


Figure 12: The facilitators, Michelle and Helen, were skilled and helpful (Avg 4.44)

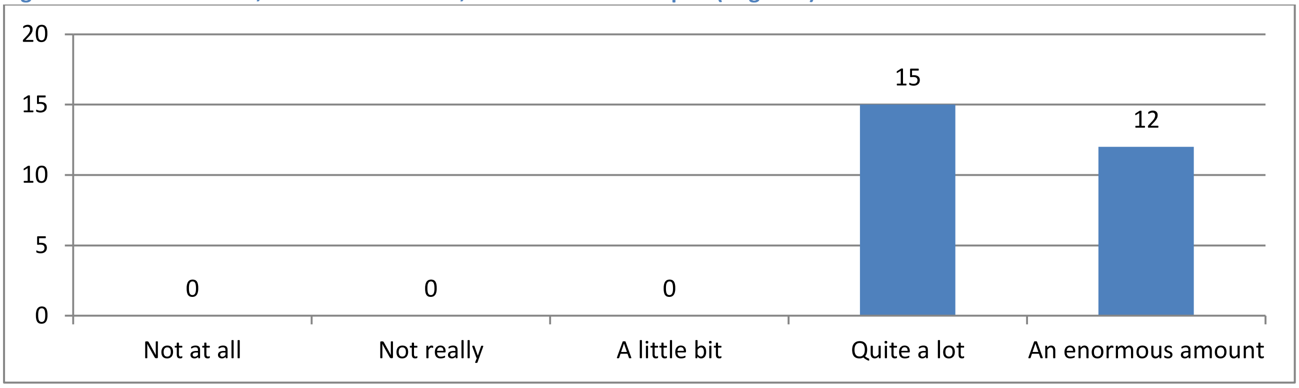
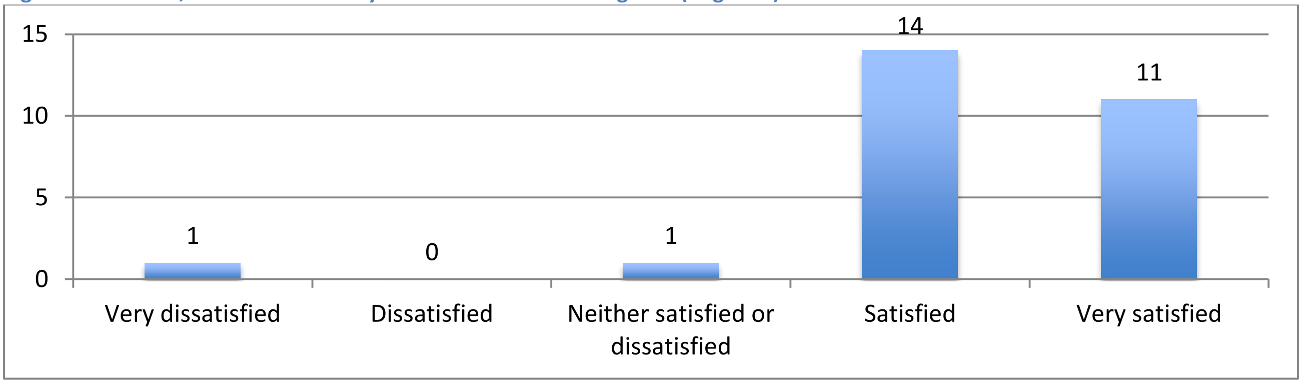


Figure 13: Overall, how satisfied are you with the Garbo Dialogues? (Avg 4.26)



Things we did well

- Presentation skills (7 comments)
- Facilitation skills (6 comments)
- Felt contribution was encouraged and valued (4 comments)
- Time management (3 comments)
- Variety and type of activities (3 comments)
- Accessibility of information and format (3 comments)
- Pleased to have the opportunity to participate (1 comment)
- Venue (1 comment)
- Zing (1 comment)

Things we could have done better:

- Too much content in the second session/confusing (4 comments)
- More time needed explaining diversion rates (3 comments)
- Would have liked more information before starting (2 comments)
- Would have liked more time/felt rushed (2 comments)
- Parking at venue difficult (1 comment)
- Liked catering (1 comment)
- Didn't like catering (1 comment)
- Accessibility of information (1 comment)

4. Engagement Findings

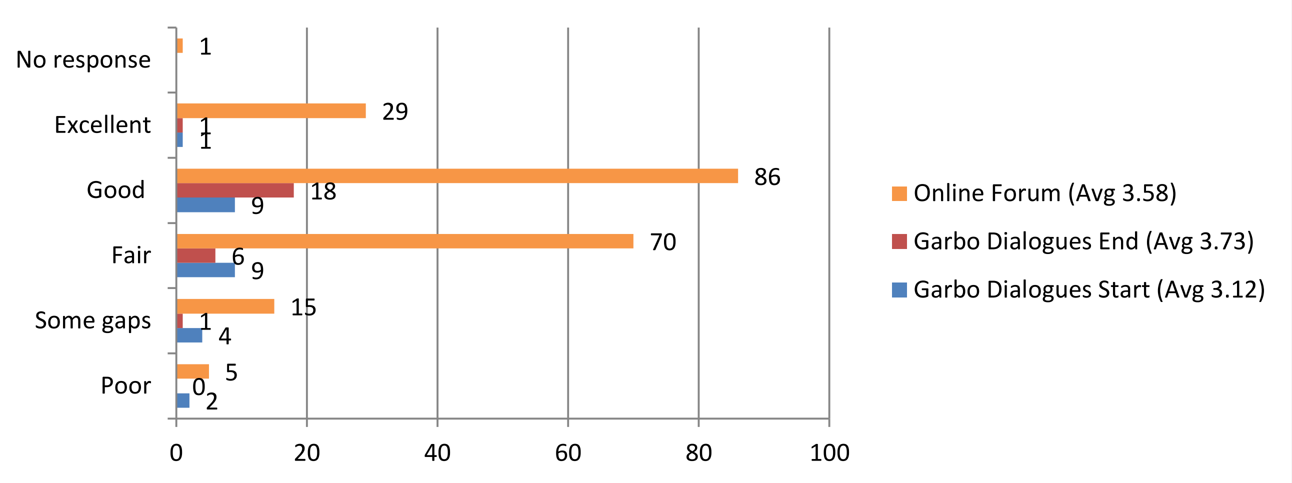
The engagement findings reported in this section relate to the engagement objectives and report on the findings from both the Garbo Dialogues and Managing Waste in the Future Online Forums.

4.1 Waste Management Issues & Challenges

Understanding of Waste Management

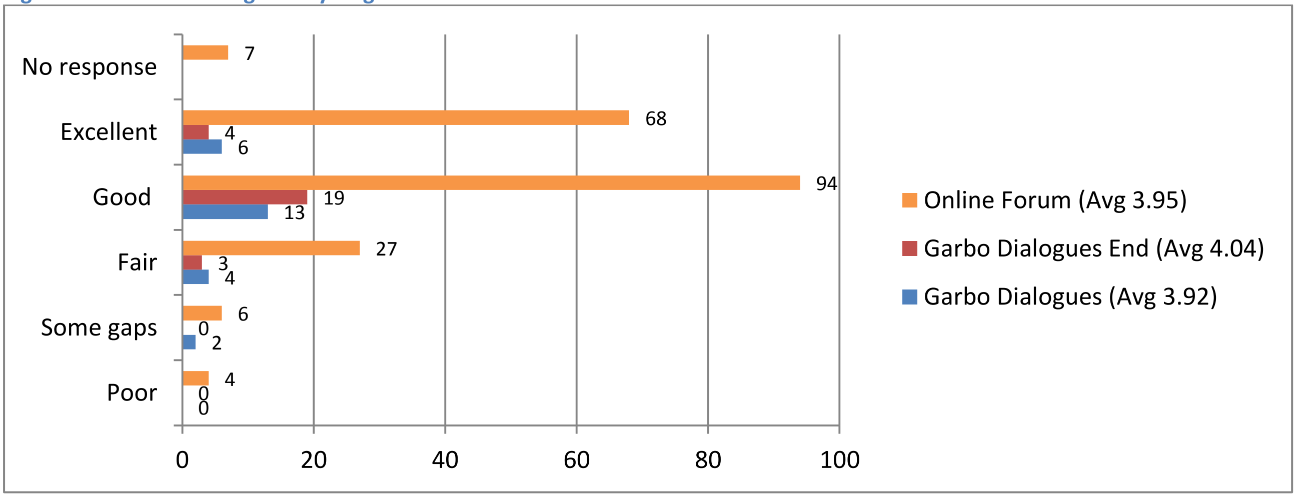
Both the Garbo Dialogues group and online forum participants were asked in a survey to rate their understanding of waste management. The purpose of this question was to ascertain people's level of knowledge about the subject. As the figure below shows, average for both groups between 'fair' and 'good'. The online forum group were more likely to rank their understanding as excellent.

Figure 14: Understanding of waste management



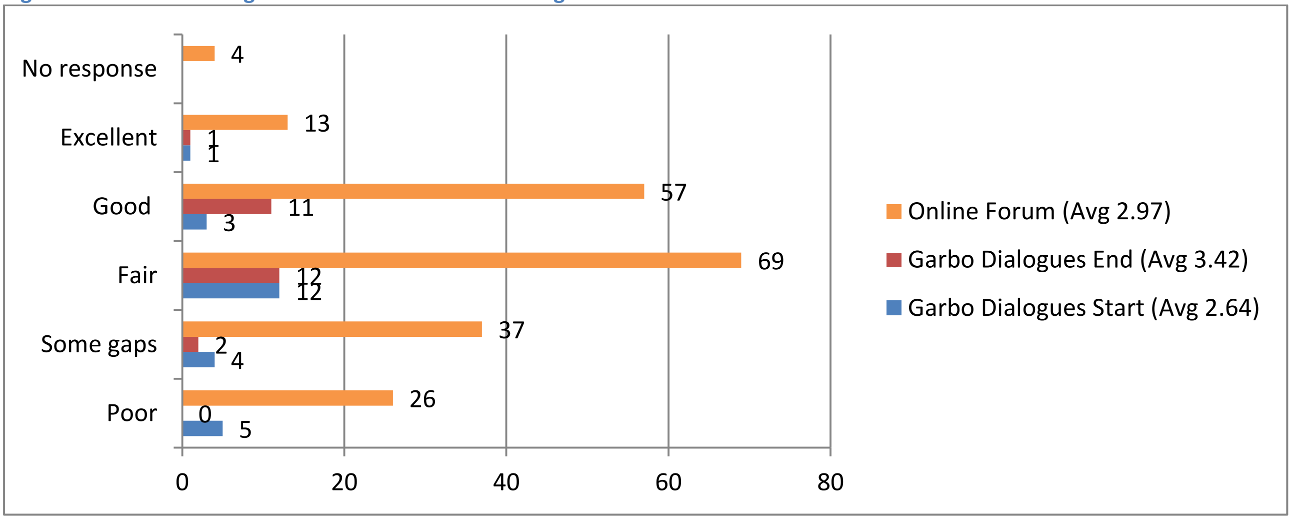
When asked about their knowledge of recycling, the average scores were slightly higher, once again, with online forum participants more likely to choose 'excellent'.

Figure 15: Understanding of recycling



Understanding of alternative waste technologies scored averages less than 'fair' and comments from the online forum indicated that some people are still unsure of what AWT is and what role it plays.

Figure 16: Understanding of alternative waste technologies



Considerations

A large proportion of the community has limited knowledge or exposure to alternative waste technologies. When planning waste management systems for the future, clear communication of what AWT is, its role and how it works will be required and/or educative programs.

Values Toward Diverting Waste from Landfill

In addition to participants' knowledge of waste management issues, they were directly asked to rate their value or how important diverting waste and reducing waste is to their household. This question was asked to ascertain value towards waste management as an indication of whether diversion from landfill targets identified in the Waste Minimisation Strategy were reflective of community values. As the two figures below show, responses varied with averages between 'somewhat important' and 'very important'.

Figure 17: How important to you and your household is diverting waste from landfill?

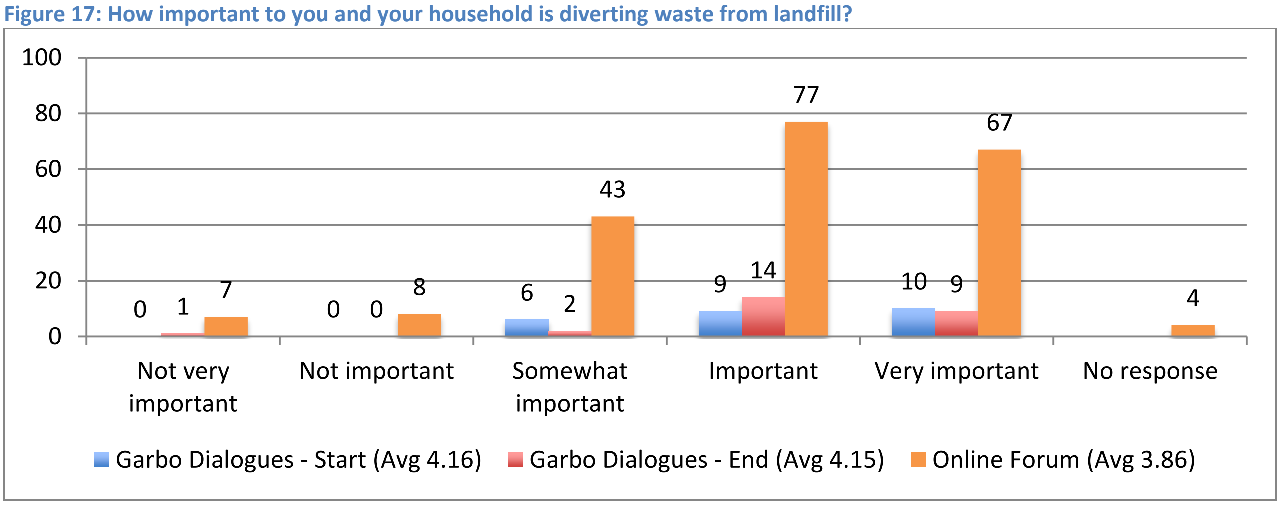
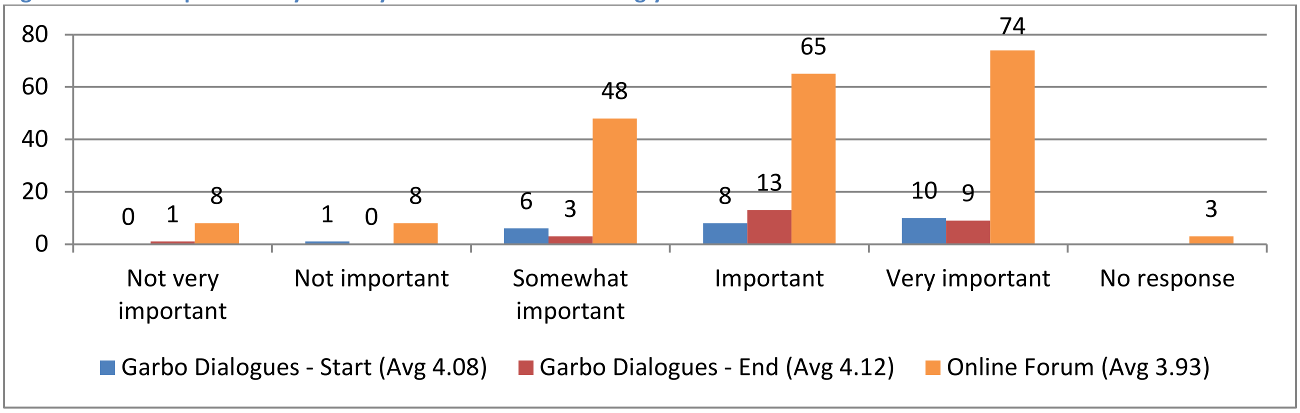


Figure 18: How important to you and your household is reducing your household waste?



Commitment to Diverting Waste from Landfill

In addition to asking about knowledge and values of waste management aspects, participants were asked what their commitment levels were to sorting recyclables, reducing waste and reducing organic waste. Overall the online forum group was more committed in all three areas, as shown in the figures below.

As with other responses, the online forum group ranked higher responses, or in this case, commitment levels. The average for sorting for all groups rated between ‘committed’ and ‘very committed’. The average for reducing waste rated between ‘a little committed’ and ‘committed’. The average for reducing organic waste rated slightly lower between ‘not committed’ and ‘committed’.

Figure 19: How committed do you consider your household to be at sorting recyclables from rubbish?

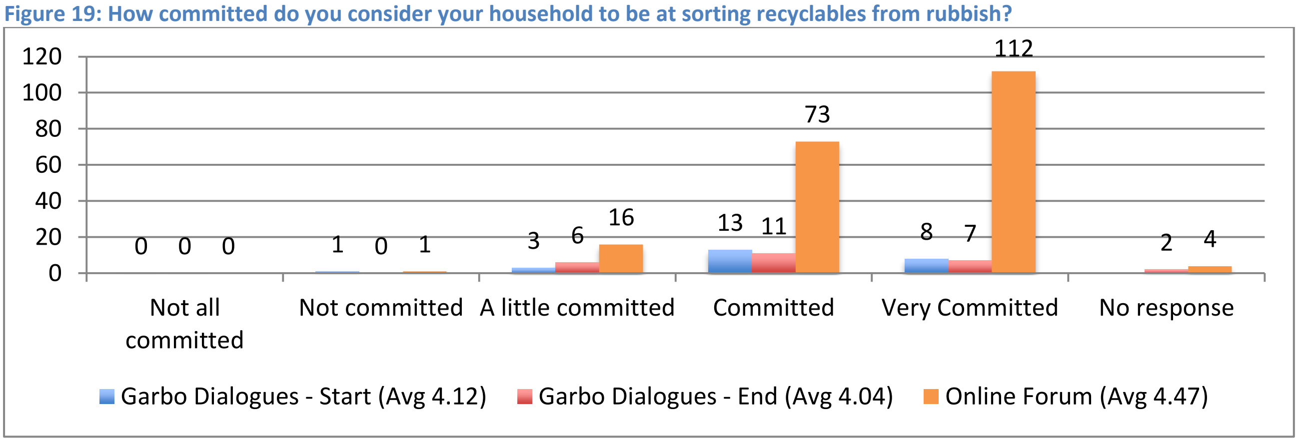


Figure 20: How committed do you consider your household to be at reducing waste where possible?

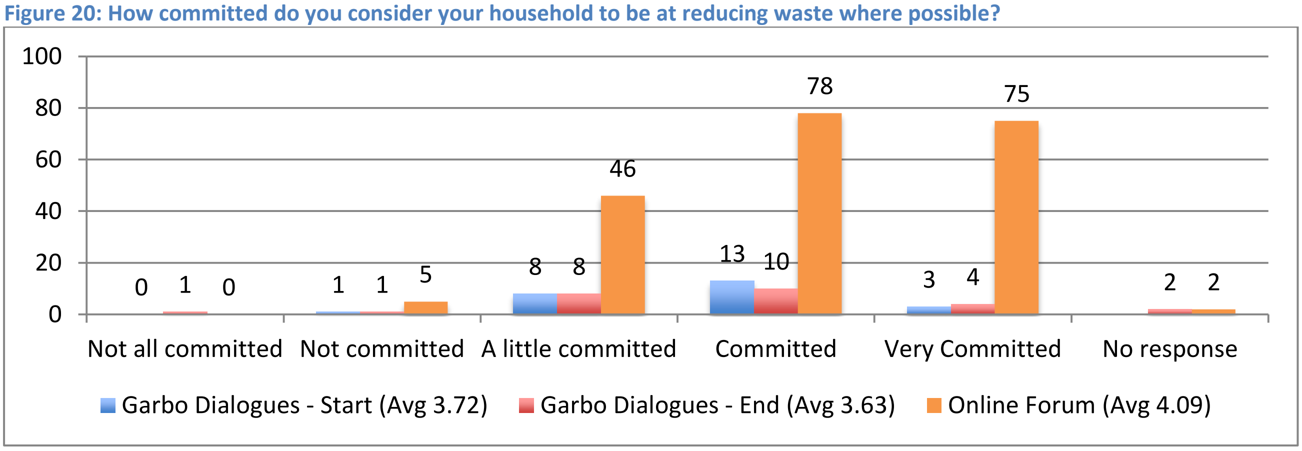
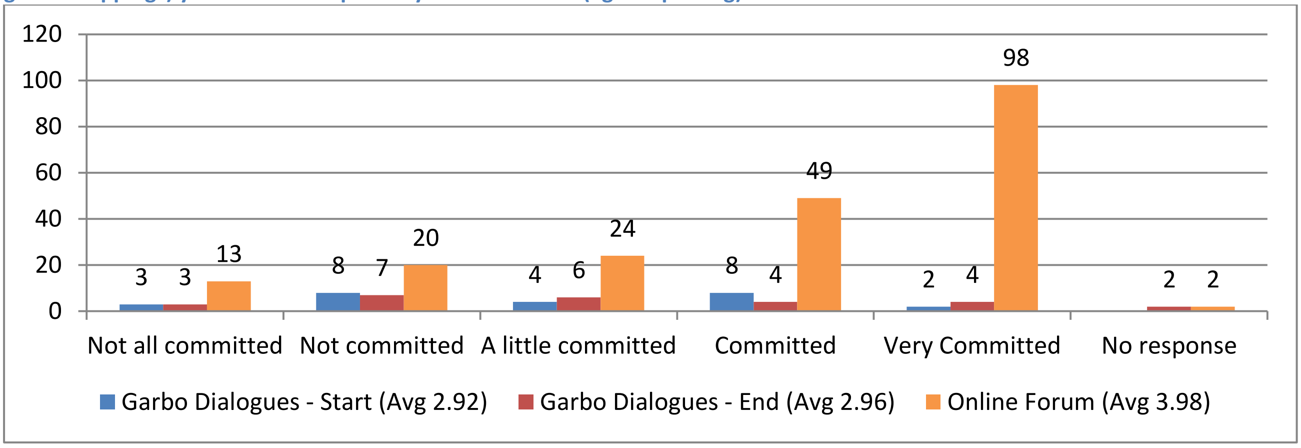


Figure 21: How committed do you consider your household to be at reducing the amount of organic waste (food scraps and garden clippings) your household puts in your rubbish bin (eg composting)?



Many online forum discussion participants expressed a strong commitment to keeping organic waste out of landfill. Of the 206 people who completed the survey, 58 made comments that they already dispose of all or most of their organic waste mostly through composting. In addition to this over 22 of the 159 online forum comments related to people's unwillingness to consider a third bin because they already reuse their organic waste.

When asked on the online forum whether Council's diversion targets were too high, the forum conversation was dominated by solutions for reductions, only two respondents indicated they were too high and another two indicated they were acceptable targets.

Considerations

Of those that participated in the online survey and those that participated in the Garbo Dialogues, reducing waste, recycling and reducing landfill all ranked above high in importance and commitment. This indicates that waste and landfill reduction is a community concern and the community is generally supportive of Council's aim to minimise waste and landfill.

There are a number of people who already make use of their organic waste, particularly through composting, who may object to additional cost for a service they may not fully utilise.

4.2 AWT Types and Bin Systems

In the second session of Garbo Dialogues, a great deal of time was spent discussing the different types of waste, what processes they can go through and what bin systems could be used with what AWT approaches. The figure below presents the information given to participants as well as a triple bottom line analysis they undertook, where they considered the social (people), environmental (planet) and economic (profit) advantages and disadvantages of each.

There was some initial confusion among participants around the following points:

- How the current 2 bin system would differ from an AWT 2 bin system
- How costs were estimated, with many believing Council was 'revenue raising'

These points were clarified in the following session.

Figure 22: Facts and Considerations of Different AWT and Bin Systems

IMPACTS	Current	2 Bin Option	3 Bin Option (Garden and Food)	3 Bin Option (Garden Only)
Diversion from MSW	0%	50% (Basic) - 85% (Thermal)	25%	17%
Household Sorting	• Waste • Recyclables	• Waste • Recyclables	• Waste • Recyclables • Green (Garden and Food)	• Waste • Recyclables • Green (Garden)
Estimated Cost	$209pa $4.02wk	$320 (Basic) $360 (Thermal) $6.15-$6.92wk	$280-$290pa $5.38-$5.58wk	$270pa $5.19wk
Collection	Waste – Wk Recycle – FN	Waste – Wk Recycle – FN	Waste – FN (or Wk) Recyclables – FN Green – Wk	Waste – Wk Recyclables – FN Green – FN
What Happens With What's in the Bins	• Waste → Landfill • Recyclables → Recycled	• Waste → AWT (Sorted into Recycled, Landfill and Compost) or Thermal (energy) • Recyclables → Recycled	• Waste → Landfill • Recyclables → Recycled • Green → AWT (Sorted into Landfill and Compost)	• Waste → Landfill • Recyclables → Recycled • Green → AWT (Sorted into Landfill and Compost)
Outputs & Markets	None	Low Quality and Value Compost and some recyclables (Basic) Energy (Thermal)	High quality and value compost	High quality and value compost
People		+ Simple and easy to understand + Extends life of landfill = more space for people + less greenhouse has emission - More expensive for households	- Space for additional bin in kitchen and outside - More time required sorting and taking out bins - Perceived confusion and smelliness - Equity for people without gardens or who compost	- Space for additional bin outside - More time required sorting and taking out bins - Equity for people without gardens or who compost + Cheapest option for households
Planet		+ Much Less landfill needed ? Poor quality compost ? Air emissions (from thermal)	+ Less landfill needed ? Carbon/climate impact eg. More trucks + High quality compost	+ Less landfill needed ? Carbon/climate impact eg. More trucks + High quality compost
Profit		- Finding market for output - Value of output - Most expensive	+ Product that can be sold + lower cost than 2 bin system	+ Product that can be sold

When asked on the online forum whether the end product of AWT was an important consideration, respondents appeared apathetic, either not answering the question specifically, indicating it was not a priority to them (1 comment) or that they would not trust a compost product from Council as they are unsure what would be in it as opposed to a compost they had prepared themselves (2 comments).

Considerations

In order for the community to gain a sound understanding of AWT and different bin systems, there needs to be a period of explanation and discussion. Garbo Dialogues participants welcomed the opportunity to be involved in weighing up the advantages and disadvantages of the different options.

There is a belief in some sections of the community that AWT will be a revenue generator for Council. This point would need to be clearly addressed in future engagement and communication.

4.3 Bin System Household Considerations

In one Garbo Dialogues activity participants were asked to consider how the proposed bin systems would work in different sorts of households. Households included: people from non-English speaking backgrounds and recent arrivals, unit dwellers, frail and disabled as well as different household sizes, ages and current commitments to organic waste minimisation.

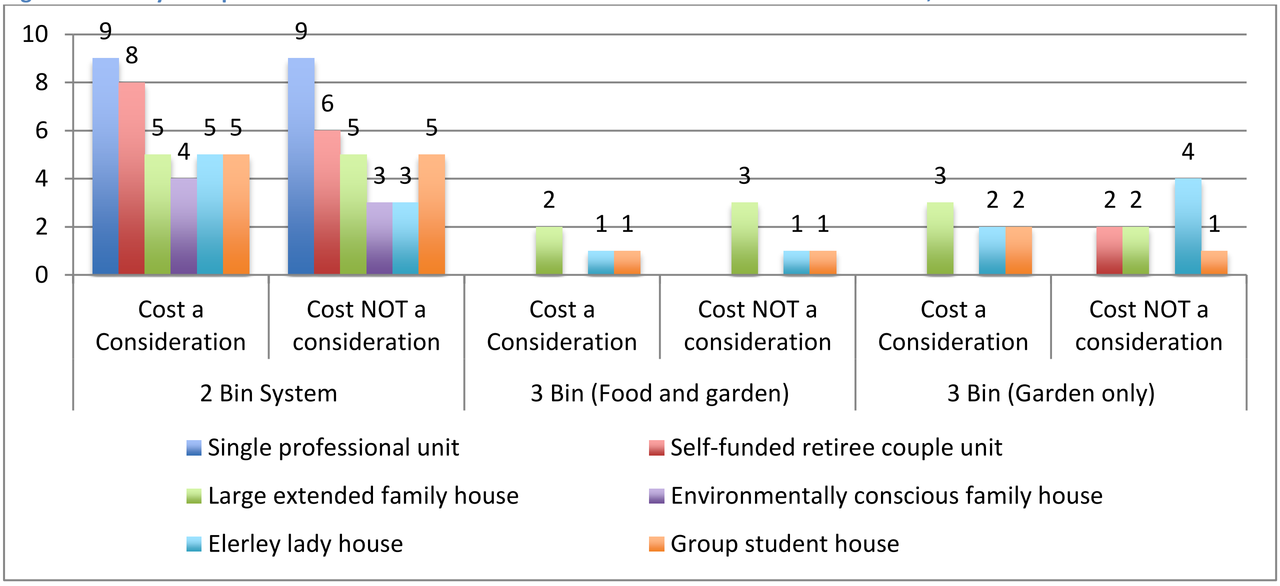
Considerations identified by the group in implementing a new bin system for different sorts of households included:

- Perceived willingness and ability to further sort rubbish
- Storage space for additional bin in yard and in kitchen
- Unit dwellers who do not produce garden waste
- Households already composting
- Mobility issues in taking out additional bin to kerb
- Frequency of collection

Unit dwellers who do not produce garden waste and have limited storage options was also raised by online forum respondents (5 comments) and in online forum comments (6 comments).

When asked which of the three bin systems these fictional households would be likely to prefer if cost was or was not a consideration, they tended to prefer a 2 bin system, although this varied by household type.

Figure 23: Bin system preference with cost as a consideration and cost not as a consideration, fictional households



Considerations

Changes in bin systems are likely to impact household behavior which will require promotion and education.

A 3 bin garden only system is unlikely to be of use to unit dwellers which may have implications for pricing.

Different household types are likely to prefer different systems, for some households, cost will be a major consideration.

4.4 Bin System Preferences

Both the Garbo Dialogues group and online forum participants were asked in a survey to rate their willingness to use a third bin, whether that it was for food and garden or garden only organic waste with 1 being 'no thanks' and 5 being 'would love to'.

Willingness with Garbo Dialogues participants was higher, scoring between 'would strongly consider it' and 'maybe' although willingness had decreased a little by the end of the sessions. This is likely due to a small group of participants who were in favour of the 2 bin thermal system which gives the highest diversion rates.

Figure 24: Would your household consider using a third bin for garden clippings?

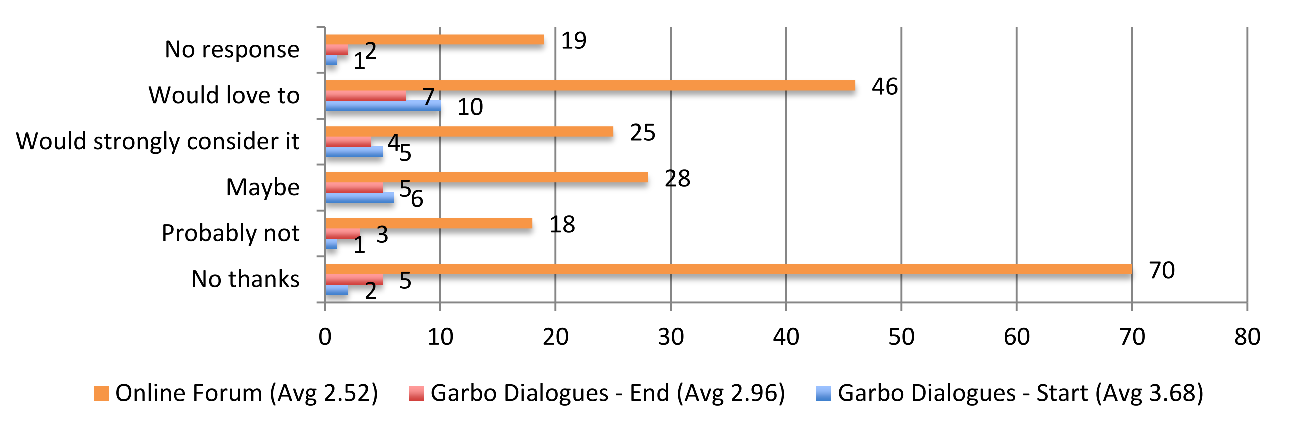
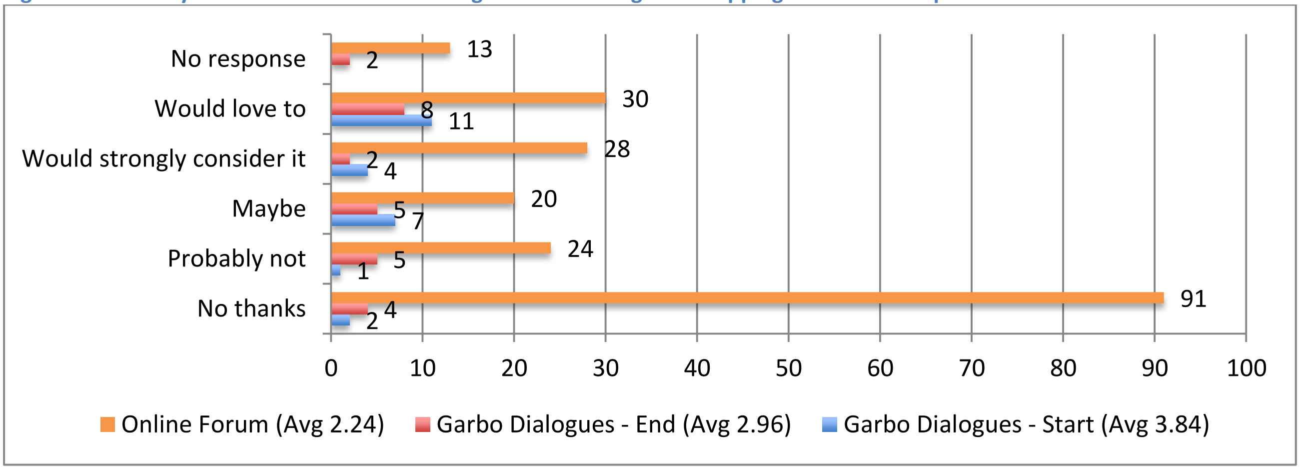


Figure 25: Would your household consider using a third bin for garden clippings and food scraps?



Of the 159 comments on the online forum 11 people indicated clearly they were supportive of a new system, a large proportion indicated they would have no use for a third bin as they already reuse their organic waste (22 comments) and a large number (33 comments) suggested other measures or initiatives be implemented. These typically related to composting, providing use of chippers as well as community compost and garden schemes and worm farms. A number of comments indicated people should have a choice as to whether they participate in a three bin system or not.

The concluding activity of the Garbo Dialogues sessions was a chance for participants to enjoy themselves as well as explore the issue of how the different options might be "sold" to the community. The six groups were invited to choose one of the options and create a pitch with a series of key messages. Three of the groups chose the two bin system with thermal technology and the other three groups chose the three bin system with food and garden. Participants were invited to participate regardless of whether or not it was their preferred system.

Key messages for the two bin thermal system included:

- It has the highest diversion rate
- There will be more land available
- The cost per week isn't that much
- It can produce energy

Key messages for the groups presenting the three bin (food and garden) system included:

- It's better for the environment
- The cost isn't as much
- The community has a responsibility to do the right thing

Considerations

Willingness for community members to consider a third bin rates between 'probably not' to 'would strongly consider it' which does not indicate strong initial support for a three bin system.

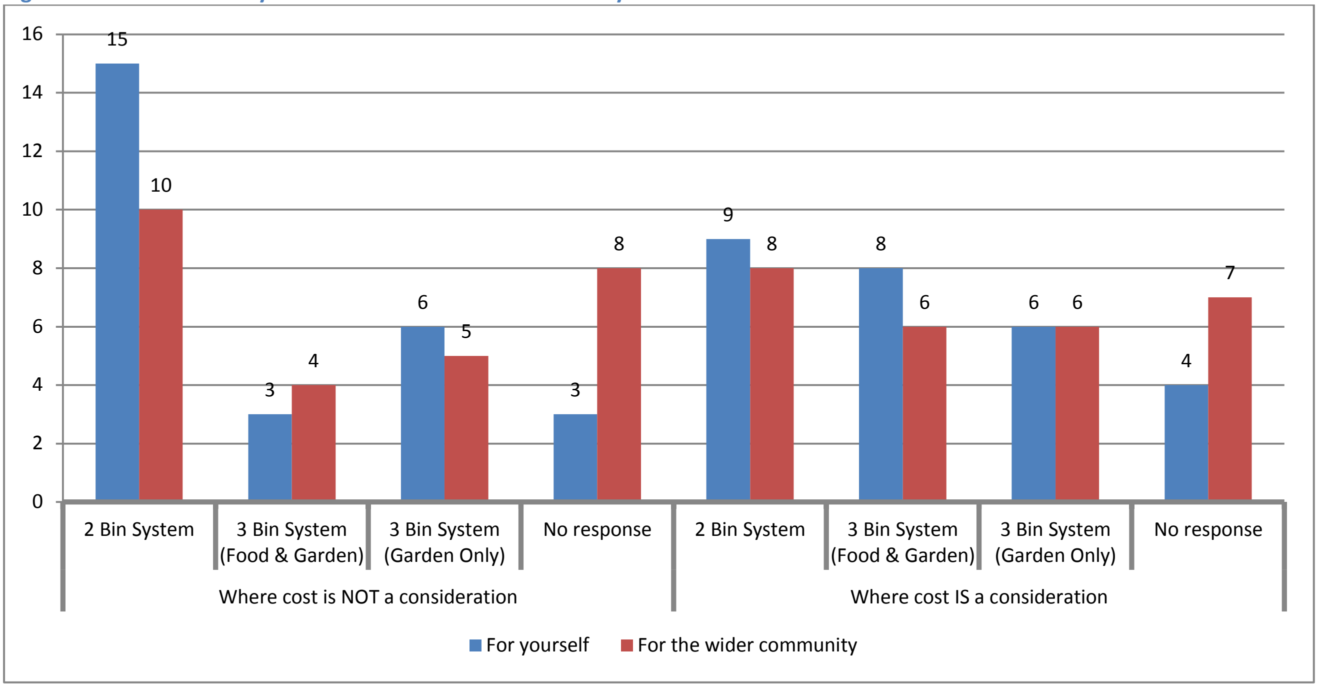
4.5 Bin System Preference and Price Tolerance

In addition to the activity where participants were asked to consider which bin system a number of different types of households would be likely to prefer, they were also asked which bin system they would prefer and the wider community would be likely to prefer. Once again they were asked to consider this preference in two ways, one where additional cost of the bin system was not a consideration and where the additional cost was a consideration.

Participants preferred a 2 bin system for themselves when not considering cost, but when cost was a consideration, preferences were divided between a 2 bin system and a 3 bin system with food and garden waste and a 3 bin system with garden only.

Participant's views of which system the wider community would prefer varied across all systems with a number of respondents unable to make a choice for the wider community. The results are shown below.

Figure 26: Preferred Bin System for Self and Wider Community With and Without Consideration of Cost



Of the 159 online forum comments, 28 indicated they are not willing or unable to pay an additional cost. In addition to this, four comments indicated it was already too expensive to dispose of waste in the region. The examples given for this were tip fees and the charge for requesting a smaller bin. Of those that completed the survey online 10 indicated that they would consider a new system depending on how much it would cost and nine indicated they cannot afford any increase. Some comments (5) from both the online survey and online discussion forum, suggested that bins be weighted on a user pays system and three comments were received that people should be penalised for not using the correct bins.

Considerations

Although the Garbo Dialogues participants were demographically representative they are a small group. Their preferences indicate that cost is a consideration when choosing a preferred bin system, with the more expensive 2 bin system less popular when considering cost. Overall preferences are divided across the three options.

The online forum discussions indicated price is a major consideration in any bin system changes. Many participants in this group suggested alternative ways forward to avoid cost increases.

4.6 Energy from Waste

The online forum discussion question, 'What do you think about a facility that harnesses energy from waste?' received 16 comments. Most of these (9 comments) indicated that this would be fine dependent on various factors, of which cost was the most dominant. Another four comments received were supportive and two comments suggested that any profit be directed to have a social benefit.

4.7 Waste Management Facility and AWT Perceived Impacts

In the first Garbo Dialogues session, participants were asked what they thought were the key concerns around waste management sites for the community as well as how these can be mitigated. A summary of responses is presented below.

Figure 27: Concerns and Possible Mitigations around Landfill Sites

Concerns about landfill sites	Strategies to address concerns
• Spread of vermin and disease • Reduction in property and land values • Traffic • Contamination of water, air and soil quality • Negative impact on natural ecosystems and native flora and fauna • Bad odours and noise pollution • How long before the landfill land can be re-used • Rising costs to dump there	• Education from state and local government • Group landfill with power stations, wind farms and sewage • Better practices for processing waste – e.g. greater sorting of recycling and waste at transfer stations • Use methane gas produced as an alternative energy source • Make landfill into fuel • Organic waste treated like sewage dumped, treated and piped upwardly into an integrated fertilizer sale site • Relocation of landfill sites inland and out of the way into non-residential, non-popular areas.

Once participants had learnt more about AWT facilities and systems they were asked to list what they thought the likely community concerns would be around such facilities. Responses, in no order of priority, were:

- May not be seen as high priority by community members compared to other projects
- Belief that if the community does not have enough information they will be unsure and fearful of the impacts
- There is already a lot of confusion around waste practices in the community such as what to recycle this may lead to more
- Thermal has high diversion rates and benefits but many remember government initiatives to stop incinerating and burning due to environmental impacts

Considerations

The concerns around waste management sites identified by participants are expected and the mitigation strategies innovative. Education and communication were common themes in this exercise and throughout the process.

4.8 Sustainability Park

During the third session of Garbo Dialogues, participants were given a short presentation on the proposed Sustainability Park. This presentation included:

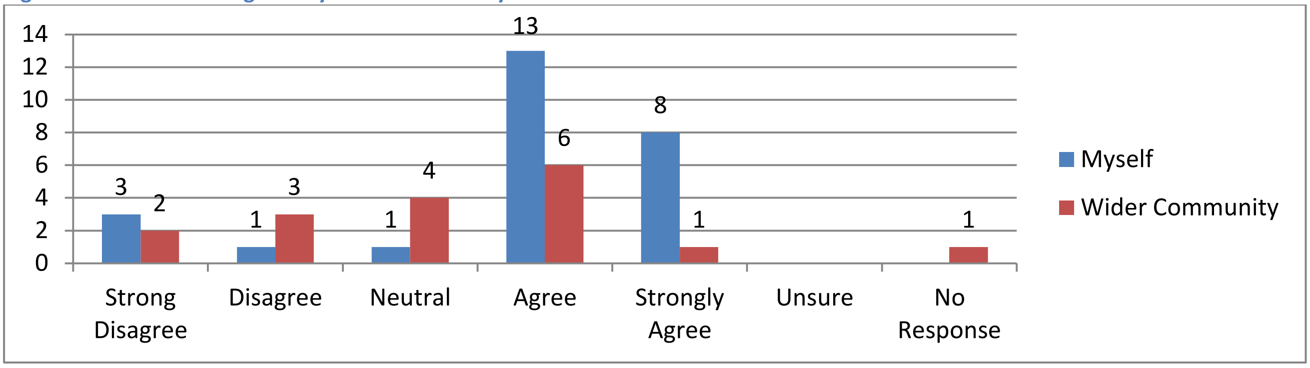
- The proposed site and why it was chosen
- The benefits of this site

- Characteristics of the site including access points

Time was also given for questions.

The 26 participants were invited to complete a short comment form containing four questions. Participants were asked to rank how strongly they agreed with the statements "I can understand why Council chose this location" and "I believe the wider community will understand why Council chose this location". As shown below, the majority participants agreed or strongly agreed themselves that they understood why the site was chosen, whereas they were less certain the wider community would.

Figure 28: Understanding of why the Sustainability Park Site was Chosen



Benefits identified by participants included:

- Location including surrounding buffer, compatible uses, zoning and access (30 comments)
- Employment opportunities (3 comments)
- Landfill reduction and environmental benefits for the coast (6 comments)

Challenges included:

- Public criticism from nearby residents (12 comments)
- Perceived environmental impacts from community (4 comments)
- Location including too far south in the region and increased traffic (11 comments)
- Cost of facility and to ratepayers (6 comments)

Further comments included:

- Questions about other materials that can be recycled or recovered – batteries, rubber, copper, car bodies (4 comments)
- Question if there will be incentives for people to use the site directly (1 comment)
- Will need to promote to and educate community (6 comments)
- Transport strategy will be needed (1 comment)
- Question if the site is big enough for future growth and expansion (1 comment)
- Consider going thermal and harnessing energy (2 comments)

Considerations

On the whole, Garbo Dialogues participants who were presented with information and given the opportunity to ask questions could understand why Sustainability Park has been chosen as the proposed site for an AWT facility. Participants were less sure the wider community would be supportive, presumably because they may not have the same opportunity for explanation and questions. Particular care will need to be given when engaging with residents in neighbouring areas.

4.9 Other Waste Management Considerations

A large number of comments on the online forums have related to other aspects of waste management on the Sunshine Coast. Of particular note was:

- A call to reinstate kerbside pickup and/or tip vouchers (42 comments) many respondent saw this as an alternative to a new waste management system
- A call for government and/or community response to reduce product packaging and plastic bags (32 comments)
- A call for recycle bins to be collected more frequently (13), smaller waste bins (4 comments) and the green bins to be collected more frequently (2 comments)
- The desire for further education, more information and further engagement was also called for (13 comments).

5. Summary and Considerations

Through the course of Garbo Dialogues and the Managing Future Waste online forum, a variety of aspects of waste management have been examined and considered with the community. Unfortunately, for decision makers, there is no clear way forward with a desired alternative waste and bin system option but the engagement has revealed the complexity of the issues and those which are likely or unlikely to trigger responses from the wider community.

Considerations, which have been developed in response to the engagement objectives, show the nature of the values and concerns the community has towards waste management and alternative waste technologies. These are collated below as a reference for decision making and the planning of future community engagement activities.

Considerations

A large proportion of the community has limited knowledge or exposure to alternative waste technologies. When planning waste management systems for the future, clear communication of what AWT is, its role and how it works will be required and/or educative programs.

Of those that participated in the online survey and those that participated in the Garbo Dialogues, reducing waste, recycling and reducing landfill all ranked above high in importance and commitment. This indicates that waste and landfill reduction is a community concern and the community is generally supportive of Council's aim to minimise waste and landfill.

There are a number of people who already make use of their organic waste, particularly through composting, who may object to additional cost for a service they may not fully utilise.

In order for the community to gain a sound understanding of AWT and different bin systems, there needs to be a period of explanation and discussion. Garbo Dialogues participants welcomed the opportunity to be involved in weighing up the advantages and disadvantages of the different options.

There is a belief in some sections of the community that AWT will be a revenue generator for Council. This point would need to be clearly addressed in future engagement and communication.

Changes in bin systems are likely to impact household behavior which will require promotion and education.

A 3 bin garden only system is unlikely to be of use to unit dwellers which may have implications for pricing.

Different household types are likely to prefer different systems, for some households, cost will be a major consideration.
Willingness for community members to consider a third bin rates between 'probably not' to 'would strongly consider it' which does not indicate strong initial support for a three bin system.

Although the Garbo Dialogues participants were demographically representative they are a small group. Their preferences indicate that cost is a consideration when choosing a preferred bin system, with the more expensive 2 bin system less popular when considering cost. Overall preferences are divided across the three options.

The online forum discussions indicated price is a major consideration in any bin system changes. Many participants in this group suggested alternative ways forward to avoid cost increases.

The concerns around waste management sites identified by participants are expected and the mitigation strategies innovative. Education and communication were common themes in this exercise and throughout the process.

On the whole, Garbo Dialogues participants who were presented with information and given the opportunity to ask questions could understand why Sustainability Park has been chosen as the proposed site for an AWT facility. Participants were less sure the wider community would be supportive, presumably because they may not have the same opportunity for explanation and questions. Particular care will need to be given when engaging with residents in neighbouring areas.

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