Waste Futures

Hastings District Council and Napier City Council

Economic Case

1.4

19 September 2018

CON2014024

Waste Futures

Project no:	AE04853/IZ038900
Document title:	Economic Case
Document No.:	
Revision:	1.4
Date:	19 September 2018
Client name:	Hastings District Council and Napier City Council
Client no:	CON2014024
Project manager:	Gavin Sole
Author:	Gavin Sole, Dave Harridge, Brett Osborne, Bruce Clarke, Carl Hughes
File name:	Y:\AENVW\Projects\AE04853\Deliverables (issued)\Reports\03 Economic Business Case\IZ038900 ANZ Waste-Waste Futures Hawkes Bay-Economic Case- V1.4.docx

Jacobs New Zealand Limited

Level 3, 86 Customhouse Quay,
PO Box 10-283
Wellington, New Zealand
T +64 4 473 4265
F +64 4 473 3369
www.jacobs.com

Document history and status

Revision	Date	Description	By	Review	Approved
1.0	July 2015	Detailed Economic Case – Final Draft for Peer Review by SLR	Tess Drewitt, Chris Purchas	Chris Purchas	Bruce Clark
1.1	October 2015	Detailed Economic Case – Final incorporating comments from SLR Review	Gavin Sole, Louise Cannon	Gavin Sole	Carl Hughes
1.2	December 2015	Detailed Economic Case – Final incorporating comments from meeting	Carl Hughes	Gavin Sole	Carl Hughes
1.3	January 2015	Executive Summary added, SLR comments included.	Gavin Sole	Carl Hughes	Carl Hughes
1.4	April 2016	Updates to cost model to reflect Landfill Gate Fee information from T&T report and ETS			

JACOBS

Contents

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to provide technical assistance to Hastings District Council and Napier City Council (the Client) for the Waste Futures project in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, Jacobs's Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Financial support has been received from the Waste Minimisation Fund, which is administered by the Ministry for the Environment, to complete this study. The Ministry for the Environment does not necessarily endorse or support the content of this publication in any way.

Executive Summary

The Hastings District and Napier City Council's jointly own the Omarunui Landfill with the currently consented area projected to be full by 2025 at current rates of disposal. In order to expand the Landfill operation into the adjoining valleys, a significant investment will be required. Prior to committing to expand the landfill, the Councils are together reviewing the strategic options available to manage solid waste.

This review process is employing the New Zealand Better Business Case framework with the outcome being a detailed business case comparing various solid waste disposal and recovery options. The overarching project is known as Waste Futures.

The Councils are seeking an integrated, systems level approach to waste management and resource recovery that:

- Ensures the efficient and economic recovery, re-use and recycling of resources;
- Extracts the maximum amount of potential value from residual waste streams;
- Minimises potential future liabilities from waste disposal;
- Is consistent with the overarching goal of maintaining Hawke's Bay's competitive position as the food production centre of New Zealand.

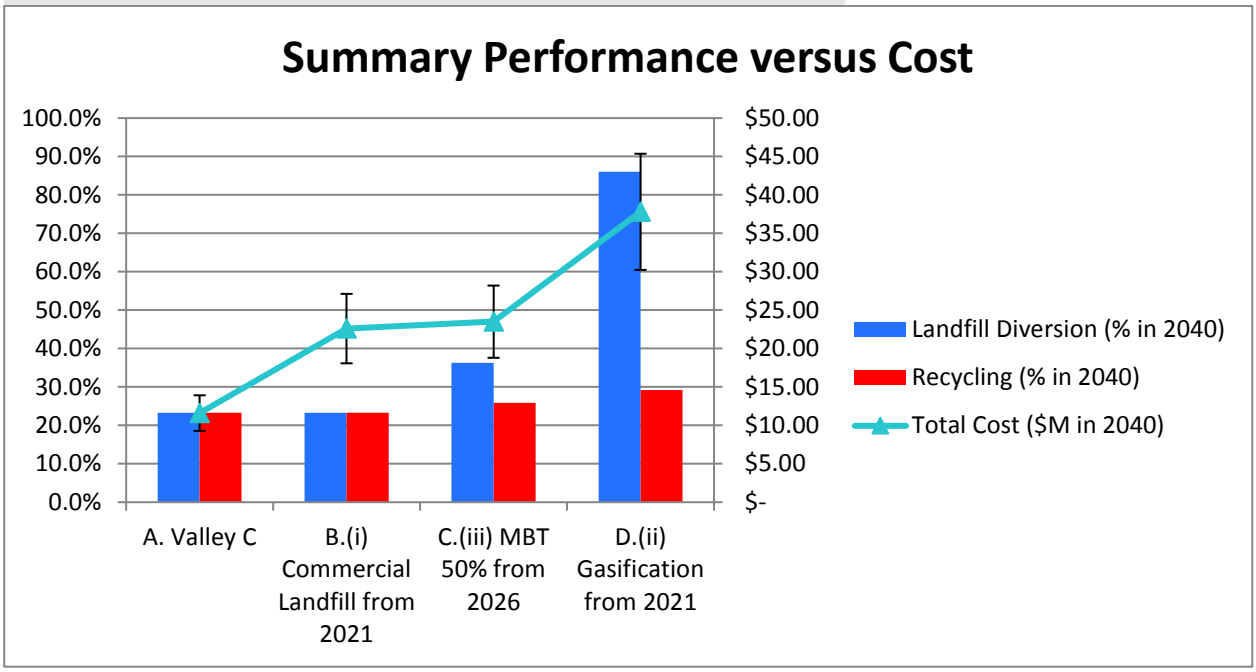
The business case has been developed in the following stages

- A summary of the current situation in terms of population, waste services and disposal, waste composition and commercial waste. This was called the **Baseline Report.**
- A recommended shortlist for detailed consideration (The **Indicative Business Case - Economic Case)**. This looked at options that would meet the requirements of the Councils over a long term, and considered the status quo, an improved kerbside collection service with an extension to the landfill, and also emerging technologies for waste reduction. A long list of options (35) were evaluated using a multi-criteria analysis to deliver a short list of options. These short listed options were:
    - Completion of a new Landfill Cell (Valley C) with a new kerbside collection that includes refuse, recycling and organic material.
    - Completion of a Commercial Landfill that is completed in 2020 that accepts commercial waste only.
    - Using a Mechanical and Biological Treatment to process the general waste. This technology sorts the waste material into more usable waste streams that can be processed into other uses
    - Using gasification technology to burn the waste material to recover the energy form it. This process can produce electricity or stream which can be beneficially used by other industrial processes.

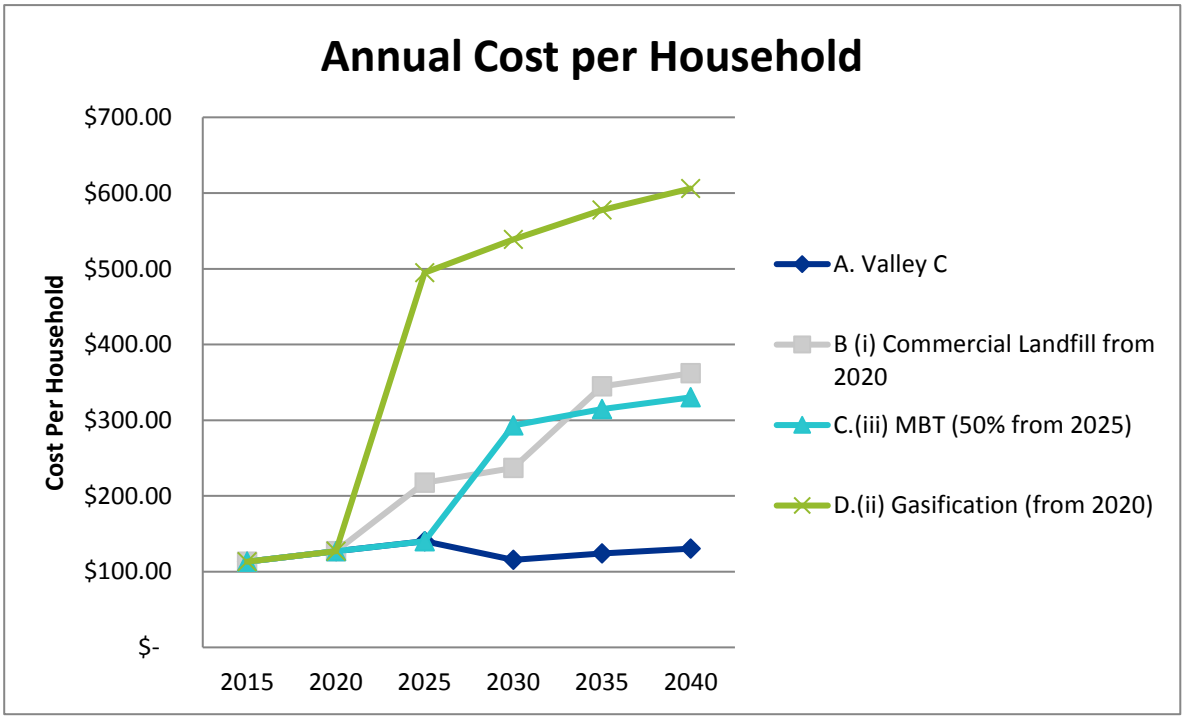
The **Detailed Business Case - Economic Case** (this report) looked at the short list options in more detail to evaluate their economic, social, cultural and environmental impact. The evaluation consisted of sensitivity testing, which looked at commercial and economic factors that could affect the short listed options. The critical elements for cost were the cost per household and the impact on the diversion of material from landfill.

The ability to divert material from landfill is critical, as this can significantly extend the life of the landfill and reduce future generational costs.

The graph below illustrates the diversion performance of the four options for diversion against cost.



While Gasification performs very well for diversion the cost is very high compared to the other options. This is illustrated further when the total cost per household for each option is evaluated. This is shown in the graph below.



Based on the current performance of the collection system there are opportunities to improve performance of the collection system (kerbside and transfer station network). This could be achieved by a combination of

- Improving performance of kerbside recycling (increased capture of materials from existing system users, new system users). This could be through common communications between Councils and commercial

collectors e.g. shared advertisements that have common themes about what can and cannot be collected. From the recent waste surveys certain locations could be targeted that have low set out rates for recycling services.

- Targeting household organics via existing commercial collection providers
- Community based projects around ways to reduce food waste, budgeting for food purchases, household composting initiatives
- Targeting the capture of recoverable materials (recycling, composting, bioenergy) in collected C&I and C&D
- Targeting increased diversion of materials at transfer stations (MSW, C&I and C&D)

Based on the discussion above the **preferred option** involves:

- **Optimising the collection system** to maximise the diversion of materials from landfill
- Working towards development of **additional landfill capacity at the Omarunui Landfill**

It is important to note that while landfill may not be considered to be as environmentally friendly as thermal treatment, a well-run modern and fully contained landfill with effective leachate management and gas capture/utilisation is considered to be an appropriate technology for the Councils within the current legislative and economic framework.

Future considerations for waste reduction should be included as the project progresses, as technology can change rapidly and as can the viability. A relevant New Zealand project is the construction of a commercial and industrial sorting facility being built by Marlborough District Council (construction starting in February 2016). It is recommended that this project is followed closely in terms of actual build costs and diversion rates achieved. If successful it should be considered and assessed for it application for Hastings and Napier Councils.

The next steps for this project are:

- Review is how the pricing structure across both Councils needs to be the same for the kerbside collection, and the impacts of this.
- Agreement by both Councils on strategy for implementation (dates and actions) for the landfill and kerbside collection
- Preparation of resource consent applications for the landfill
- Preparation of a public consultation document. This will include information on both the consenting of the landfill and changes to the kerbside collections for both Council. The consultation document will be based on other New Zealand Council's consultation experience for implementation of a new kerbside collection service and international experience e.g. DEFRA.
- Review of common documents and contracts for the two Councils. This include items such as:
    - Bylaws
    - Current kerbside collection contracts
    - Waste Minimisation Bylaw e.g. KPIs for waste minimisation
    - Waste Education

1. Introduction

The Hastings District Council (HDC) and Napier City Council (NCC) ("the Councils") are at an important decision point for shaping the future of solid waste management within Hastings and Napier. The Councils jointly own the Omarunui Landfill with the currently consented area projected to be full by 2025 at current rates of disposal. In order to expand the Landfill operation into the adjoining valleys, a significant investment will be required. Planning for that extension will need to start by 2016.

Prior to committing to expand the landfill, the Councils are together reviewing the strategic options available to manage solid waste. This review process is employing the Better Business Case framework with the outcome being a detailed business case comparing various solid waste disposal and recovery options. The overarching project is known as Waste Futures.

Jacobs New Zealand Limited have been engaged by the Councils to provide professional services in relation to the development of a business case for changes to the waste management system across Hastings District and Napier City in Hawkes Bay, New Zealand. This business case needs to deliver to the community the identification of a preferred integrated solution for waste management. The Councils are seeking an integrated, systems level approach to waste management and resource recovery that:

- Ensures the efficient and economic recovery, re-use and recycling of resources;
- Extracts the maximum amount of potential value from residual waste streams;
- Minimises potential future liabilities from waste disposal;
- Is consistent with the overarching goal of maintaining Hawke's Bay's competitive position as the food production centre of New Zealand.

To do this both Councils are committed to first developing a detailed business case, in accordance with the New Zealand Government's Better Business Case guidelines, to ensure that the right decision on the future direction of solid waste management in the Hastings District and Napier City areas is made.

The business case will be developed in stages, with the first stage leading to an indicative business case aimed at advising the Councils of a short-list of options followed by a detailed business case aimed at a final decision on what components the entire solid waste management systems operated by the Councils should be comprised of.

The Councils require the assistance of suitably qualified professionals to assist with the development of this business case, either in whole, or for a portion of this work.

Jacobs deliverables for the projects reflect the project tasks and will be developed over the life of the project. They include:

- A summary of the current situation (**Baseline Report**)
- A recommended shortlist for detailed consideration (The **Indicative Business Case - Economic Case**)
- A recommended option (The **Detailed Business Case - Economic Case,** this report)
- A suite of implementation information to complete the Detailed Business Case
    - **Detailed Business Case - Commercial Case**
    - **Detailed Business Case - Financial Case**
    - **Detailed Business Case - Management Case**

2. Project Context

In identifying and evaluating options it is important to understand context. This might relate to current and project waste flows, the statutory environment, commercial conditions (for waste generators and those operating in the waste sector) and the cost of operation. This section provides a brief summary of context for the Waste Futures project drawing on material set out in more detail in the **Baseline Report**. There is also discussion on project boundaries and other key issues that have a material impact on option identification and evaluation.

2.1 Background/Baseline Information

2.1.1 Key Metrics

With a population of approximately 76,200 and land area of 5,200km^2, Hastings District is the larger of the two areas. The population across both Napier and Hastings is growing, with a projected population increase from 2006 – 2031 of 7,300 (0.4% average annual growth) in Hastings and 1,200 (0.1% average annual growth) in Napier. The number of households across both centres is also expected to increase at a faster rate – 0.8% average annual growth rate in Hastings and 0.5% average annual growth rate in Napier. This is shown in the tables below.

Table 2.1. Population projections 2006-2031[1]

Territorial authority area	Population at 30 June						Change 2006–31	
	2006	2011	2016	2021	2026	2031	Number	Average annual increase (%)
Hastings district	73,200	75,500	77,200	78,600	79,700	80,500	7,300	0.4
Napier City	56,800	57,800	58,300	58,500	58,500	58,000	1,200	0.1

Table 2.2. Household projections 2006-2031

Territorial authority area	Households at 30 June						Change 2006–31	
	2006	2011	2016	2021	2026	2031	Number	Average annual increase (%)
Hastings district	26,800	28,200	29,700	31,000	32,100	33,100	6,300	0.8
Napier City	22,600	23,500	24,200	24,900	25,300	25,700	3,100	0.5

[1] Statistics NZ Area Unit Population Projects by Territorial Authorities, Age and Sex, 2006(base)-2031 update

Waste generation can generally be linked to population and household growth – i.e. as the number of users grows, more demand is placed on waste infrastructure and services. As such, it is expected that the projected population growth across both of the centres will put an added pressure of waste infrastructure and services.

2.2 Industry

Industry and activities in the area also contribute towards waste generation and the waste compositional profile in Hastings and Napier. The Hawke's Bay is a food production region, well known for its grape and wine production, stone fruits, apples and other vegetables, as well as beef farming. As a result, there are a number of large food producers in the area, including Heinz Watties, Silver Fern Farms (Beef), McCain Foods and CSI Processors. As well as foods, many other processing and manufacturing industries are located in the area, including pulp and wood processing, tanneries and wool production.

3. Where we are now

Understanding the baseline waste position is important for identifying where improvements can be made. The following section provides an overview of the current waste management services and infrastructure, waste generation and waste composition in Hastings and Napier.

3.1 Waste services and infrastructure

The current waste management configuration across the two centres is made up of a number of discrete and interconnected components. The system includes the following **council-owned** waste management services:

- Kerbside collection for household and commercial (CBD areas only) residual waste;
- Kerbside collection for household recyclables;
- Three primary refuse transfer stations for residual waste, recyclables, green waste and special waste drop-offs (Henderson Road and Blackbridge in HDC and Redclyffe in NCC); and
- Omarunui Landfill for all solid waste disposal across the Councils.

There are also a number of **privately-owned** services that are offered to the community. These include:

- Waste Management NZ Limited (previously Allbrites), which offers kerbside collections and drop-off facilities for households and business recyclables;
- Middle Road Cleanfill, which provides disposal services for Construction & Demolition (C&D) waste;
- BioRich composting green waste and other organic waste streams;
- PanPac Forest Products utilising green waste as biofuel; and
- Other privately-owned kerbside collection and drop-off services for waste and recyclables in both centres.

The following provides a brief summary of these services.

3.1.1 Household kerbside collection

Both Councils offer a 2-stream kerbside collection service for municipal solid waste (MSW), with Waste Management contracted to provide residual waste collection and Green Sky contracted for recycling collection. The NCC residential kerbside collection is funded through a uniform annual charge and does not use an official refuse bag. HDC operates a user-pays system for residential kerbside collection using an official orange bag. Bag costs rate are $1.60 for a 40 litre bag and $2.60 for a 60 litre bag. Maximum weight for bags from both Councils is 10 kg.

A number of private companies also offer kerbside collections in Napier and Hastings. These collection systems use mobile garbage bins (MGB's) on a user-pays basis. The total number of households serviced by private operators is unknown.

In Napier, almost all kerbside waste (council- and privately-collected) is taken directly to Omarunui Landfill. All Council-collected recycling is taken to Redclyffe Transfer Station. Privately-collected recycling is taken to Redclyffe RTS or the Waste Management recycling centre.

In Hastings, all council-collected kerbside waste goes to the Henderson Rd Transfer Station. Privately-collected kerbside waste goes to Henderson Rd (skips, around 40%) or directly to the landfill (wheelie bins, around 60%). Council-collected recyclables go to Henderson Rd, with privately-collected recyclables either going to Henderson Rd or the Waste Management recycling facility.

3.1.2 Drop-off facilities

The Council provides a number of drop-off facilities in the area for residual waste and recyclables. The main transfer stations are Redclyffe (NCC), Henderson Rd (HDC) and Blackbridge (HDC). Table 3.1 provides an overview of these transfer stations.

Table 3.1. Council-owned drop-off facilities in Napier and Hastings

Table 3-1. . Council-owned drop-off facilities in Napier and Hastings

Name	• Accepted materials	• Charge
Redclyffe RTS	• Residual waste • Household recycling (temporarily excluding plastics) • Green waste • Wood waste • Hazardous waste • Metals • Concrete	• Residual: $144/T • Green waste & untreated wood: $78/T
Henderson Rd	• Residual waste • Household recycling • Car batteries • Scrap metal • Waste oil • Clean fill • Reusable items (for shop)	• Residual: $126.50/T • Green waste: $82.80/T
Blackbridge	• Domestic waste only • Residual waste • Household recycling • Green waste • Waste oil	• Residual: $15-65 • Green waste: $10-35
Martin Place	• Household recycling	

All green waste collected is sent to private operators, either Bio Rich or Pan Pac, for processing into compost.

Waste Management also provides a drop-off facility for recycling in Napier. The public can drop-off plastics, glass, paper, cardboard and cans. The councils are not involved in the provision of this service and it is funded privately.

Aside from the daily drop-off facilities, the Councils also offer annual hazardous waste collection day for the collection of hazardous wastes and chemicals. The Hazmobile parks up at two sites in Napier and Hastings for householders to dispose of their hazardous wastes safety. Hazardous wastes are then sorted and sent to various processes in the region and across the country for recovery or safe disposal.

3.1.3 Council clean-ups

The Councils offer a litter bin collection service within CBD areas and at parks and other public areas with some litter bins accompanied by public place recycling bins. The litter bins are serviced in-house.

In addition to residual waste, both councils also offer an annual E-Waste collection day.

3.1.4 Recovery

There are a range of recovery services operating across the two centres for recyclables and green waste, including both Council- and privately- operated services. Recovery services for recyclables include –

- Scrap metal and building recyclers;
- Beard's Environmental;
- Hawk Group Limited;
- Full Circle (paper and cardboard);
- Charity shops; and
- Re-sell shops at RTS's.

Green waste recovery services include –

- Pan Pac, which processes a portion of organic waste from Napier, including green waste that has been dropped off to Redclyffe RTS and large commercial loads delivered to the site from industry.
- Bio Rich, which processes organic waste and waste plasterboard in Hastings, including all green waste that has been dropped off to Henderson Rd RTS
- Other private green waste collection services, including Bay Environmental Bins Limited and Clean Earth Limited.

In addition, many food processors in the region deal with their own waste, including CSI Processors who have a bio-digester that is commercially available.

3.1.5 Disposal

Most of the residual waste across the two centres is disposed of at the Omarunui Landfill, which is jointly owned by NDC and HDC. Only commercial operators can access the landfill, so all waste either comes through the transfer stations or is dropped off directly by commercial operators. The landfill accepts all MSW, as well as commercial and industrial (C&I) waste, and special waste, including waste from the tannery, asbestos waste, contaminated soil, organic waste from food processing and bio-solids from the wastewater treatment plant. The advertised charge for the Omarunui Landfill is $83/tonne with a minimum charge of $148, with higher charges for special wastes.

Private operators may also dispose waste at other landfills outside of the Hawke's Bay region. However, the total amount of waste disposed of this way is likely to be minimal given the transport involved.

3.1.6 Commercial and Industrial (C&I) waste

C&I waste producers have access to Council- and private- operated kerbside collections. Both Councils run a residual waste kerbside collection service for CBD areas, and private companies operate residual and recycling kerbside collection services. C&I waste can also be dropped off at the various drop-off facilities, or directly at the Omarunui landfill through private operators.

As well as collection and drop-off facilities, many commercial waste producers – particularly farmers – dispose of their own waste on site. However the actual amount of waste disposal in private disposal facilities in unknown. Rather than disposal, some commercial waste generators are also recovering energy from waste, particularly organic waste – as in the example of CSI Processors above.

3.1.7 Construction and Demolition (C&D) waste

C&D waste producers have access to privately-operated "one-off" collection or skip services. Middle Road cleanfill in Hastings is an example of a privately operated waste disposal service for C&D waste, and accepts private drop-offs and transfers from Henderson Road and Blackbridge RTS's. There is also provision for the acceptance of C&D waste for disposal in a dedicated area at Omarunui Landfill.

3.2 Waste Generation

3.2.1 Total waste

From the data available, approximately 90,000 T of waste and recyclables was generated across Napier and Hastings in 2013/14. This waste was either managed through Council services or infrastructure at some point, or disposed of at the Middle Road cleanfill (for which HDC has volumetric data). Of this waste, 75,500 T was landfilled at either the Omarunui Landfill or the Middle Road Cleanfill[2], and approximately 14,200 T of waste was recycled or recovered through Council-operated transfer stations.

Shown in Table 3-2e below is the waste data by waste stream for 2013/14.

Table 3-2. NCC/HDC Waste Generation in 2013/14 (T)

WASTE STREAM	Total weight (T)		
	NCC	HDC	Total
KERBSIDE COLLECTIONS (MSW)			
Council kerbside collections			
Residual	6,347	2,070	8,420
Recyclables	3,130	3,320	6,450
Private kerbside collections			
Residual	5,452	10,615	16,066
SELF HAUL – Council RTS (MSW)			
Residual	9.120	5,559	14,680
Recyclables	1,020	2,370	3,390
Green waste	1,630	2,730	4,360
SPECIAL WASTE			
Residual (to Omarunui)	-	-	13,130
GENERAL WASTE (including C&D, C&I)			
Residual (to Omarunui)	-	-	20,860
C&D WASTE			
Residual (to cleanfill)	-	-	2,380
TOTAL WASTE			
Total residual			**75,536**
Total recyclables			**14,200**
Total waste			**89,736**

[2] Middle Road Cleanfill accepts C&D waste material separated at council transfer stations (included in the estimate noted here) as well as materials taken directly to the site by waste generators or commercial waste transporters.

The data available is limited to weighbridge data over the past 5 years and the Survey of Solid Waste in the Hawke's Bay, March 2012, prepared by Waste Not Consulting (SWAP, 2012). The weighbridge data provides total weights of waste going through the landfill and Council-operated RTS, and the SWAP, 2012 data provides waste composition and source proportions. As such, data from the two sources have been combined to estimate a better picture on waste generated in Napier and Hastings provided in Table 3-2 (i.e. the proportions of SWAP, 2012 have been applied to total weights).

The waste data provided in Table 3-2 has the following additional notes and assumptions:

- Total private kerbside collections, special and C&I waste is based on SWAP proportion of total known waste to landfill
- NCC and HDC private kerbside collections are assumed proportions of total private kerbside collections based on population
- While C&I waste producers have access to kerbside and drop-off facilities, we have assumed all waste is household waste;
- All NCC private kerbside collections go directly to Omarunui Landfill, however HDC private kerbside collections also includes 4,000 T of privately collected MSW that goes through Henderson Road RTS to landfill
- Self-haul data only includes waste that has come through a Council-operated RTS;
- Only total figures have been provided for special, C&I and C&D waste as there is no information regarding the proportion of this waste coming from NCC and HDC
- Special waste has the same definition used in SWAP, 2012 and includes all materials with potentially toxic or eco-toxic properties, and having properties requiring special disposal techniques, and other substantial waste streams that affect residual waste composition, including waste from waste water treatment plants
- General waste has the same definition used in SWAP, 2012 and includes general C&D and C&I waste
- C&D waste to landfill is based on volumes provided by the Mill Road cleanfill operator to HDC, which have been converted to weights using the WRAP conversion rate for C&D waste of 0.87 T/m^3.

The tonnage provided in Table 4 excludes the following waste streams for which no data is available:

- Recyclables and organic waste collected and sorted privately (for example, through Waste Management)
- Other waste disposed of or recovered onsite or privately
- Otherwise waste transported outside the Hawke's Bay region.

3.2.2 Household waste and market share

Households generated an estimated 53,400 T of waste in 2013/14. Of this, approximately 73% (39,200 T) was landfilled and 27% (14,200 T) was recycled. As such, households in Napier/Hastings have an average household diversion rate of 27%. However the total waste excludes all waste that is diverted through privately-operated kerbside collection schemes and self-haul facilities, which would increase the household diversion rate.

In 2013/14, private operators managed the majority share of kerbside residual waste collections. Of the 24,486 tonnes of kerbside waste collected in 2013/14, private operators collected approximately 66%, while the Councils only collected 34%. However, including the Council drop-off facilities, private operators only managed 41% of the total MSW generated (prior to landfill drop-off), while Councils managed 59%.

As data for total kerbside recyclables either collected by private operators or dropped off at private recycling facilities is not available, we do not know how much of the market share Council has for household recyclables.

3.2.3 C&I and C&D waste

C&I and C&D waste producers send an estimated 34,000 T of waste directly to the Omarunui Landfill each year, with some residual waste also going through RTS's – an estimated 1,800 T to Redclyffe RTS and 3,000 T to Henderson Road and Blackbridge RTS's.

C&D waste producers send 2,300 T of C&D waste goes to Middle Road Cleanfill each year, and this includes transfers from the Hastings RTS's.

As all recyclables are assumed to go through private operators (either kerbside or drop-off), we do not know the total amount of recyclables generated each year. In addition, no data is available on C&I and C&D waste that is recovered each year. As such, we cannot estimate the diversion rate of C&I and C&D waste. We also do not know the Council's market share for C&I and C&D recyclables.

3.3 Waste composition

SWAP, 2012 was conducted to better understand the composition of household and commercial kerbside residual waste collection bags, as well as residual waste in the RTS's and the Omarunui Landfill. The following section provides a brief overview of waste compositions identified in that audit.

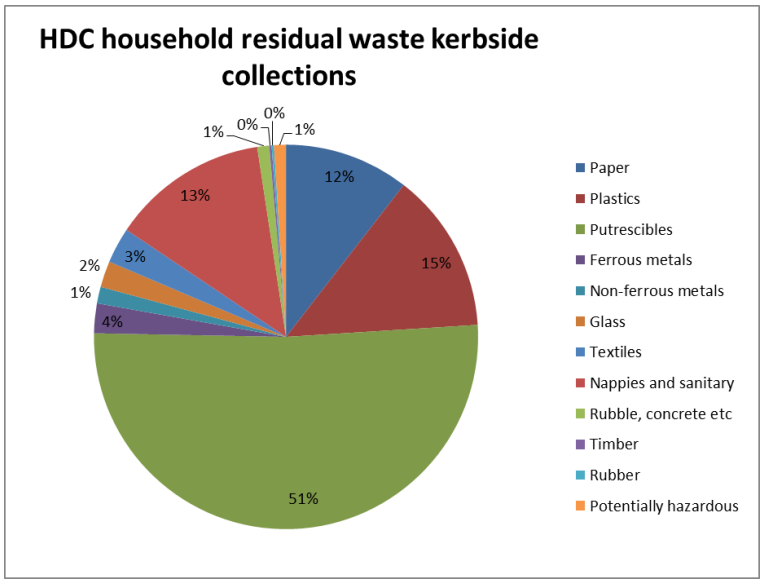
3.3.1 Household Residual Waste

SWAP, 2012 identified residual waste bag composition through domestic bagged refuse audits. The audits identified that household kerbside waste in Hastings and Napier is dominated by organic waste, which represents 51% and 48% respectively of all household kerbside residual waste by weight (Figure 3.1 and Figure 3.2). Other significant waste streams include paper and plastics (in kerbside collected waste).

Household waste dropped off at RTS's is dominated by timber (22-29%) and organic waste (20-23%). Paper, metals and plastics also make up a large proportion of household residual waste dropped off at RTS's.

The composition figures presented here are not dissimilar to those for other parts of New Zealand.

Figure 3.1 : Household Residual Composition (Collection)



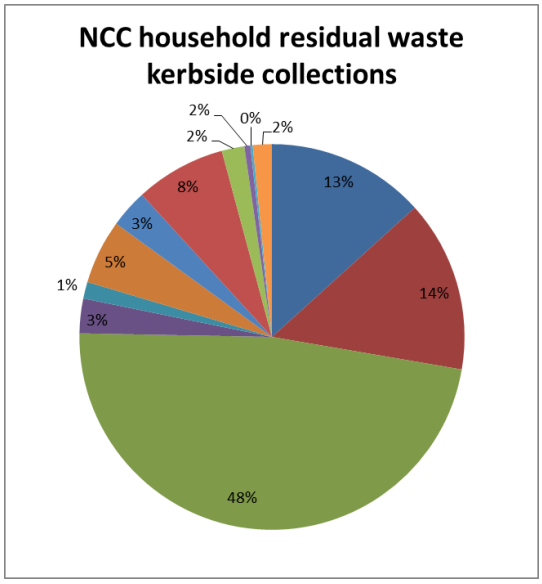
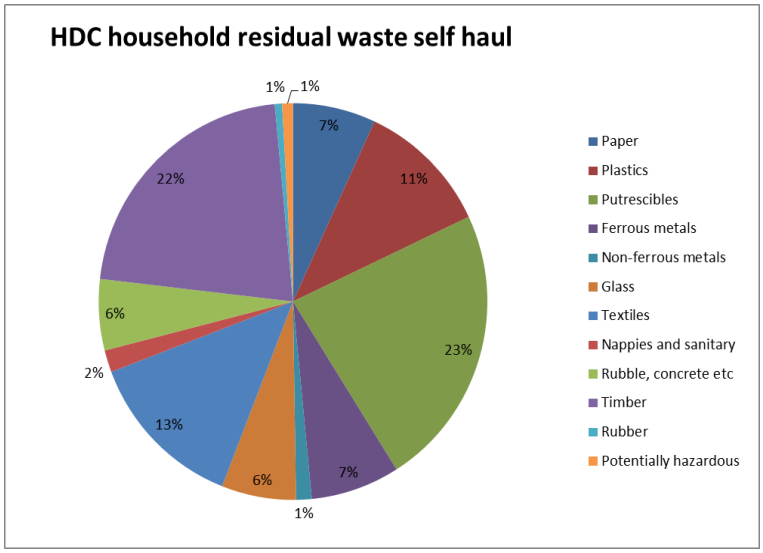
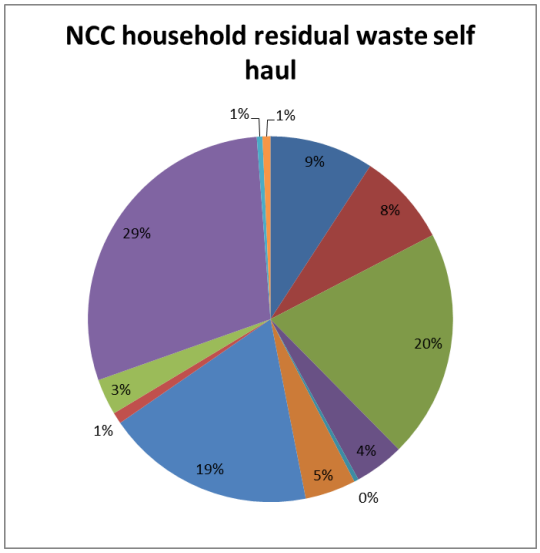


Figure 3.2 : Household Residual Composition (self-haul)



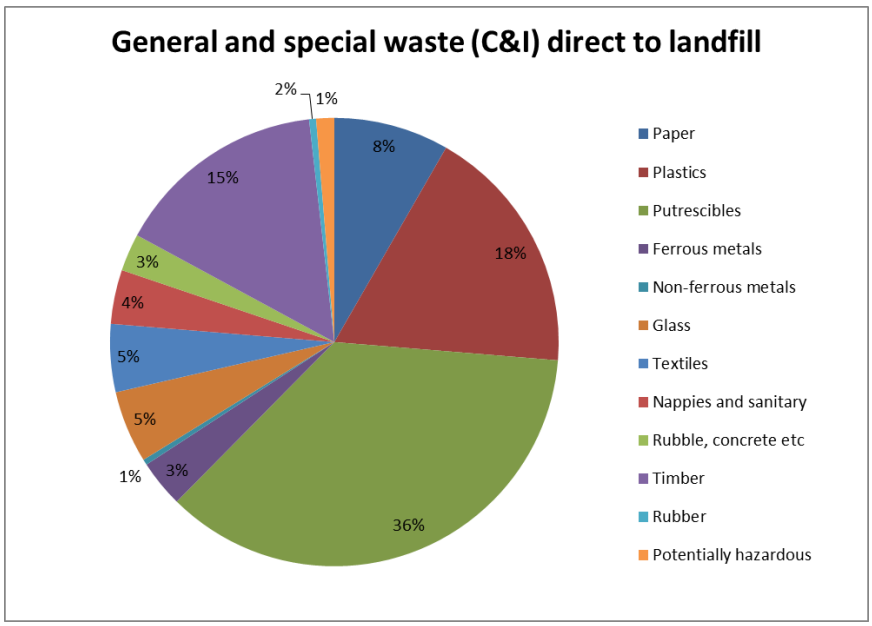


3.3.2 Waste Direct to Landfill (C&I, C&D)

Waste direct to Omarunui Landfill, including the special waste and general waste (C&D and C&I) also contains a significant portion of organics, paper, plastic and timber (Figure 3.3).

The high proportion of organics represents the industries that are using the landfill, including tanneries, food industries and the waste water treatment plant. The organic waste represents a significant waste diversion opportunity for the Councils.

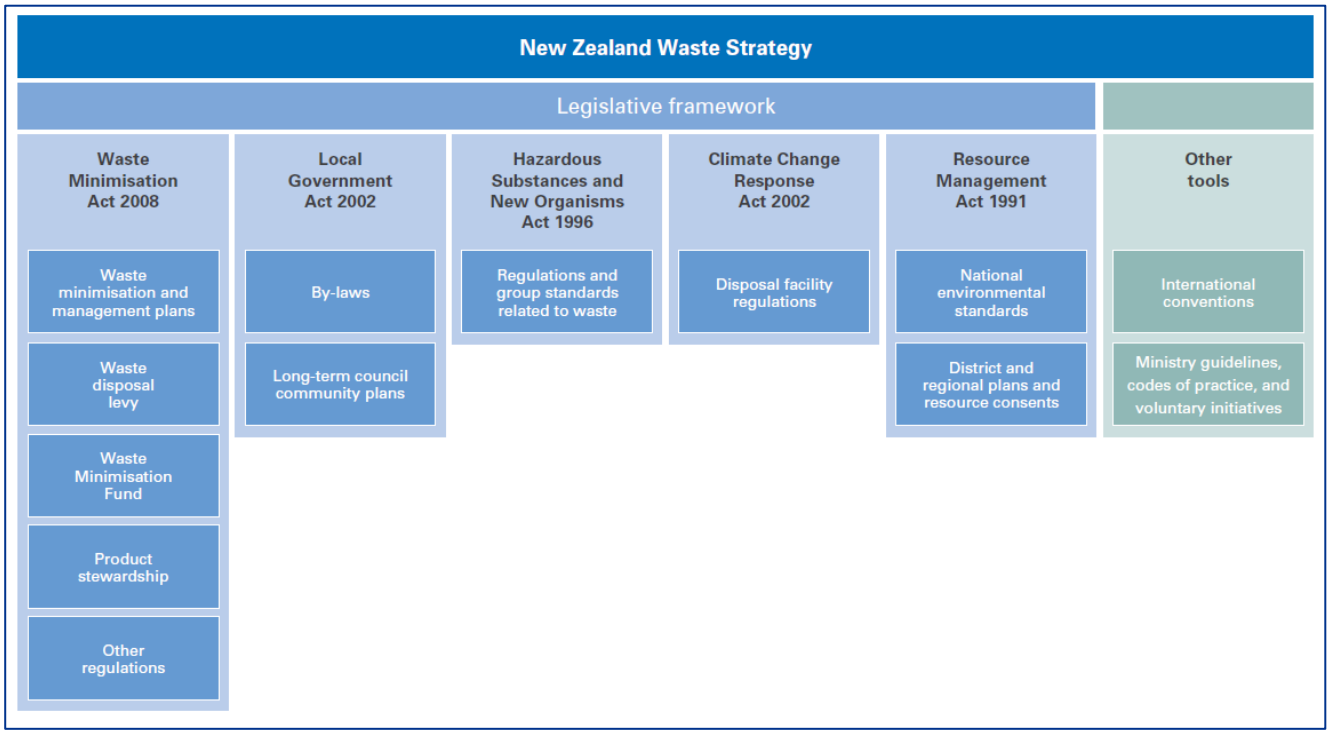
Figure 3.3 : Waste direct to landfill composition (C&I, C&D)



3.4 Policy Environment

The NZ waste industry is regulated by a number of policies, which are summarised in Table 3.3 below.

Table 3.3 : Key NZ Waste Policies



HDC and NCC have a joint waste management and minimisation plan for 2012-2018 with the next review due by 2018. Together, the Councils have developed objectives and policies for each of the two goals of the New Zealand Waste Strategy. The objectives and policies of the joint waste management plan are provided in Table 3. on the following page.

Table 3.4 : Objectives and policies in the Napier/Hastings Joint Waste Management and Minimisation Plan 2012-2018

Goal 1: Reducing the harmful effects of waste	
	Objectives
1	Ensure that cost effective services are available for the safe, secure and affordable collection, treatment and disposal or diversion of waste; and
2	Avoid or mitigate adverse environmental effects for the storage and handling of solid waste and diverted material.
	Policies
1	The Councils will continue to provide waste management and minimisation services.
2	The Councils will avoid or mitigate adverse environmental, health and safety effects for the storage and handling of solid waste and diverted material.
3	The Councils will gather information about waste streams in the districts to improve waste management and minimisation planning.
4	The Councils will collaborate with other parties in the provision of waste management services and meeting future demands.
5	The Councils will raise awareness about waste issues and waste minimisation.
6	The Councils will maintain a user pays charge system, where appropriate for waste disposal that provides cost recovery as well as incentives and disincentives to promote the objectives of the Councils' WMMP.
Goal 2: Improving the efficiency of resource use	
	Objectives
1	Ensure services are available for the effective and affordable collection, processing and marketing or beneficial use of diverted material.
2	Improve the opportunity for avoiding or reducing waste at source.
3	Improve the quality of diverted material where cost effective.
	Policies
1	The Councils will continue to provide waste minimisation services.

2	The Councils will ensure sufficient capacity exists at all recycling facilities to allow for continued growth and efficiency
3	The Councils will gather information about waste and diverted material streams in the district to improve waste management and minimisation planning.
4	The Councils will recognise the benefits of collaborating with other parties in the provision of waste minimisation services and meeting future demands.
5	The Councils will encourage waste minimisation, especially the reduction of waste, source separation and the importance of reducing the contamination of diverted material.
6	The Councils will maintain a user pays charge system for waste disposal and collection that provides cost recovery as well as incentives and disincentives to promote the objectives of the Councils' WMMP.

The joint waste management and minimisation plan also includes a range of methods for achieving the objectives and policies. A number of these methods are particularly relevant to this project, including:

- The Councils will investigate access to kerbside recycling for CBD businesses through a targeted business rate;
- The Councils will continue to support the green waste/organic waste diversion and will monitor the impact of green waste collection services;
- The Councils will continue to use the Omarunui Landfill for safe waste disposal. The landfill has the capacity to accept the district's residual waste over the period of the plan and beyond
- The Joint Omarunui Landfill committee will consider the development of a clean fill site to be sited at Omarunui Landfill, as demand requires (now developed)
- The Councils will monitor quantities and composition of waste and diverted material streams together with origin and destination, and number of customers, using Council information and data gathered from private operators
- The Councils will promote waste minimisation by continuing to support educational and promotional programmes, and all aspects of waste minimisation to ensure the region remains informed of waste minimisation activities.

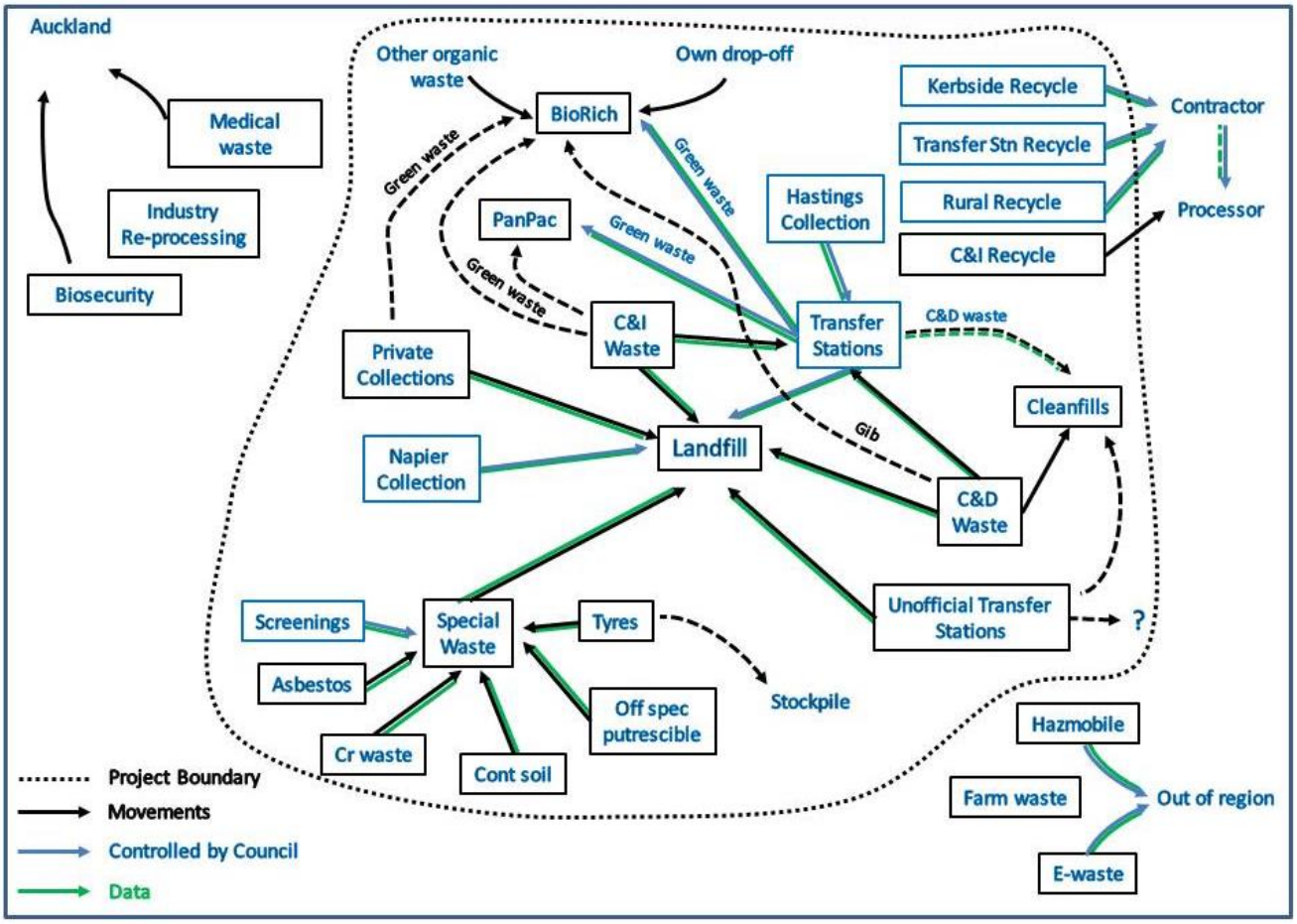
3.5 Project Boundaries

The Waste Futures project is focussed on determining whether extending the footprint of Omarunui Landfill is the most sensible course of action. In this context the boundaries for the identification and evaluation of options need to include waste streams and movements that are relevant to the landfill operation i.e. materials entering the landfill or prevented from entering the site. On this basis exclusions from the project scope include (illustrated in Figure 3.4 below):

- Medical waste;
- Biosecurity waste;
- industry re-processing;
- Farm waste;
- e-Waste collections; and
- Hazmobile collections.

For many of the waste streams and movements relevant to the landfill operation the Councils have limited ability to exercise control.

Figure 3.4 : Project Boundaries



3.6 Other key issues

There are a range of other issues that require consideration as options are identified and evaluated. These include:

- The importance of job creation to the region including considering the impact of increasing the cost of doing business through change sin waste management and minimisation costs;
- The role of by-laws in managing service levels and collecting data about waste streams and waste movements;
- The role of technology - low tech, social enterprise versus complex technology/risk and links to environmental issues such as air quality;
- The lack of clear targets for waste minimisation and management at a local or national level;
- Stakeholders with a high level of interest in the project include the community, councillors, waste collectors and waste processors
- Other important stakeholders include iwi, key waste generators (food processors), and users of energy/recycled products.

3.7 Waste levies

At the moment the waste levy in New Zealand is set at $10/tonne +GST. Approximately half of this money goes back to Councils to invest in policies or methods to minimise waste or to improve the efficiencies of resource use. Overseas waste levies can be set at much higher rates.

Waste levies or tax on landfill tonnages have been used across Australia and the UK with varying degrees of success since the mid-nineties. In densely populated areas (most of the UK and metropolitan Australia) where landfill capacity issues also exist, the cost per tonne uplift has enhanced the viability for Advanced Waste Treatment facilities or energy from waste facilities.

A similar levy system exists across Victoria, Metropolitan Western Australia, and part of South Australia and New South Wales, whereas Queensland removed their waste levy on landfill in 2014. New South Wales have a more complicated system where the liability lies with the producer not at the gate, which potentially allows all waste management facilities to introduce a gate tax. The benefits of this system allows for better control of the mass flow and stops stockpiling and cross boarder transport of wastes, the downside is that it has to be managed through a range of facility or process exemptions.

In the UK Examples include the European Union (EU) Landfill Directive which required the reduction of biodegradable municipal waste (BMW) going to landfill and the promotion of alternatives such as recycling, composting and energy recovery from waste. To this effect, the Directive contains three targets at the national level that will reduce the amount of BMW disposed to landfill:

- By 2010: reduce the amount of BMW landfilled to 75 percent of that produced in 1995;
- By 2013: reduce the amount of BMW landfilled to 50 percent of that produced in 1995;
- By 2020: reduce the amount of BMW landfilled to 35 percent of that produced in 1995.

The implementation of this varied across Europe but in the UK a levy was introduced called the landfill tax with the specific intention of incentivising other forms of waste treatment. The current levels of landfill tax (standard rate of £80 (NZ$180) per tonne rising to £82.60 (NZ$190) per tonne from 1 April 2015, and a lower rate of £2.50 ($5.5) per tonne rising to £2.60 ($6) per tonne from 1 April 2015 (the lower rate is for inert material). The result of this tax has resulted in landfill costs rising sharply with alternative waste treatment technologies being economically viable compared to landfill in the UK market.

The Landfill Directive also brought other changes in waste management including:

- A complete ban on the landfill of tyres, liquid wastes, infectious clinical wastes and certain hazardous wastes;
- The requirement for separate landfills for hazardous, non-hazardous and inert wastes;
- The introduction of a requirement for treatment of waste prior to landfill and the establishment of acceptance criteria for waste arriving at sites.

In addition to direct impact on the way waste is managed there have been other fiscal incentives made available to low carbon technologies such as recovered energy from the biomass proportion of waste, including Anaerobic Digestion (AD). Depending on the technology and incentive scheme it was eligible for this could result from additional income of $100 to $200 extra per MWh produced although this has recently been altered and a number of projects are currently reviewing their business cases with a number of new projects unlikely to materialise.

The overall effect has resulted in the investment of certain waste technologies which would not have been economically feasible without the fiscal drivers. New Zealand currently has a $10 levy/tonne on waste to landfill which is unlikely to be high enough in itself to drive a move away to alternative technologies and the fact that New Zealand already produces the majority of its energy from low carbon technologies and therefore does not have incentives for low carbon waste technologies.

3.8 Kerbside Collection Services

There is a wide range of services offered by Councils throughout NZ for kerbside collection services. These range from Councils that offer a three wheelie bin collection system for landfill material, recycling and organics collections, to refuse bags. Some Councils do not collect kerbside material at all, and have chosen to opt out of this service.

Councils in NZ are not obligated to collect kerbside waste material. In Australia and the UK, Councils are obliged to provide waste collection services to all residents. There are some subtle nuances where access to services must be offered rather than direct collection from the kerbside. In essence, Councils in the UK and Australia have a monopoly on household waste collection services.

Australian councils are able to levy a direct charge for delivering waste services, (which are set by each Council). Australian councils therefore have a ring fenced fund to deliver waste services, which means that they are able to generally operate with a surplus so they can more easily meet additional financial pressures, and for any medium to long term pressures, they have the power to increase the annual waste charge.

In the UK, waste services only form part of the total rate levied to householders. In contrast, UK councils have no direct control of the amount of money available to deliver waste services, and have to balance across all other council delivered services, e.g. roads maintenance, social services, street lighting, library services, child care services. The implication of this is that UK Councils have to actively monitor the financial risks and liabilities from service provision as there is no surplus to cover overspend, when for example, there is an increase in waste charges above what was budgeted for.

In Australia and the UK, as a result of the fact that all residents are offered a kerbside collection service by the Council, there are three scenarios which generally occur:

1. In-house service provision (this is becoming increasing more rare in the UK and Australia because of range of factors)
2. Individual councils procure contracted services for collection of all waste streams, and sometimes this is combined with processing and disposal contracts, and
3. Councils have joined together to procure joint collection contracts as this offered economies of scale and greater efficiencies.

Shown in Table 3.5 below is information from four Councils throughout NZ that offer different types of kerbside collection services.

Table 3.5 : Current Waste Management Services

Council	Current kerbside service and landfill	Comments
Taupo District Council	• Refuse bag collection $1.50 per bag • Four contractors in the market • Kerbside sort for recycling • Have own landfill	• Staying in the market helps control bag price for refuse collection (keeps it at a fair and reasonable price) • Envirowaste is Council contractor
Kapiti Coast District Council	• No council service for landfill or recycling kerbside collection • Facilitate waste minimisation	• Bag price has not changed and is still comparable to neighbouring Councils. • Decided in July 2013 to opt out of the kerbside collecting service due to market influences reducing market share of refuse collection. • Put bylaw in place before opting out. • High ratepayer satisfaction with current service • Licensed operators for KCDC to collect information • Focus is on excellent delivery of service and achieving objectives, not concerned too much about how this is done.
Selwyn District Council	• Three wheelie bin kerbside collection service • Some compulsory charges with options for some services • Diverted material currently at 49% for kerbside collection • Regional landfill (Kate Valley).	• Refuse and recycling kerbside service ranked number 1 and 2 in ratepayer satisfaction surveys • Well established (since 2008) • Kate Valley is shared by five Canterbury councils. Transwaste operates the landfill. Transwaste is 50% owned by the Councils and 50% owned by Waste Management. Very well run and managed.
Timaru District Council	• Compulsory three wheelie bin collection system • Has own material recycling facility • Has own composting facility • Has own landfill (Redruth) • Diversion for kerbside collection service at 70%	• Looking to build commercial material recycling facility for drop off material • Work well in the community facilitating education and waste minimisation initiative • Some competition with refuse material being taken out of district makes it difficult to predict waste tonnages and therefore costs for annual plans, and to meet operational budgets.

4. Health and Safety

Health and safety in New Zealand, including the waste sector, will be managed through the soon-to-be Health and Safety Reform Act 2016 (H&S Act). The H&S Act was passed by Parliament in 2015 and is set to become law in April 2016. Primarily, compared to the current framework, the new H&S Act will broaden the range of parties who are responsible for health and safety in the work place. The new H&S Act introduces the concept of a "person conducting a business or undertaking" (PCBU), which extends and clarifies responsibilities beyond employers to principals and other upstream parties. It also introduces a new duty where more than one person can have responsibilities over the same matter, thus broadening the scope of people responsible to consult and coordinate health and safety activities.

The H&S Act will also replace "all practicable steps" in the current legislation with the qualifier of "so far as reasonably practicable". The duty of persons (including PCBU's) under the H&S Act will also move from a hazard-based approach to a risk-based approach – a hazard being any source of potential damage, harm or adverse health effects, while a risk is the chance or probability a person will be harmed if exposed to a hazard. In particular, duty-holders will have a duty to eliminate risk, so far as reasonably practicable and, where not practicable, minimise those risks. A risk-based approach means there is more of a balancing act around identifying the chance or probability that a person will be harmed.

In practice, the H&S Act will place clearer responsibilities on principles and companies / territorial authorities who operate in the waste industry, either directly or through contractors, and require such parties to have a more hands on approach to health and safety. The main responsibilities of all PCBU's (which will include HDC and NCC) will include:

- Ensuring, as far as reasonably practicable, the health and safety of employees, contractors and others;
- Providing and maintaining a safe work environment, adequate facilities, information and training; and
- Monitoring the health and safety of workers and conditions of the work place.

The broadened scope of responsibilities cannot be contracted out of. The penalties under the H&S Act are also harsher than the existing legislation. The penalties are staged ranging from failure to comply with health and safety duties to reckless conduct, with the fines ranging from $100,000 to $600.000 for a person or $500,000 to $3 million for a body corporate. Reckless conduct offences also carry a maximum prison sentence of 5 years.

Waste Management have indicated that they will not be considering any new kerbside collection contracts that involve refuse bag collections due to soon-to-be H&S Act. Whether this statement is true or not remains to be seen.

What is true, however, is that since Christchurch City Council changed from a bag collection for refuse and containers for recycling to a three wheelie bin collection Waste Management have recorded no lost time injuries (LTIs). Previously LTIs were a weekly occurrence.

5. Developing a Short list

5.1 Evaluation Framework

A list of critical success factors have been developed for the project with reference to the Investment Logic Map and considering the project context noted in Section 2.

The Critical Success Factors identified are:

- ***Diversion from landfill*** - to be modelled in naus (naus is a modelling tool used to analyse waste flows and running and evaluating scenarios for different options).
- ***Total System Cost*** - to be modelled in naus.
- ***Technical Risk*** - assessed with reference to application at commercial scale globally, Australasia or NZ.
- ***Health and Safety*** – with recent legislative changes kerbside collection of refuse bags and processing of recyclables the associated Health and Safety risks (sharps, repetitive strain injuries etc.) were taken into consideration.
- ***Resilience/Adaptability*** - assessment of resilience to changes in material quantity or composition.
- ***Market Risk/Opportunity*** - assessment of security of market for end product.
- ***Community acceptance*** - assessment of whether community is likely to be opposed, ambivalent or supportive.
- ***Environmental Impact*** - assessment of whether the net environmental impact is negative, similar or positive compared to the current situation.
- ***Cultural Impact*** – this is tied with the environmental impact and community acceptance, as adverse effects on the land have cultural significance. The beneficial impacts on increased diversion and particularly diverting food waste out of the waste stream for composting and reuse, are also applicable.
- ***Compatibility with system*** - assessment of the level of change required to implement the solution.
- ***Broader economic impact*** - assessment of whether net economic impact is negative, similar or positive compared to the current situation.

Diversion from landfill and total system cost can be modelled based on existing data and assumptions developed based high level system design and understanding of markets for waste technology and products. The remainder of the factors are scored through a workshop based assessment of comparative performance. To provide a repeatable process scoring guidance for each Critical Success Factor has been developed. Further detail is provided in Table 5.1, including guidance on scoring options using these factors.

Consideration was also given to the relative importance of the Critical Success Factors. For the purposes of the option evaluation the key factors are ***Resilience/Adaptability*** and **Total System Cost** with ***Community Acceptance*** and ***Market Risk/Opportunity*** also important.

- ***Total System Cost*** - weighted at 3 times the default.
- ***Resilience/Adaptability*** - weighted at 3 times the default.
- ***Market Risk/Opportunity*** - weighted at 2 times the default.
- ***Community acceptance*** - weighted at 2 times the default.
- The remaining criteria are weighted at a default of 1 x the score out of 5.

Table 5.1 : Critical Success Factors - Scoring Guidance

	Evaluation Criteria	Weighting	Score	
Performance	Diversion from landfill	1		Modelled
Cost	Total System Cost	3		Modelled
Implementation	Tech Risk	1	1	Tech score 1
			2	Tech score 2
			3	It has been done before globally (succeeded)
			4	It has been done before in Australasia
			5	It has been done before in NZ
	Resilience/Adaptability	3	1	Highly sensitive to material composition and quantity
			2	Requires committed tonnage and composition
			3	Technically able to scale up/down
			4	Res Score 4
			5	Minimal financial or tech impact when scale up and down easily, not impact by change in compositio
	Market Risk/Opportunity	2	1	Market score 1
			2	Markets identified but not proven (incl value)
			3	Markets available but not secure (incl value)
			4	Market score 4
			5	Markets for products secure
	Community acceptance	2	1	Widespread opposition likely
			2	Stakeholder 2
			3	Community nuetral
			4	Stakeholders likely to be broadly supportive of change - community benefit
			5	Stakeholders likely to be highly enthusiastic about change
	Env Impact	1	1	Environmental impact
			2	No change from env perspective
			3	Local environmental benefit
			4	Env score 3
			5	Regional environmental benefit
Other	Compatability with system	1	1	Incompatable/complete change
			2	Significant change to system
			3	Add or remove components but some components used in the same way
			4	Existing system but changes in the way it is used
			5	No change to system
	Broader economic impact	1	1	Adverse impact e.g. less employment/$ through region
			2	Broader economic Impact 2
			3	No change in economic impact
			4	Broader economic Impact 4
			5	New Industry, new jobs, …

5.2 Long list Options Considered

As noted above, the Waste Futures project is intended to be an integrated assessment looking at all aspects of the waste management system that are relevant to Omarunui Landfill. This means any solution will contain a range of elements including:

- **Collection** - either kerbside collection (council or commercial) or drop-off at transfer stations. Options for improvement focus on transferring materials from the residual waste collection to materials collected for recycling or recovery.
- **Processing** - processing of residual waste or source separated recycling or organic waste. Examples include composting, bioenergy (wood waste fire boiler), Mechanical Biological Treatment (MBT), Energy from Waste (Gasification) and Anaerobic Digestion. There is also potential to upgrade the current simple sort-line process for the kerbside recycling collection to a modern Material Recovery Facility (MRF).
- **Market/Disposal** - the final destination of materials, either disposal or beneficial use/sale. Examples include existing landfill with extension, transport to a remote landfill (commercial or local authority controlled) or markets for products including compost, mulch and recycling commodities.

There are a large number of combinations of collection, process and market/disposal options that are theoretically possible. In some cases options are not considered feasible and have not been considered in our assessment. The approach adopted is summarised below and in the figures on the following page.

Collections:

- Improved capture of targeted materials[3] has been assumed for all options considered. This would be form an improved education and waste minimisation programme. An improvement of 20% for recycled materials has been assumed and a reduction by 30% of kerbside collected landfill material for the inclusion of an organics kerbside collection;
- Three household **organic kerbside collection** options have been considered (garden, food, and combined food and garden).

Processing/Market/Disposal

- **Anaerobic digestion** has been considered with food organics and combined food and garden organics feedstock;
- **Mechanical Biological Treatment (MBT)** has been considered with residual waste and a dedicated biological module processing, garden, food and combined food and garden feedstocks;
- Omarunui's **New Valley** has been considered with residual waste (as per current with projected growth), stabilised organics from an MBT facility and ash from an EfW facility.
- Transport to a **Commercial Landfill** has been considered with residual waste (as per current with projected growth), stabilised organics from an MBT facility and ash from an EfW facility.
- Transport to a **Local Authority Landfill** has been considered with residual waste (as per current with projected growth), stabilised organics from an MBT facility and ash from an EfW facility.
- **Energy from Waste (EfW)** (gasification with pre-treatment as noted above from an MBT) has been considered for residual waste with ash to landfill.
- In all combined options recyclables are linked to a recycling commodities market and compost to a compost market;
- Provision of **stabilised organics** and **digestate** to a compost market is also included.

5.2.1 Advanced Waste Treatment (AWT)

AWT is influenced by three primary drivers:

- Cost
- Performance, or
- Landfill capacity.

When investigating AWT, Councils will seek to offset their potential financial liabilities from developing landfill capacity and look at procuring a medium to long term disposal solution to mitigate these costs. This is a significant driver for infrastructure development in the UK but a clear financial tipping point has not been reached in Australia for Councils to lead this. Therefore development of AWT solutions has been mostly market led, resulting in either low capacity facilities (proof of concept or trials funded from venture capital) or low risk technologies.

Composting Mechanical Biologic Treatment (MBT) has emerged as the most popular with seven in operation across Australia. Dirty MRFs (those that process general waste) have also been seen in Western Australia and South Australia. Many Councils have opted to pay more per tonne than landfill in order to improve the recovery rates and report performance in line with state targets. If landfill capacity is pressured then the financial burden of the planning process and capital outlay for developing a new landfill site is often used as a trigger for

[3] Due to a combination of increased participation in the kerbside recycling scheme and increased recognition of materials from participating households.

exploring AWT development, the Raymond Terrace ARRT facility is an example that was built under a 20 year contract with Port Stephens Council.

Anaerobic Digestion (AD) facilities have been emerging in the UK market with several successful examples accepting municipal solid waste food wastes and exporting heat or power. The complexities of AD and variability of food wastes presents some significant technical challenges to AD and market investment caution; shown by the high number of planned and consented facilities versus the limited examples of built and operational facilities. The cost viability model relies on a dual income from the gate fee and sales of gas or electricity to a close market (either industry or residential).

AD has had limited success in Australia with two historic AD plants in NSW both having experienced operational inefficiencies and commercial failure. One remains operational but has required additional investment and process changes and mainly services commercial clients.

In the UK, the main investment in AD for waste has been in Wales and Scotland where specific legislation was brought in to require food waste to be collected separately from other materials which meant that the feedstock was very consistent and homogenous in nature. This has been supported with specific government investment into the development of AD facilities.

Also in the UK, AD technology was entitled to apply for additional income on the energy it produced through the Renewable Obligation Certificate (ROC) scheme giving them anything up to an extra $200 per MWh. The recent removal of the ROC scheme has a huge impact on the current business case for AD facilities with a number of organisations reviewing the economic feasibility of their facilities.

AD was considered in the long list evaluation, but due its success relying largely on high levies being put on waste and shortage of available land for landfill, it is not likely to be a viable option for the NZ market unless market conditions change.

5.3 Long-list evaluation

The scenarios considered have been modelled to determine system costs over time and develop estimates of recycling and landfill diversion performance. In summary:

- Diversion increases with the introduction of mechanical biological treatment (MBT) then energy from waste (EfW by gasification);
- The introduction of an organic waste collection service does not have a major impact on diversion. This is related to collection system performance being linked to councils relatively small share of the domestic waste collection market i.e. the system is only available to a small proportion of the total number of households;
- Based on the cost assumptions used, MBT and EfW (Gasification) are significantly more expensive (by a factor of close to 50%) - the modelling suggests increases in diversion are achievable but at significant cost.

Leading options based on the overall assessment are:

- The highest weighted score (60 for *Option 9 Food and Garden Organics and New Valley*) combines an '**optimised' collection system** (food and garden organics) with an **extension at Omarunui Landfill**. This scenario offers low cost combined with a modest increase in diversion from landfill.
- Several other collection arrangements combined with an **extension at Omarunui Landfill** also scored well. These scenarios offer similar combinations of relatively low cost with a modest increase in diversion form landfill;
- Disposal of residual waste to a **commercial landfill** (*Option 20 Commercial Landfill*) scored 59 reflecting relatively low risk and comparable but higher cost than extension at Omarunui. This scenario involves a modest increase in annual cost, no significant improvement in diversion but avoids the need to fund or manage major new infrastructure;

- **MBT** with **stabilised organics to an extended Omarunui Landfill** (*Options 3, 6, 10*). This involves significant investment in new infrastructure (MBT and new landfill airspace at Omarunui) with resulting increase in diversion from landfill; and
- **EfW (gasification) with char disposed of to an extended Omarunui Landfill**. This involves significant investment in new infrastructure (EfW and new landfill airspace at Omarunui) with resulting increase in diversion from landfill.

5.4 Short-listed options

The shortlisted options are set out in Table 5.2 below. The short-list has been established based on the analysis and discussion summarised in the section above.

Table 5.2 : Recommended Short-List

Option Title	Sub-Option	Processing	Disposal
A. Residual Waste to Omarunui Landfill	i. From 2025	Food/Garden to existing	Until 2025 Omarunui Landfill From 2025 - New Valley at Omarunui Landfill
B. Residual waste to Commercial Landfill	i. From 2025	Food/Garden to existing	Until 2025 Omarunui Landfill From 2025 - Commercial Landfill
	ii. From 2020 split with Omarunui	Food/Garden to existing	Until 2020 Omarunui Landfill From 2020 - 30[4] 50% Commercial Landfill, 50% Omarunui Landfill From 2030 - Commercial Landfill
C. Residual waste to MBT	i. From 2025 residual to New Valley with per tonne rate reflecting lower tonnage.	Food/Garden to existing Residual to MBT from 2025 Stabilised organics (ex MBT) to landfill	Until 2025 Omarunui Landfill From 2025 - New Valley at Omarunui Landfill
	ii. From 2020 extending life of Omarunui to around 2030-35 at lower cost than New Valley, then as for i.	Food/Garden to existing Residual to MBT from 2020 Stabilised organics (ex MBT) to landfill	Until 2030[5] Omarunui Landfill From 2030 New Valley at Omarunui Landfill
	iii. From 2025 taking 50% of residual with per tonne rate reflecting lower tonnage	Food/Garden to existing Residual to MBT or landfill from 2025 Stabilised organics (ex MBT) to landfill	Until 2025 Omarunui Landfill From 2025 - New Valley at Omarunui Landfill
	iv. From 2020 taking 50% of residual extending life of Omarunui to approx. 2030 then new valley	Food/Garden to existing Residual to MBT or landfill from 2020 Stabilised organics (ex MBT) to landfill	Until 2030[6] Omarunui Landfill From 2030 - New Valley at Omarunui Landfill
D. Residual Waste to EfW	i. From 2025 ash/char to New Valley with smaller scale unit rate for landfilling	Food/Garden to existing Residual to EfW from 2025 Ash/char (ex EfW) to landfill	Until 2025 Omarunui Landfill From 2025 - New Valley at Omarunui Landfill

[4] Additional years capacity to be assessed in next stage
[5] Additional years capacity to be assessed in next stage
[6] Additional years capacity to be assessed in next stage

Option Title	Sub-Option	Processing	Disposal
	ii. From 2020 extending life of Omarunui to around 2035-40 at lower cost than New Valley	Food/Garden to existing Residual to EfW from 2020 Ash/char (ex EfW) to landfill	Until 2030[7] Omarunui Landfill From 2030 - New Valley at Omarunui Landfill
	iii. From 2025 taking 50% of residual	Food/Garden to existing Residual to EfW or landfill form 2025 Ash/char (ex EfW) to landfill	Until 2025 Omarunui Landfill From 2025 - New Valley at Omarunui Landfill
	iv. From 2020 taking 50% of residual extending life of Omarunui to approx. 2035 then new valley	Food/Garden to existing Residual to EfW or landfill form 2020 Ash/char (ex EfW) to landfill	Until 2030[8] Omarunui Landfill From 2030 - New Valley at Omarunui Landfill

5.5 Details of shortlisted options

5.5.1 Collection System

For the short-list evaluation we assumed that the collection system will be optimised i.e. maximising capture of materials at kerbside and refuse transfer stations. From a modelling/assessment perspective our assumptions included:

- Food and garden organics collection with 30% capture across full domestic waste stream
- Optimised (20% increase in capture - paper, card, plastics) kerbside recycling collection
- Optimised (20% increase in capture - paper, card, plastics, glass, metals, organics) at refuse transfer stations

An additional cost of has been assumed to cover the cost of improving the system based on $5/T for promotion to optimise the collection and $35/T for kerbside garden waste collection.

While outside the scope of the detailed assessment that contributes to the detailed economic case, implementation options will be considered and explored as part of the other components of the Detailed Business Case. Components of implementation may include:

- Working with existing collection providers (contracted to council and private providers) to promote existing recycling collection services to increase participation, capture and improve materials quality;
- Working with existing organics collection providers to increase participation and capture of materials including exploring the potential for incentives for use/provision of organics collection services;
- Considering new/enhanced collection methodology for recyclables (for example multiple containers vs co-mingled), education;
- High level consideration of modifying transfer station layout and communications.

Further details of the assumed characteristics of and requirements for future collection systems are provided in Section 7.

5.5.2 Processing Options

For the short list evaluation some arrangements are assumed to continue as currently configured. Examples include arrangements for collected recyclables (kerbside sort and sort-line) and garden organics (composting

[7] Additional years capacity to be assessed in next stage
[8] Additional years capacity to be assessed in next stage

and bioenergy). A range of food and garden organics are currently processed via existing composting operations and are assumed to continue to be processed in this way.

Four processing/disposal options will be considered as part of the short-list. They are discussed below with key assumptions and sub-options noted.

A Residual waste to Omarunui Landfill New Valley

Option A reflects a continuation of the current situation with an optimised collection system and an extension to the Omarunui Landfill constructed around 2025. Collection, process and treatment costs and flows are similar to current. The modelled landfill costs assumes a gate fee of$83 until 2026 where $90/T for Valley C is then used incorporating capital and operating costs including levy and ETS charges.

Sub-options:

i. From 2025

B Residual waste to Commercial Landfill

Option B replaces an extension to Omarunui Landfill with transport of residual waste to a commercial landfill, commencing either in 2020 (to extend the life of the current landfill area) or 2025 once the current area is completed.

The modelling assumes a transport distance of 210 km each way, $0.30 $/T.km and $50/T residual waste at the gate. Giving a total fee of $176 /T.

Sub-options:

i. From 2025

ii. From 2020 with 50:50 split with Omarunui until completed and then 100% to commercial landfill.

C Residual waste to MBT (stabilised organics to Omarunui Landfill)

Option C involves processing of residual waste through a Mechanical Biological Treatment (MBT) facility to remove additional recoverable materials, stabilise residual organic material and reduce the volume of residual waste requiring disposal. Sub-options will consider sizing the MBT facility for 100% or 50% of the projected residual waste stream and early implementation (from 2020, to extend the life of the current landfill area).

The modelling assumes a MBT cost (CAPEX of $24M, OPEX of $126) incorporating, operating costs and revenue from recovered materials. The range is based on information from Australian markets (Port Stevens and Coffs Harbour), with the selection of $200/T based an estimated cost for the NZ context. This needs to be tested and verified. The reduction in residual waste requiring disposal is assumed to be in the order of 30%.

Where CAPEX figures have been used we have assumed it will be paid off over 20 years with 6% borrowing rate

Sub-options:

i. From 2025 residual to New Valley with per tonne rate reflecting lower tonnage.

ii. From 2020 extending life of Omarunui to around 2028, then as for i.

iii. From 2025 taking 50% of residual with per tonne rate reflecting lower tonnage

iv. From 2020 taking 50% of residual extending life of Omarunui to 2026 then new valley

D Residual waste to EfW (ash to Omarunui Landfill)

Option D involves processing of residual waste through an Energy from Waste (EfW, assuming gasification) facility to remove additional recoverable materials, recover energy and produce an ash product. For the

purposes of modelling the ash is assumed to be landfilled. Sub-options will consider sizing the EfW facility for 100% or 50% of the projected residual waste stream and early implementation (from 2020, to extend the life of the current landfill area).

The modelling assumes an EfW cost (CAPEX of $71M, OPEX $225), operating costs and revenue from recovered materials. The range is based on information from Australian markets, with the selection of $250/T based an estimated cost for the NZ context. It is important to note that the costs are higher than the estimated costs being used by providers of gasification plants in NZ market place to councils, which is nearer to $80-$100. The main driver for the difference in costs is that the cost of pre-treatment of the waste to be suitable for processing through a gasification technology, without which facilities have failed to operate. This needs to be tested and verified. The reduction in residual waste requiring disposal is assumed to be in the order of 65%.

Sub-options:

i. From 2025 ash to New Valley with smaller scale unit rate for landfilling

ii. From 2020 extending life of Omarunui to beyond 2040 at lower cost than New Valley

iii. From 2025 taking 50% of residual

iv. From 2020 taking 50% of residual extending life of Omarunui to approx. 2030 then new valley

Where capex figures have been used we have assumed it will be paid off over 20 years with 6% borrowing rate

5.5.3 Review of Options

SLR performed a peer review of the Jacobs report with regards to the viability of the options and how the evaluation was completed. The peer review commented on issues that were addressed by Jacobs. The main comments and how they were addressed are as follows:

1. Questions were asked about source and validity of data and more historical information. This was addressed by providing more historical information about waste data and comparing waste data and trends from other Councils to validate the assumptions made for waste projections.

2. How the increased capture of recyclable material and organic material would be achieved, and how Councils will take control of the waste streams. This was addressed by indicating in more detail what services would be introduced and, from other Councils experience from doing this, likely participation rates and diversion that could be achieved. The estimates for diversion are conservative. Both Councils need to work together on the kerbside collection service, and this has been highlighted in the strategy going forward to be addressed and agreed on.

3. Waste processing options. The SLR report indicated that Anaerobic Digestion of waste material is common and successful in the UK and Europe, and is well understood and technically proven. Jacobs disagree with this statement as Anaerobic Digestion is a complex process that requires significant pre-treatment of materials. The UK and Europe examples are successful to the legislative environment and subsidies that exist in UK and Europe. It is worthy to note that some of these subsidies have been removed recently in the UK which makes this technology doubtful.

4. The cost assumptions for processing of waste material were not clear. The values used for processing and were clarified and examples given of where these values came from.

5. Thermal processing of waste material. The SLR review indicated that there are significant risks with the development of gasification technology to process residual waste material, and SLR would have significant reservations over adopting a funding approach for this technology. Jacobs are in agreement with recommendation.

6. Short-list Evaluation

Details on each of the options considered are presented in Appendix B.

6.1 Environmental/Planning/Health Impact

Appendix B provides detailed comments on planning and environmental issues for each of the options considered. In summary, there are no clear 'show stoppers' from a planning or environmental perspective. There are however a number of considerations including:

- Planning instruments relevant to various activities and locations
- The status of gasification or other waste to energy technology under the National Environmental Standards for Air quality
- The implications of community support or opposition for various options in the context of the consent process.

From an environmental impact and planning perspective, a waste to energy technology is likely to have the highest risk for gaining a consent for a discharge to air. This could be problematic when dealing with a waste stream as a fuel source that has unknown product feed materials, and defining what may be in any discharges to air.

6.2 Technology

Appendix B provides detailed comments on technology considerations for the options considered.

There are two valleys available for additional landfilling at Omarunui and preliminary design and cost estimates have been developed to inform this assessment. Potential sources of construction materials have been considered but there remains some uncertainty about suitability and quantity available.

Both EfW and MBT are potentially applicable at 60-70,000 TPA but EfW in particular becomes increasing problematic at lower quantities. MBT has been successfully implemented at a comparable scale (as low as 40,000 tonnes per annum) in Australia while EfW in the 60-70,000 Tonnes per annum scale has yet to be implemented in Australasia.

There are a wide range of costs quoted for advanced technologies covering capital, operating costs as well as gate rates. As for the long list evaluation process, a range of costs have been considered recognising that real costs in New Zealand will only become apparent once a facility has been constructed and operated for an extended period of time. While cost information from Australia and the UK provide an indication of potential costs in New Zealand both capital and operating costs will vary due to a range of factors including:

- Labour rates
- Manufacturing costs
- The value of product and/or energy

Experience in Australia also suggests that differences in waste characteristics can have a significant impact on the cost viability and process capability of advanced waste treatment. A market driver is also the cost of electricity to make AWT technologies viable. If the market cost of electricity is high than AWT technologies that produce energy or electricity become more viable. Given NZ sources most of its electricity from renewable sources (hydro and thermal) there is unlikely to be a market driver from an energy generation perspective to implement a waste from energy plant.

From a technology perspective there are some significant risks associated with introducing new (to New Zealand) technology in Hawkes Bay. There is also some uncertainty in availability of suitable construction materials for an extension at the Omarunui Landfill site.

The lowest risk and therefore preferable option from a technology perspective is to dispose of materials at a commercial landfill.

The next preferable options involve extension at Omarunui followed by treatment of a portion of the waste stream. The application of MBT in Australia and a similar scale puts it ahead of EfW from a technology perspective in this assessment.

6.3 Modelling - mass flow and financial

As for the previous analysis, each of the shortlisted options have been modelled from a mass flow and cost perspective to provide an indication of their comparative performance. The modelling has incorporated a number of assumptions; these are set out in Appendix B.

Figure 6.1 : presents a summary of cumulative costs for each of the short-listed options. Costs are modelled in terms of an annualised cost i.e. any capital investment is incorporated into the annual cost over the life of the asset. The increase in growth in cumulative spend from 2020 or 205 reflects the timing of implementation of alternatives or replacements for Omarunui.

Based on the assumptions used Figure 6.1 : shows that Option A (Extension of Omarunui Landfill) provides the lowest overall cost. As noted above this assessment spreads the capital cost i.e. hides the capital investment to establish a new landfilling area (estimated at NZ$10M) required in the lead up to the completion of the current Area D landfilling operation.

JACOBS

Figure 6.1 : Cumulative Capital and Operating Costs from 2014 to 2040

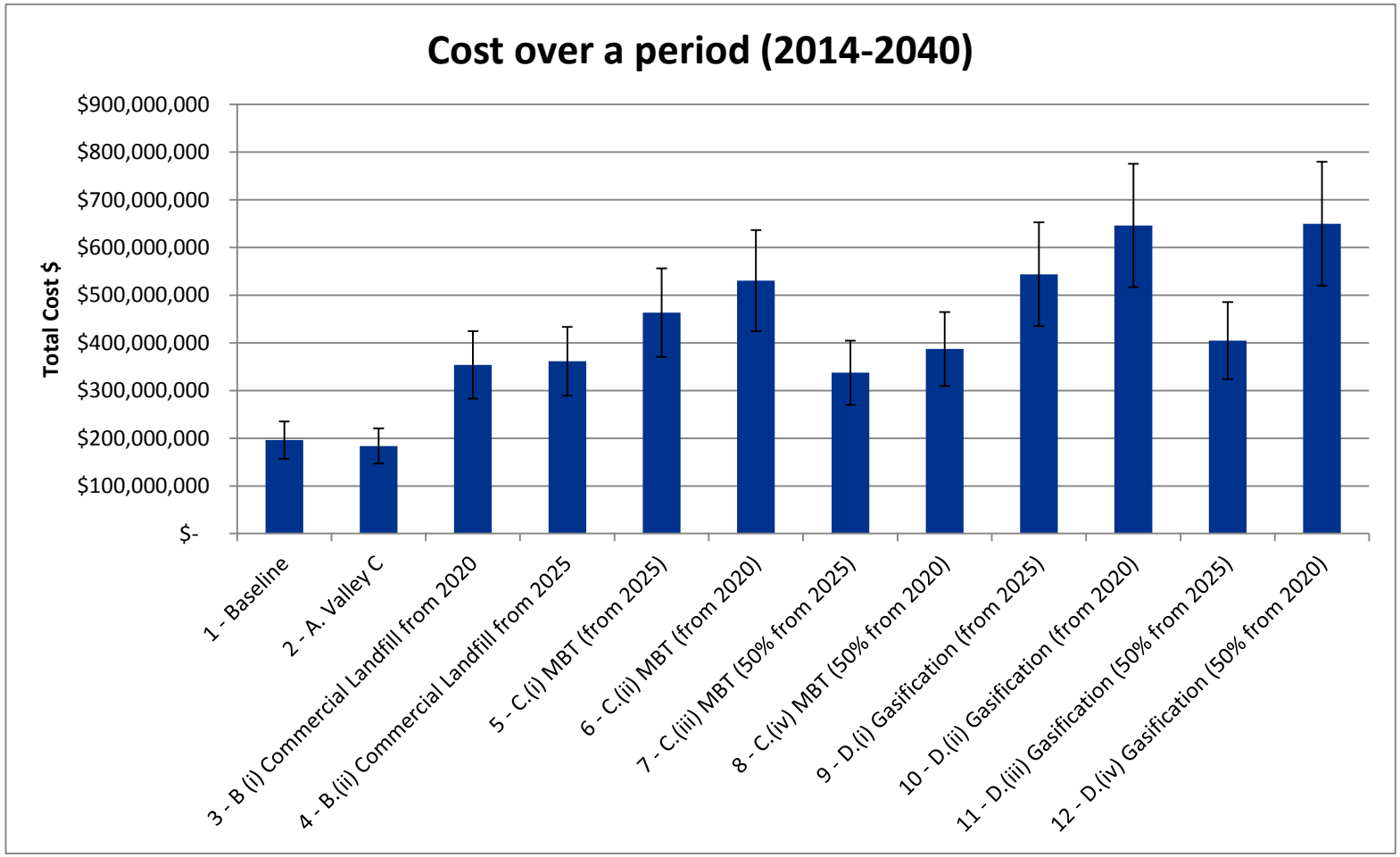


Figure 6.2 summarises the cumulative disposal to landfill with the red horizontal line indicating the remaining capacity for the existing area at Omarunui. The various treatment options provide an opportunity to delay the completion of the current area with EfW options having the greatest impact.

The cumulative disposal figures take into account an optimised collection system decreasing the amount of material requiring treatment and/or disposal. They also take into account reduction in materials via MBT or EfW processing. A key point from this analysis is that all of the options considered will require access to a new disposal facility once the current area at Omarunui is full, anywhere from 2025 to after 2040. This means that overall system costs reflect the cost of developing any additional treatment infrastructure as well as the cost of developing new landfill capacity or making use of commercially available landfill capacity.

JACOBS

Figure 6.2 : Cumulative Residual Waste Disposal from 2014 to 2040

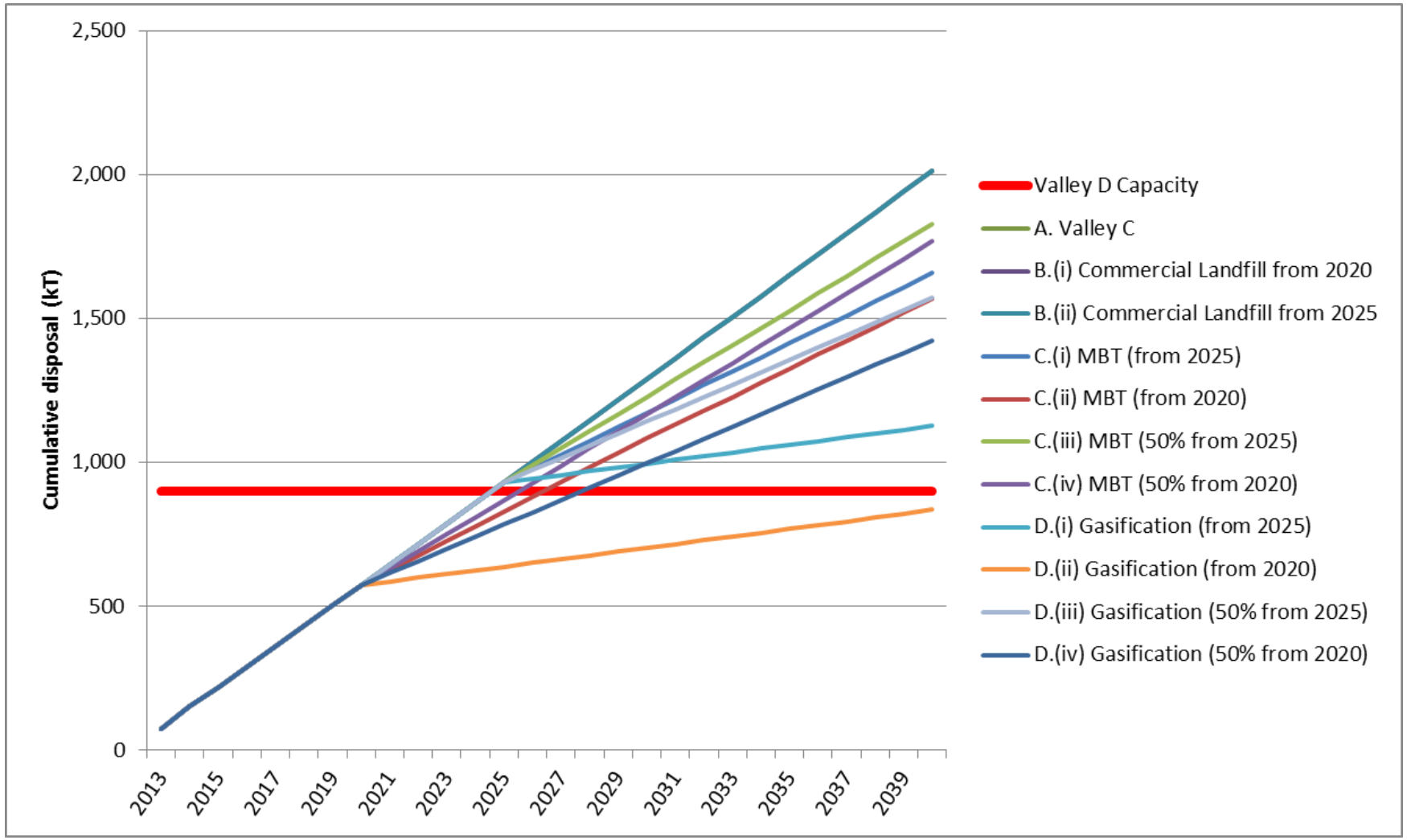
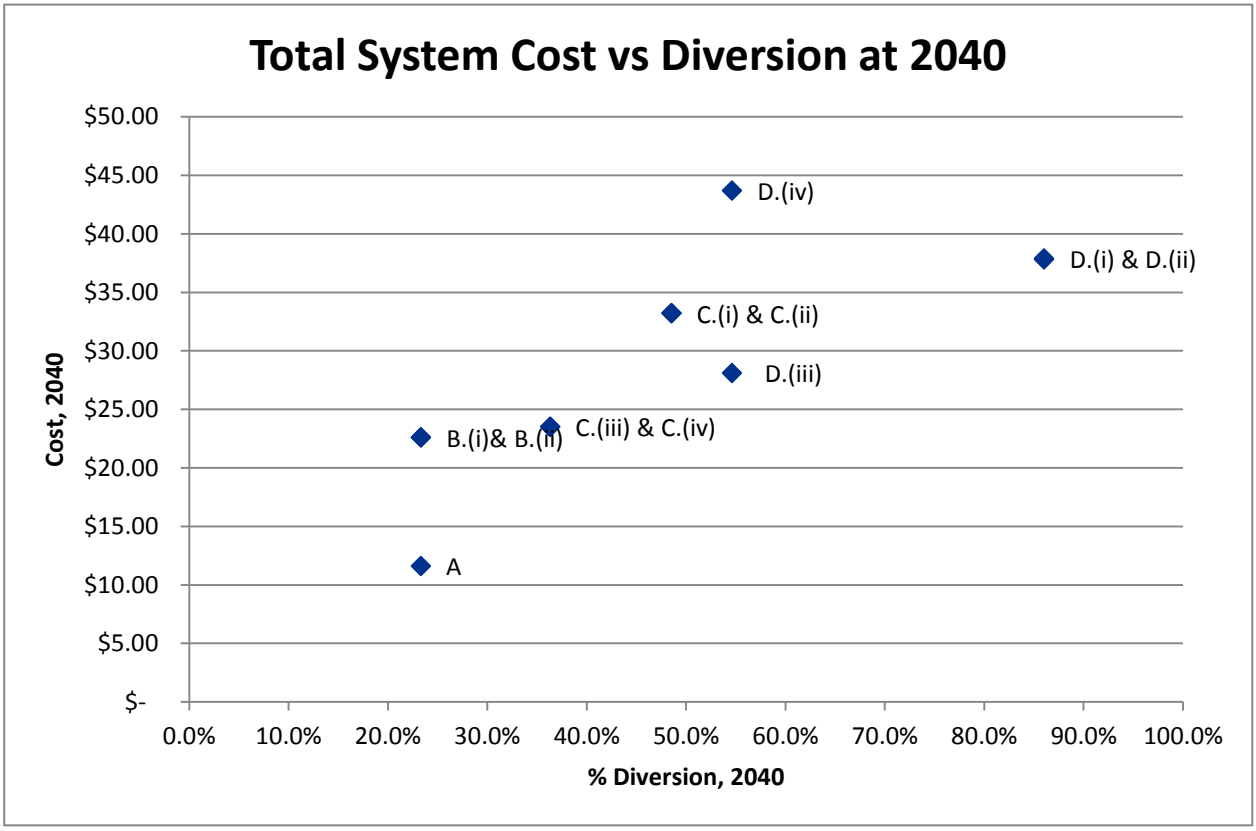


Figure 6-3 presents total system cost vs. diversion in 2040 for the short-listed options. The costs reflect collection, processing and disposal costs. Disposal costs vary with the total quantity of material accepted at landfill, increasing on a per tonne basis as the total quantity reduces.

Figure 6-3 : Cost vs. Diversion



In general, increased annual cost provides increased diversion. However, for similar overall system cost the modelling suggests EfW will provide a higher level of diversion. This is based on assuming that stabilised material from the MBT is landfilled. If markets can be found for the stabilised organics component of the MBT outputs diversion could increase and costs decrease through avoiding landfill. During the development of the short-list the project team concluded that finding markets for this material would be challenging in Hawkes Bay

6.4 Integrated Assessment

A Multi Criteria Assessment was used to summarise the assessment of options. The Total Cost, Landfill Diversion and Recycle columns reproduce outputs from the option modelling. The Unweighted and Weight scores reflect the full multi-criteria assessment drawing on the discussion in this section. A full summary of the assessment is provided in Appendix C.

The green cells highlight the best scores for each column. In summary:

- Landfill related options score well from a cost perspective
- MBT and EfW perform well with respect to diversion of waste from landfill
- The unweighted multi-criteria assessment favours Options A and advanced waste treatment (MBT or EfW) applied to 50% of the waste stream.

- The weighted multi-criteria assessment increases the influence of resilience and cost and favours options involving landfill with advanced waste treatment (MBT or EfW) applied to 50% of the waste stream also scoring well.

Table 6.1 : Assessment of Options using Multi Criteria Analysis

Option	Total Cost ($M in 2040)	Landfill Diversion (% in 2040)	Recycle (% in 2040)	Unweighted Score	Weighted Score
A. Valley C	10.9	23.3%	23.3%	34	60
B.(i) Commercial Landfill from 2020	12.9	23.3%	23.3%	31	56
B.(ii) Commercial Landfill from 2025	12.9	23.3%	23.3%	31	56
C.(i) MBT (from 2025)	23.6	48.5%	28.5%	33	47
C.(ii) MBT (from 2020)	23.6	48.5%	28.5%	33	47
C.(iii) MBT (50% from 2025)	17.1	36.3%	25.9%	34	54
C.(iv) MBT (50% from 2020)	17.1	36.3%	25.9%	34	54
D.(i) Gasification (from 2025)	24.4	86.0%	29.2%	31	43
D.(ii) Gasification (from 2020)	24.4	86.0%	29.2%	31	43
D.(iii) Gasification (50% from 2025)	17.6	54.6%	26.2%	34	54
D.(iv) Gasification (50% from 2020)	17.6	54.6%	26.2%	34	54

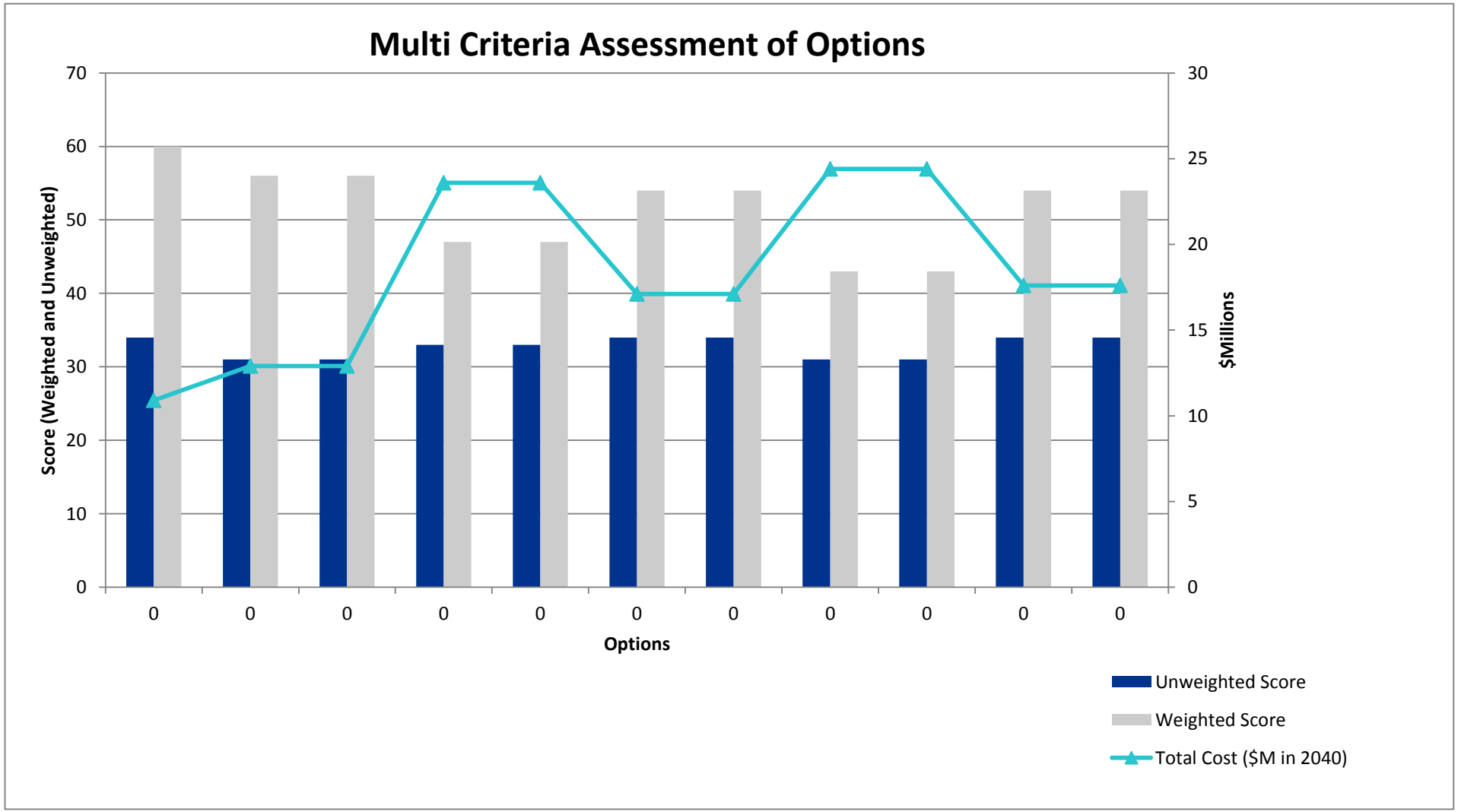
Figure 6-4 summarises the outcome of the multi-criteria assessment presented weighted and unweighted score (against the left hand axis) and total system cost in 2040 (against the right hand axis). The ideal option would have a very high weighted score combined with a low total system cost.

Figure 6-5 sets out the Multi-Criteria Assessment for the Overall Performance Summary of the top options for each of scenarios and shows the relative performance for recycling and diversion compared to the overall costs. The error bars for the total cost are set at plus and minus 20%.

Figure 6-6 sets out the estimated total cost (this includes both disposal options and a kerbside collection) per household in 5 yearly intervals showing how each option increases over time, it is noticeable that from 2020 that costs for the commercial landfill and Gasification and 2025 for the MBT option begin to diverge from Valley C option and by 2040 are almost twice as expensive for the householder

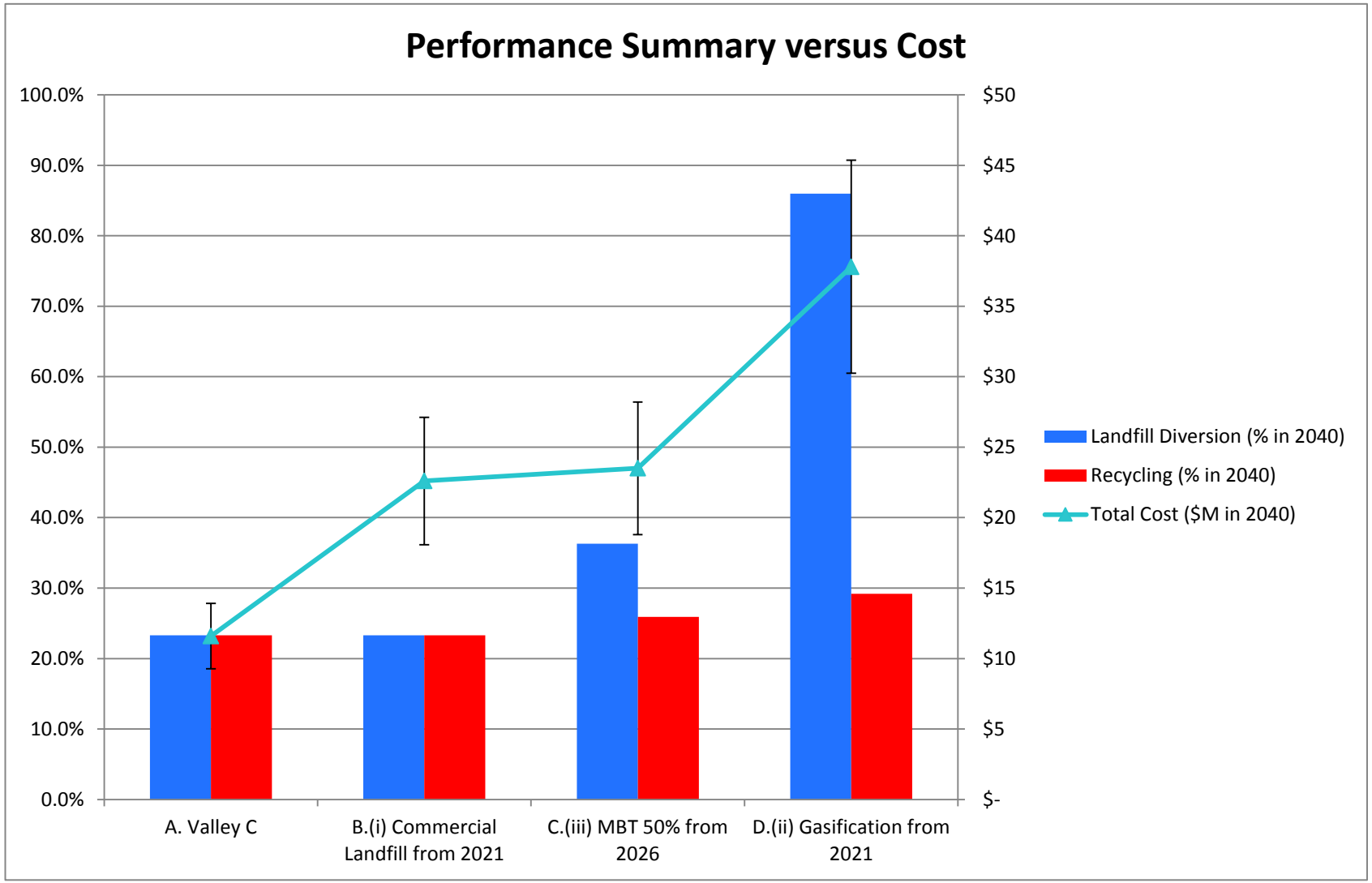
JACOBS

Figure 6-4 : Multi-Criteria Assessment



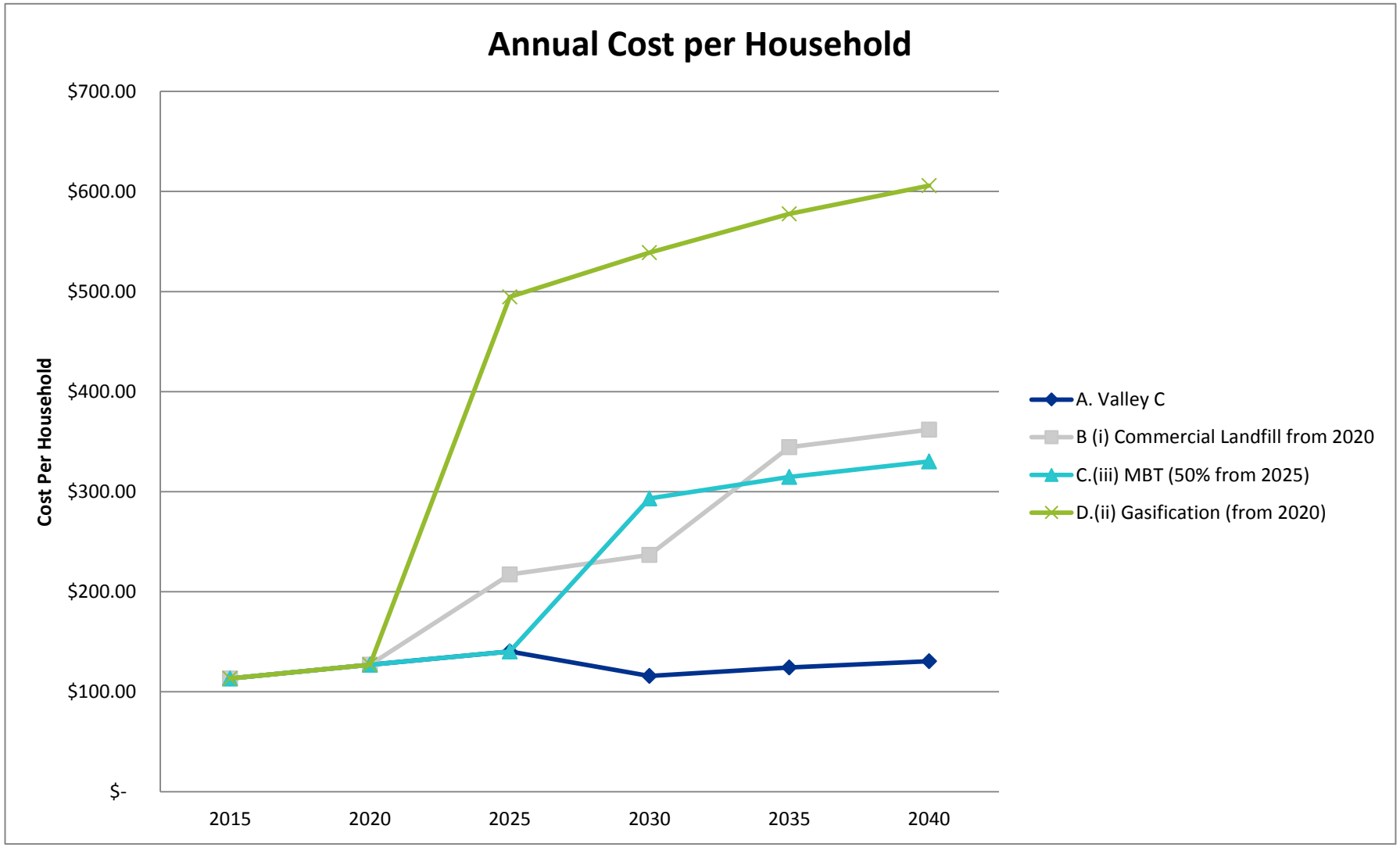
JACOBS

Figure 6-5 : Multi-Criteria Assessment - Performance Summary versus Cost (note that error bars for Total Cost are +/- 20%)



JACOBS

Figure 6-6 : Annual Total Cost per Household at 5 Year Intervals



6.5 Sensitivity Testing

As noted above there are a several key assumptions that have a significant bearing on the outcome of the integrated assessment. These include costs associated with the MBT and EfW options, the impact of changes in the quantity of waste on per tonne costs of various options.

Cost variability relates to a range of factors including scale (smaller is more expensive on a per tonne basis), revenue streams, allocation of risk and local construction and operational costs (wages, manufacturing capability). As for the analysis to develop a short-list, a cost range of each option has been considered suggesting that there is some overlap between MBT and EfW and between EfW and Landfill options.

The default costs adopted for each option ($200/tonne for MBT and $250 per tonne for EfW) are consistent with per tonne costs incorporating the cost of capital and any revenue streams. Respondents to an Expression of interest process as part of the Waste Futures project have indicated that they could process materials at a comparable cost to landfill in Hawkes Bay ($80-90/tonne), although this is not based on actual operational cost, only theoretical.

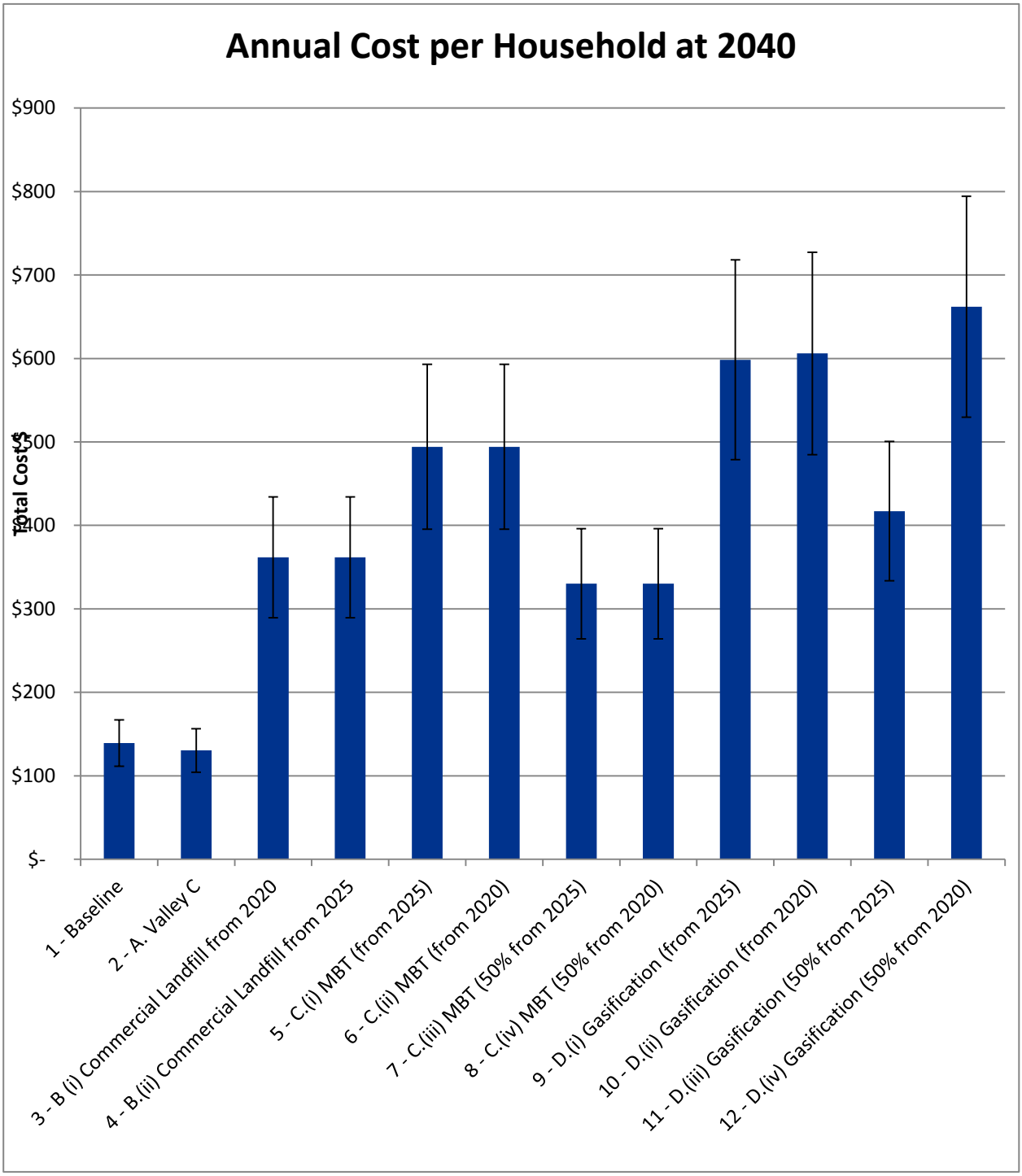
Variation in the quantity of waste requiring treatment or disposal will also have an impact on the cost and performance of various options. Preliminary analysis for landfill suggests costs will start to increase below around 50,000 tonnes per annum. MBT is applied at annual tonnages down to 40,000 tonnes per year and the costs adopted reflect this scale. Smaller scale plant will incur a higher per tonne cost. EfW typical operate at annual tonnages in excess of 60,000 tonnes per year, a smaller scale operation will operate at a premium.

Both MBT and EfW are designed to process waste of a specified quantity and composition. Variation in the amount and characteristics of the waste material introduces risk of failure from a technology and commercial viability perspective. The same applies to landfill operations but with the ability to redesign staging to account for an increase or decrease in waste volumes requiring disposal.

The MBT and EfW based options remain significantly more expensive at a system level when compared with landfill based on international cost ranges. This means their overall score in the multi-criteria assessment is lower than the landfill based options, particularly when the higher weightings for cost and adaptability are factored in. Based on the information used to derive the CAPEX and OPEX costs for the facilities it was thought prudent to carry out an additional sensitivity to take account of the variance of the input cost figures being +/- 20%.

Figure 6-7 below shows the annual cost per household in 2040 and demonstrates even when the variance is taken into account that the Baseline and Option A Valley C are still the most cost effective.

Figure 6-7 : Annual Cost per Household at 2040



6.6 Refining the preferred option

The best option from the multi-criteria assessment when all factors are taken into account is to progress with development of the next cell at Omarunui Landfill combined with an optimised collection system (enhanced kerbside recycling collection with the addition of a kerbside organics collection). Based on the modelling completed to date this will result in a modest increase in diversion while keeping costs similar to those incurred currently.

The modelling is based on conservative estimates for increasing the diversion of recyclables and organics from the waste stream.

6.7 Shortlist Assessment - Conclusion

Based on the current performance of the collection system there are opportunities to improve performance of the collection system (kerbside and transfer station network). This could be achieved by a combination of

- Improving performance of kerbside recycling (increased capture of materials from existing system users, new system users). This could be through common communications between Councils and commercial collectors e.g. shared advertisements that have common themes about what can and cannot be collected. From the recent waste surveys certain locations could be targeted that have low set out rates for recycling services.
- Targeting household organics via existing commercial collection providers
- Community based projects around ways to reduce food waste, budgeting for food purchases, household composting initiatives
- Targeting the capture of recoverable materials (recycling, composting, bioenergy) in collected C&I and C&D
- Targeting increased diversion of materials at transfer stations (MSW, C&I and C&D)

Based on the discussion above the **preferred option** involves:

- **Optimising the collection system** to maximise the diversion of materials from landfill
- Working towards development of **additional landfill capacity at the Omarunui Landfill**

For optimising the collection system the changes that may occur for both Councils would be:

1. Changing refuse collection to a fortnightly wheelie bin collection with a volume of 140 litres. This provides more volume than one 60 litre refuse bag per week, and means the waste is safely contained and easily lifted by a kerbside collection truck.

2. Changing to a fortnightly collection service for recycling (this would be on the alternate week to refuse collection) with a wheelie bin volume of 240 litres. This provides significantly more volume that the crates that are used presently, and would enable a larger volume of material to be collected. The type of material collected needs to be finalised.

3. Having a weekly 140 litre wheelie bin organics collection. This size of bin enables most organic materials to be collected (food and garden waste), and also means the bin will not be too heavy for kerbside collection (this occurs with 240 litre organic bins)

This range of bins has shown to improve the amount of diversion significantly. Selwyn District Council implemented a three bin system over a 3 year period that started in 2006. The diversion rate of kerbside collected material has increased from 29% in 2010 to almost 50% in 2015.

It is important to note that while landfill may not be considered to be as environmentally friendly as thermal treatment, a well-run modern and fully contained landfill with effective leachate management and gas capture/utilisation is considered to be an appropriate technology for the Councils within the current legislative and economic framework.

International waste management practice reflects a wide variety of local legislative and economic drivers and requirements. These have influenced the business cases for the selection and application of alternative waste management methods to landfill.

In Europe, legislative drivers have been applied which include statutory recycling targets and targets for the diversion of biodegradable wastes from landfill. These have encouraged the development of extensive

recycling programmes and alternatives treatment methods to landfill disposal. Also within Europe, the energy captured from the incineration of wastes (either in the form of electricity and/or heat) has been defined as 'renewable energy', thereby enabling financial subsidies to support alternative treatment technologies which have consequently improved the economic cases for such technologies.

Other drivers which have encouraged the move from landfill to alternative disposal methods include limitations to the development of new landfill capacity or 'landbank', as notably demonstrated by limitations to new landfill development in Japan.

If such drivers are applied to the local context, the overall economic and business cases for alternative waste management options for the Councils may change in the future and make alternative options more attractive in the medium to longer terms.

6.8 High Level Risk Assessment for the Preferred Option

As part of developing the detailed economic case the project team worked through a preliminary assessment of the risks associated with the preferred option. Appendix D summarises the risks identified (opportunities and threats) and potential strategies to realise opportunities or mitigate threats. The assessment is summarised in Table 6.3 below for an Optimised Collection System.

As part of the Risk Assessment we evaluated recent information submitted by Tonkin & Taylor (Report sent to Martin Jarvis, HDC, dated 8 March 2016). The report outlined the impacts of a possible early closure of the Omarunui Landfill (this may occur if alternative technologies arise that are cost competitive with the gate fee). The whole of life costs were calculated on a single waste scenario. Table 1 from the report is repeated in Table 6.2 below.

Table 6.2 : Whole of Life Landfill Costs based on 72,000 tonnes per annum

	Full Design Life	Closure after Stage 4
Landfill Life, excluding aftercare (years)	36	19
Total waste intake (tonnes)	2,616,000	1,376,000
Total Cost per tonne	**$56.50**	**$62.44**

The shortened life of the landfill with an earlier closure is reflected in an increase in the total cost per tonne. However, this is still below the current gate fee of $83/tonne and allows a safety margin for Councils in terms of movement from charges such as the MfE landfill levy and ETS.

It also indicates that any Energy from Waste technology needs to be profitable at a quite a low rate long term before it would become economically viable to implement this in the New Zealand context. This technology would only become viable if substantial energy or diversion incentives were in place at a central government level, electricity prices rose and legislation changes occur. We consider the alignment of these to occur as low as well as the technical and economical viability of Energy from Waste technologies to succeed.

Table 6.3 : Risk Summary Assessment of Preferred Option – Optimised Collection System with Extension of Landfill

Activity	Risk	Strategy
Optimise Collection	Opportunities • Support from waste sector • Sustainable end markets • Community supportive	• Early discussion on potential changes (and objectives) • Council procurement, focus on quality of collected material • Effective communications, careful system design

Activity	Risk	Strategy
	Threats • Community not supportive • Cost increases • H&S issues for collections • Lack of markets for materials	• Effective communications, careful system design • Clear business case, careful system design • Proactively manage H&S, link to good practice in NZ and globally • Proactively manage, careful system design Council procurement, focus on quality of collected material
Extension of Landfill at Omarunui	District Plan Requirements	• Existing Designation – subject to specific Management Plan • Outline Plan (s176A)
	Technologies become such as Energy from Waste with a lower gate fee	• Review technoloige every five years (national and international) • Ongoing dialogue with waste management companies regarding performance of this technology
	HBRC Requirements	• Air Discharge Permit • Discharge to land • Water permit • Leachate to water
	Consentability	• Represents extension of an existing activity within current operational site • Outline Plan only required (not notified). • NOR application if needed to alter designation outside identified areas.
	Overall Comment	• Expansion is specifically anticipated and provided for by the District Plan and associated Management Plan
	Commercial issues	• Transfer + disposal costs need to be comparable to alternatives (transport south) • Need to consider the impact of reducing tonnage on per tonne costs

7. Strategy for Implementation

Both HDC and NCC need to work together to have an integrated approach to waste management.

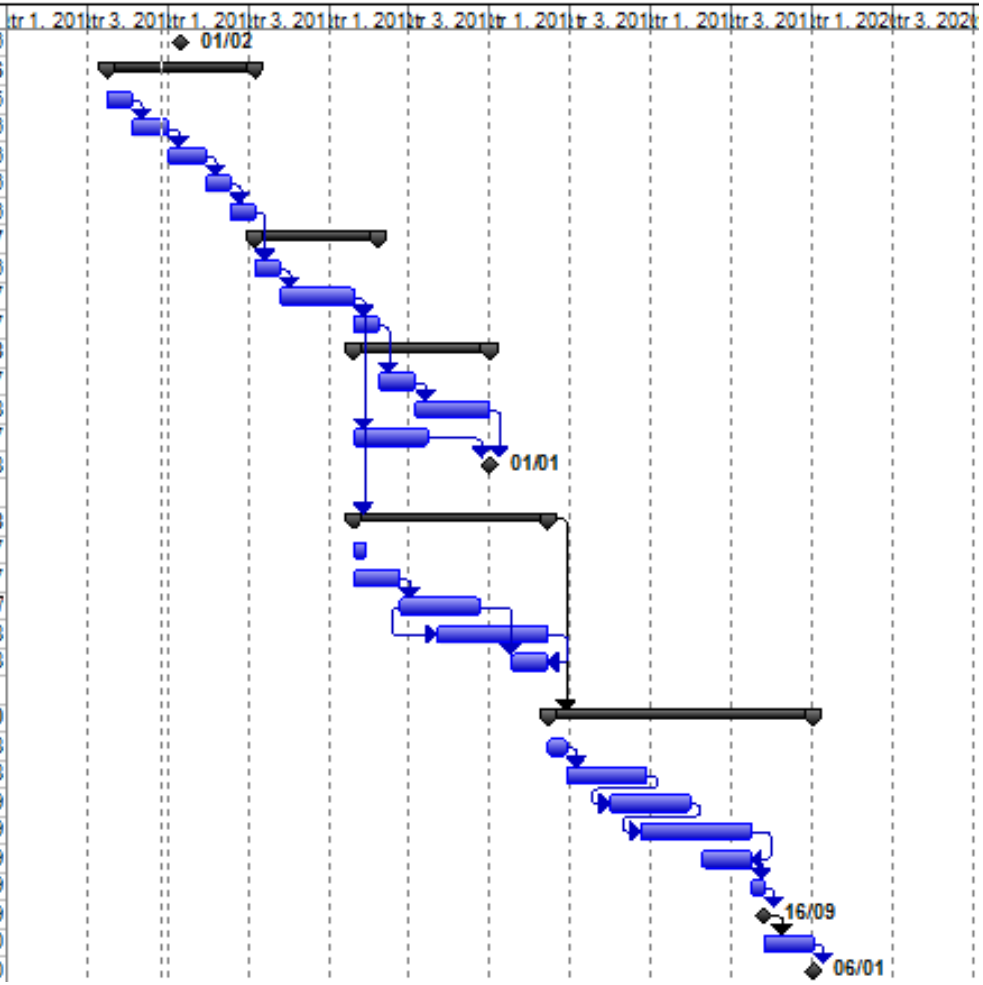
Due to simple nature of the preferred solution, the main investment and timeline will be in the extension of the landfill with minimal investment required to collection structure. Figure 7-1 on the following page outlines a strategy and timeline for HDC and NCC to develop the landfill element of the project

Figure 7.2 on the next page illustrates an implementation programme for the kerbside collection. This will need to be finalised depending on current contract terms and conditions and the procurement strategy required by both Councils.

JACOBS

Figure 7-1: Landfill Development Programme

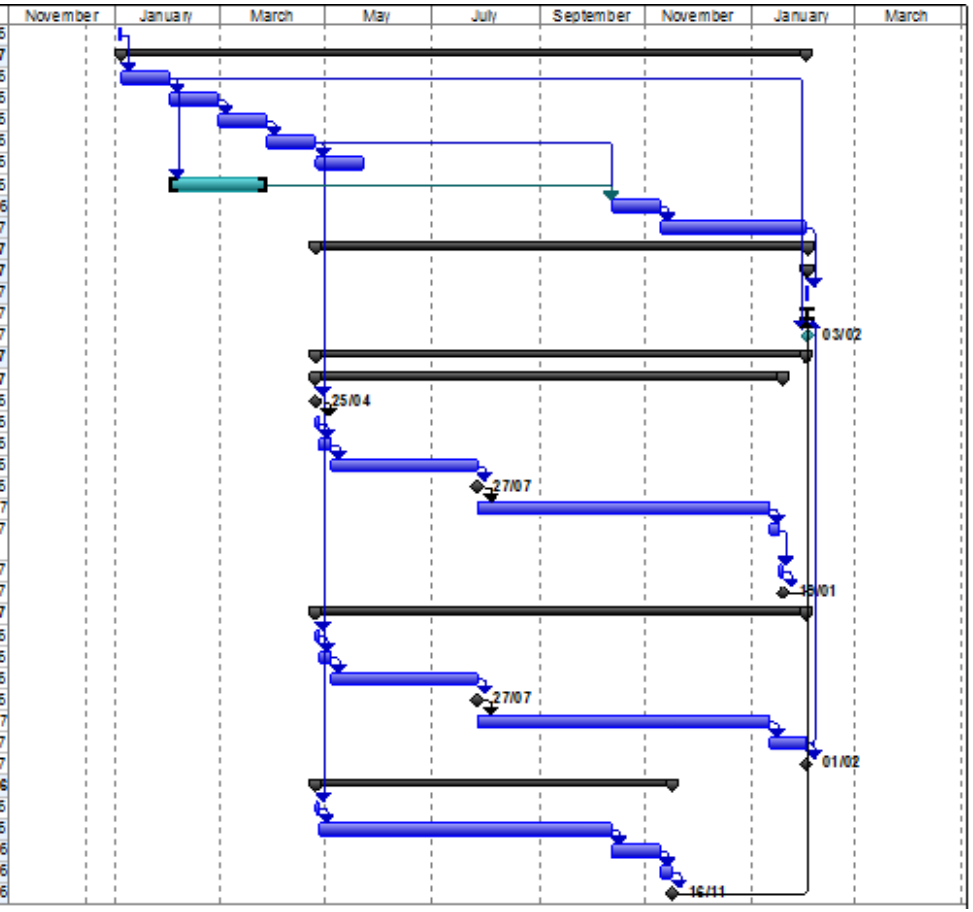
Task Name	Duration	Start	Finish
Project Start	0 days	Mon 01/02/16	Mon 01/02/16
Plan Project	**240 days**	**Tue 18/08/15**	**Mon 18/07/16**
Confirm Business Need	2 mons	Tue 18/08/15	Mon 12/10/15
Confirm Project Governance procedures	3 mons	Tue 13/10/15	Mon 04/01/16
Develop detailed business case	3 mons	Tue 05/01/16	Mon 28/03/16
Develop Procurement strategy and risk allocation	2 mons	Tue 29/03/16	Mon 23/05/16
Confirm Business Investment Strategy	2 mons	Tue 24/05/16	Mon 18/07/16
Procurement	**200 days**	**Tue 19/07/16**	**Mon 24/04/17**
Develop and Issue contract documents	2 mons	Tue 19/07/16	Mon 12/09/16
Procurement of Contractor/Partner	6 mons	Tue 13/09/16	Mon 27/02/17
Final Business case developed	2 mons	Tue 28/02/17	Mon 24/04/17
Planning & Permitting	**220 days**	**Tue 28/02/17**	**Mon 01/01/18**
Development application including ERA	3 mons	Tue 25/04/17	Mon 17/07/17
Development application assessment period	6 mons	Tue 18/07/17	Mon 01/01/18
obtain other necessary consents/licences	6 mons	Tue 28/02/17	Mon 14/08/17
all necessary consents in place	0 days	Mon 01/01/18	Mon 01/01/18
Front-end Engineering & Design	**315 days**	**Tue 28/02/17**	**Mon 14/05/18**
Site surveys (if required)	4 wks	Tue 28/02/17	Mon 27/03/17
Ground investigations (if required)	15 wks	Tue 28/02/17	Mon 12/06/17
Building, civils and infrastructure design	26 wks	Tue 13/06/17	Mon 11/12/17
Process design	36 wks	Tue 05/09/17	Mon 14/05/18
Construction planning (H&S plans, etc.)	3 mons	Tue 20/02/18	Mon 14/05/18
Construction Stage	**430 days**	**Tue 15/05/18**	**Mon 06/01/20**
Site mobilisation and enabling works	6 wks	Tue 15/05/18	Mon 25/06/18
Civils and infrastructure works	26 wks	Tue 26/06/18	Mon 24/12/18
Building works	26 wks	Tue 02/10/18	Mon 01/04/19
M&E and process technology installation	36 wks	Tue 11/12/18	Mon 19/08/19
Grid connections for Gas Engines	16 wks	Tue 30/04/19	Mon 19/08/19
Cold commissioning	4 wks	Tue 20/08/19	Mon 16/09/19
Commissioning waste deliveries commence	0 days	Mon 16/09/19	Mon 16/09/19
Hot commissioning	4 mons	Tue 17/09/19	Mon 06/01/20
Facility operation date/take-over by Councils	0 days	Mon 06/01/20	Mon 06/01/20



JACOBS

Figure 7.2: Kerbside Collection Programme

Task Name	Duration	Start	Finish
Project Start	1 day	Mon 04/01/16	Mon 04/01/16
Plan Project	**282 days**	**Tue 05/01/16**	**Wed 01/02/17**
Confirm Business Need	1 mon	Tue 05/01/16	Mon 01/02/16
Confirm Project Governance procedures	1 mon	Tue 02/02/16	Mon 29/02/16
Develop detailed business case	1 mon	Tue 01/03/16	Mon 28/03/16
Develop Procurement strategy and risk allocation	1 mon	Tue 29/03/16	Mon 25/04/16
Confirm Business Investment Strategy	1 mon	Tue 26/04/16	Mon 23/05/16
Agree New policies	2 mons	Tue 02/02/16	Mon 28/03/16
confirm revised pricing costs	1 mon	Thu 13/10/16	Wed 09/11/16
Implement by laws to support policies	3 mons	Thu 10/11/16	Wed 01/02/17
Service Change rollout	**203 days**	**Mon 25/04/16**	**Fri 03/02/17**
Communications	**1 day**	**Thu 02/02/17**	**Fri 03/02/17**
Communicate new policies and costs	1 day	Thu 02/02/17	Thu 02/02/17
service launch	1 day	Thu 02/02/17	Thu 02/02/17
Periodic publicity every 3 months	0 days	Fri 03/02/17	Fri 03/02/17
Collection Serivce	**202 days**	**Mon 25/04/16**	**Wed 01/02/17**
Vehicle Provision	**193 days**	**Mon 25/04/16**	**Thu 19/01/17**
Schedule Collection Rounds	0 days	Mon 25/04/16	Mon 25/04/16
Review Fleet Requirement	2 days	Tue 26/04/16	Wed 27/04/16
Finalise Vehicle Specifications	5 days	Thu 28/04/16	Wed 04/05/16
Procure Vehicles	3 mons	Thu 05/05/16	Wed 27/07/16
Order Vehicles	0 days	Wed 27/07/16	Wed 27/07/16
Vehicle Lead-in/Delivery	6 mons	Thu 28/07/16	Wed 11/01/17
Compile Vehicle / Plant Maintenance Schedules	3 days	Thu 12/01/17	Mon 16/01/17
Confirm tax details and insurance cover	3 days	Tue 17/01/17	Thu 19/01/17
Vehicles ready	0 days	Thu 19/01/17	Thu 19/01/17
Container Provision	**202 days**	**Tue 26/04/16**	**Wed 01/02/17**
Review Container Requirement	2 days	Tue 26/04/16	Wed 27/04/16
Finalise Container Specifications	5 days	Thu 28/04/16	Wed 04/05/16
Procure Containers	3 mons	Thu 05/05/16	Wed 27/07/16
Order Containers	0 days	Wed 27/07/16	Wed 27/07/16
Containers Lead-in/Delivery	6 mons	Thu 28/07/16	Wed 11/01/17
Delivery of Containers to households	15 days	Thu 12/01/17	Wed 01/02/17
Containers Ready	0 days	Wed 01/02/17	Wed 01/02/17
Human resources	**147 days**	**Tue 26/04/16**	**Wed 16/11/16**
Confirm Staff requirement	2 days	Tue 26/04/16	Wed 27/04/16
Recruit new staff	6 mons	Thu 28/04/16	Wed 12/10/16
Uniforms / PPE	4 wks	Thu 13/10/16	Wed 09/11/16
Training	5 days	Thu 10/11/16	Wed 16/11/16
Staff ready	0 days	Wed 16/11/16	Wed 16/11/16



8. Future Considerations

Alternative waste treatment (AWT) technologies are not currently available in New Zealand at a commercially proven stage of development. AWT have been considered as an option for the Councils but these are not considered viable from a risk or cost perspective. AWT may become viable if:

- Legislative changes occur that make it commercially viable for AWT i.e. the waste levy rises considerably, say to $80/tonne
- Landfill space becomes limited and costly – this is considered unlikely to happen in the short term
- Energy prices rise to a point where energy recovery from waste is commercially viable. This will be difficult given that 70% of our energy currently comes from renewable resources.

It is recommended that AWT are evaluated every six years (to be aligned with the WMMP review) for viability as part of an ongoing waste strategy.

Marlborough District Council (MDC) is building a commercial and industrial sorting facility (CIF). Tenders have been evaluated and construction will start in February 2016. The purpose of CIF is to try and divert the recyclable or reusable material that comes from commercial facilities to extend the life of the landfill. Alec McNeill (Solid Waste Manager) presented information about this at the last Waste MINZ conference. We have requested detailed information from Alec regarding the financial viability of this project. The cost is $2.95 million, and MDC have received partial funding from the Waste Minimisation Fund.

It is recommended that this project is followed closely in terms of cost to build and actual diversion rates.

More information on the MDC CIF project can be found in Appendix E.

9. Next Steps

The next steps for the project are as follows:

- Submit this report to the project group for review.

One of the key items for review is how the pricing structure across both Councils needs to be the same for the kerbside collection, and the impacts of this.

Once review has been completed it will be submitted and presented to Council.

Follow on steps after this if accepted are

- Agreement on strategy for implementation (dates and actions) for the landfill and kerbside collection
- Preparation of resource consent applications for the landfill
- Preparation of a public consultation document. This will include information on both the consenting of the landfill and changes to the kerbside collections for both Council. The consultation document will be based on other New Zealand Council's consultation experience for implementation of a new service and international experience e.g. DEFRA.
- Review of common documents and contracts for the two Councils. This include items such as:
    - Bylaws
    - Current kerbside collection contracts
    - Waste Minimisation Bylaw e.g. KPIs for waste minimisation
    - Waste Education

Appendix A. Definitions

Definitions

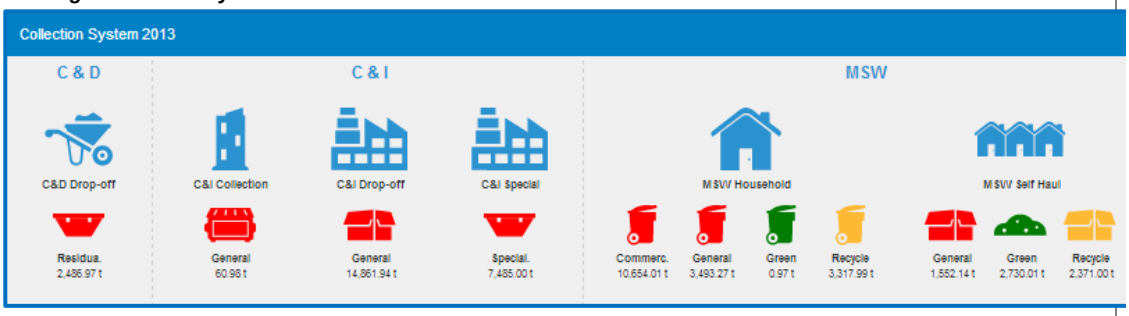
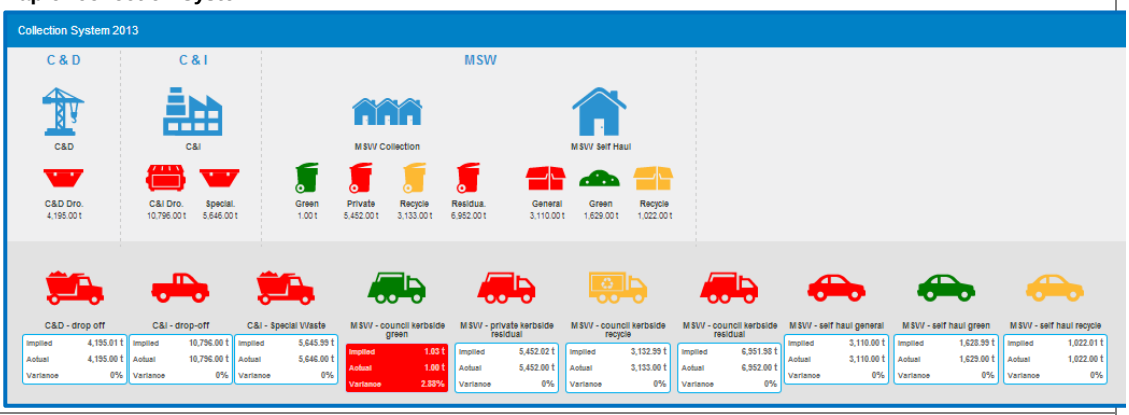
- MSW = Municipal Solid Waste
- C&I = Commercial and Industrial waste
- C&D = construction and Demolition waste
- Recycling = the proportion of material that is processed for recycling i.e. material sent to a facility and material recovered for recycling minus the rejects as a proportion of all material generated.
- Recovery = the proportion of all material produced where value is recovered from the material in terms of recycling or energy recovery.
- Waste Generation = The sum of all waste collected (at kerbside or through drop-off facilities)
- MBT = Mechanical Biological Treatment. Assumed for the purposes of this assessment to comprise automated sorting of residual waste (to capture ferrous and non-ferrous metals, plastics, glass and card) followed by biological stabilisation of the degradable fraction.
- EfW = Energy from Waste. Assumed for the purposes of this assessment to comprise mechanical biological treatment (see MBT) configured to produce a refuse derived fuel followed by gasification of the refuse derived fuel to produce char and gas. EfW also includes mass burn waste incineration, pyrolysis and other thermal conversion technologies.
- Diversion = the proportion of all material generated that is diverted from landfill.
- Compost Like output (CLO) = stabilised organics from a mechanical biological treatment process intended for use as a soil amendment
- Refuse Derived Fuel (RDF) = stabilised high calorific value fraction from a treatment process such as Mechanical Biological Treatment.

Appendix B. Combined Option Details

B.1 Option A. Omarunui Landfill

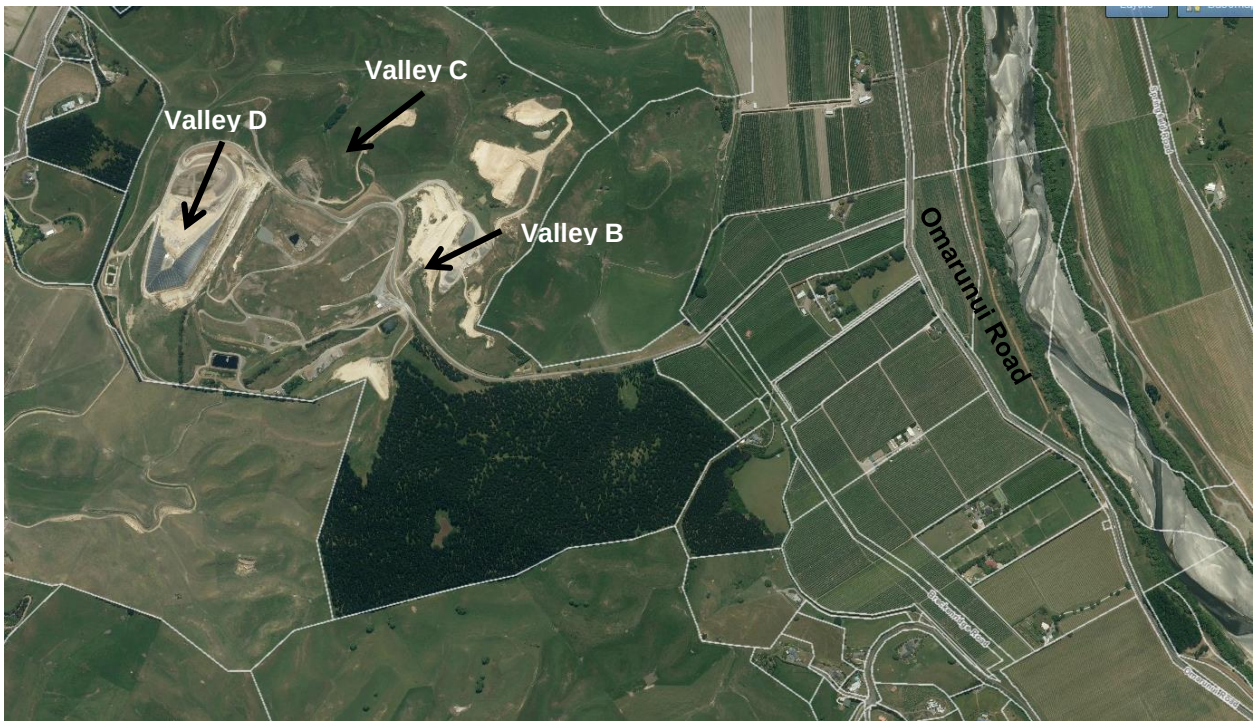
Key assumptions for Option A include:

- The new valley can be developed within and consistent with the existing designation
- The environmental impacts of the new valley will be comparable or less than the existing operation (Valley D) and treated accordingly under the RMA process.
- The cost of landfilling (including landfill levy and ETS costs but excluding GST) will be $83/T.
- The new valley will be required from 2025.

Option A(i) Residual Waste to Omarunui Landfill from 2025		
Collection System	Residual waste - Existing bag based collection Recycling - optimised collection system Transfer stations - optimised layout **Hastings collection system**  **Napier collection system**  	
Processing	As per current (garden organics to BioRich, Kerbside Recycle to GreenSky sort-line)	
Disposal/Market	Residual to Omarunui Valley D to 2026 Residual to Omarunui Valley B/C from 2026	
Technology issues	Availability of liner materials	
Planning and Environmental issues	Key Impacts	Anticipated and provided for in Management Plan (Appendix 16.0-2). No additional buildings or structures required.
	District	Hastings District

Option A(i) Residual Waste to Omarunui Landfill from 2025		
	District Plan Requirements	• Existing Designation – subject to specific Management Plan • Outline Plan (s176A)
	HBRC Requirements	• Air Discharge Permit • Discharge to land • Water permit • Leachate to water
	Consentability	• Represents extension of an existing activity within current operational site • Outline Plan only required (not notified). • NOR application if needed to alter designation outside identified areas.
	Overall Comment	Expansion is specifically anticipated and provided for by the District Plan and associated Management Plan
Commercial issues	Transfer + disposal costs need to be comparable to alternatives (transport south) Need to consider the impact of reducing tonnage on per tonne costs	

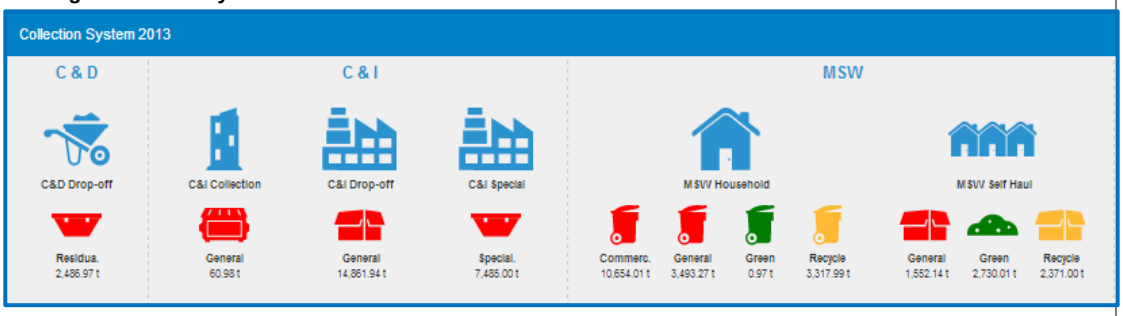
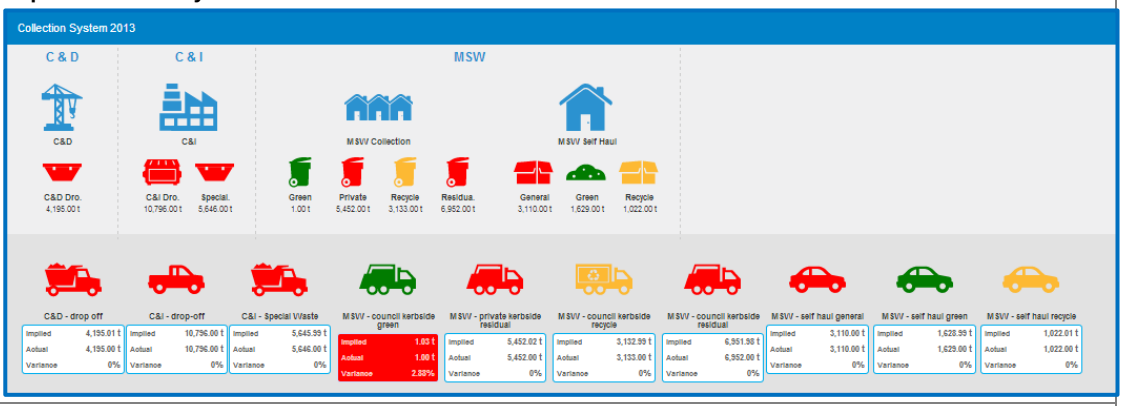
Figure 9-1 : Omarunui Landfill



B.2 Option B. Commercial Landfill

Key assumptions for Option B include:

- Waste can be transported and disposed of at a suitable site for $176 per tonne ($0.30tonne/km for the journey of 210 km each way and $50 per tonne gate fee) including levy and ETS but excluding GST
- Required bulking/consolidation infrastructure can be accommodated at Redclyffe and Henderson Road Transfer Stations
- Transporting 50% of waste to a Commercial Landfill from 2026 will extend the life of Omarunui Landfill by 5 years

Option B Residual Waste to Commercial Landfill	
Collection System	Residual waste - Existing bag based collection Recycling - optimised collection system Transfer stations - optimised layout **Hastings collection system**  **Napier collection system** 
Processing	As per current (garden organics to BioRich, Kerbside Recycle to GreenSky sort-line)
Disposal/Market	B(i) Residual waste to Omarunui Valley D to 2021, from 2021 505 of residual waste is sent to a Commercial Landfill From 2032 all residual waste is sent to the commercial landfill B(ii) Residual to Omarunui Valley D to 2026 Residual to Commercial Landfill from 2027,
Technology issues	Bulking/Transport arrangements significantly increased throughput Assume require compaction equipment at Henderson Road and Redclyffe Transfer Stations Management of potential odour issues depending on storage provision/allowance on each site.

Option B Residual Waste to Commercial Landfill		
Planning and Environmental issues	Key Impacts	• Traffic generation • Visual effects • Odour • Noise
	District	Hastings District (Henderson Road) and Napier City (Redclyffe)
	District Plan Requirements	Henderson Road (Hastings District Plan) • Resource Consent Process • Industrial 2 Zone • Performance Standards Redclyffe (Napier District Plan) • Resource Consent process • Scheduled Site (S113) • Appendix 12
	HBRC Requirements	• Air Discharge
	Consentability	Henderson Road - Consents potentially required for building infrastructure. Possibly permitted. Redclyffe - Possibly a permitted activity. A Certificate of Compliance could be submitted to confirm.
	Overall Comment	Henderson Road - Depending on associated buildings and infrastructure, consent could potentially be permitted under the HDC plan. Redclyffe - Possibly permitted activity under NCC plan.
Commercial issues	Potential for competing transfer arrangements to be established (to CHBDC Landfill, 60-70km)	

Figure 9-2 : Omarunui Landfill

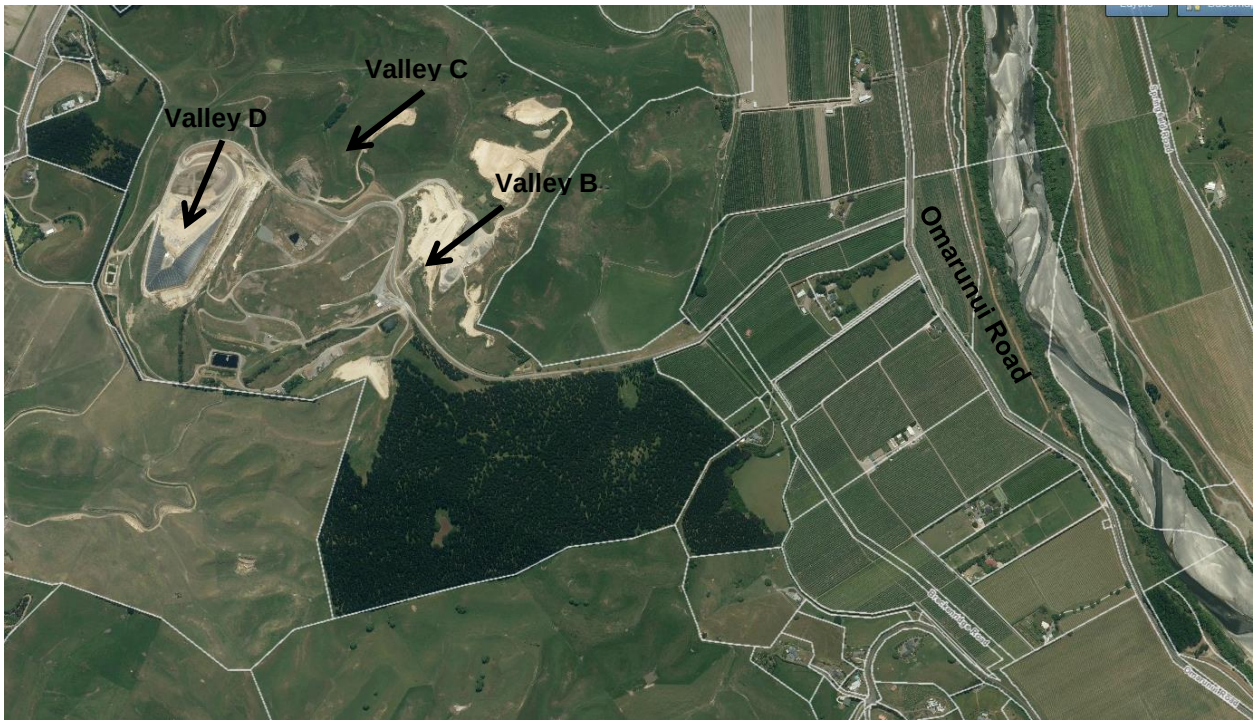
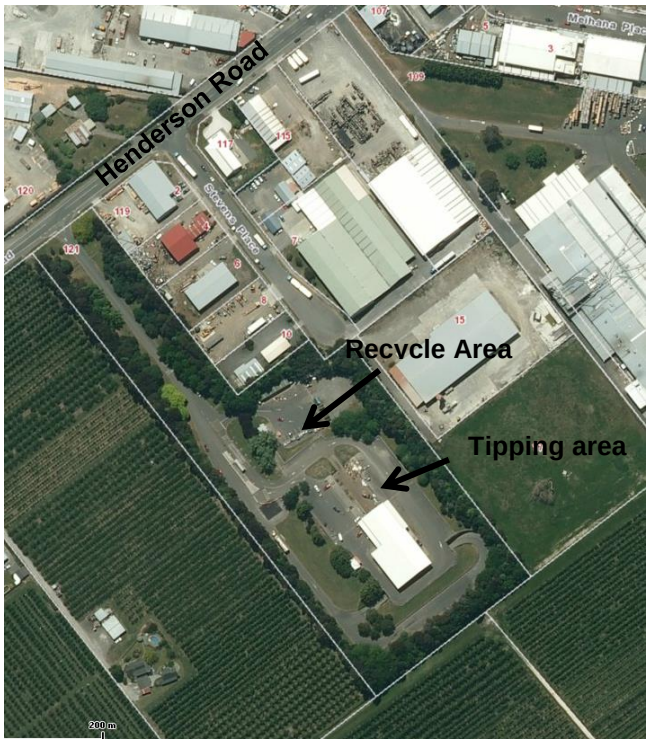
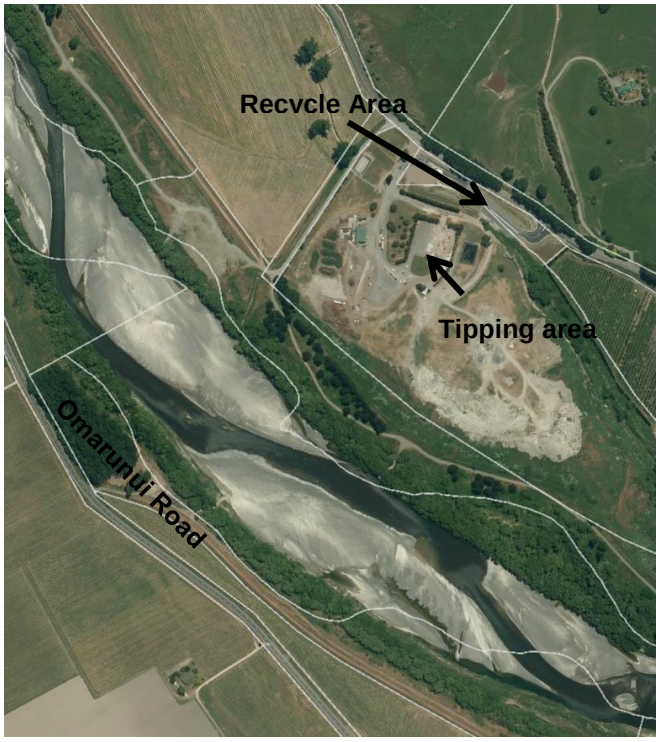


Figure 9-3 : Henderson Road and Redclyffe Transfer Stations

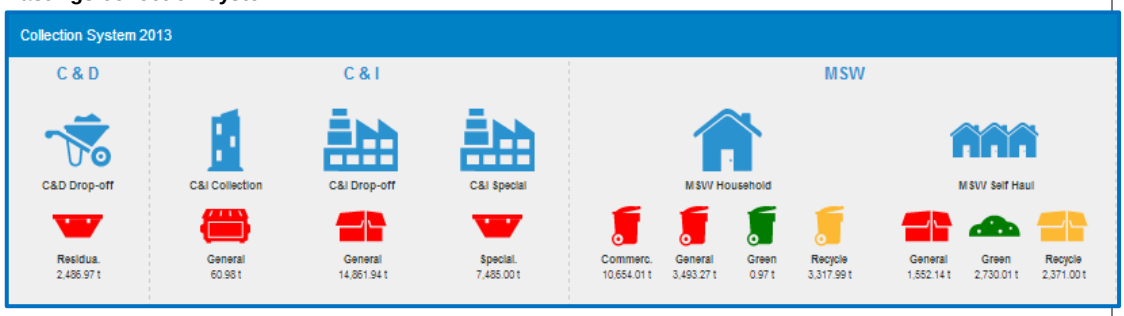
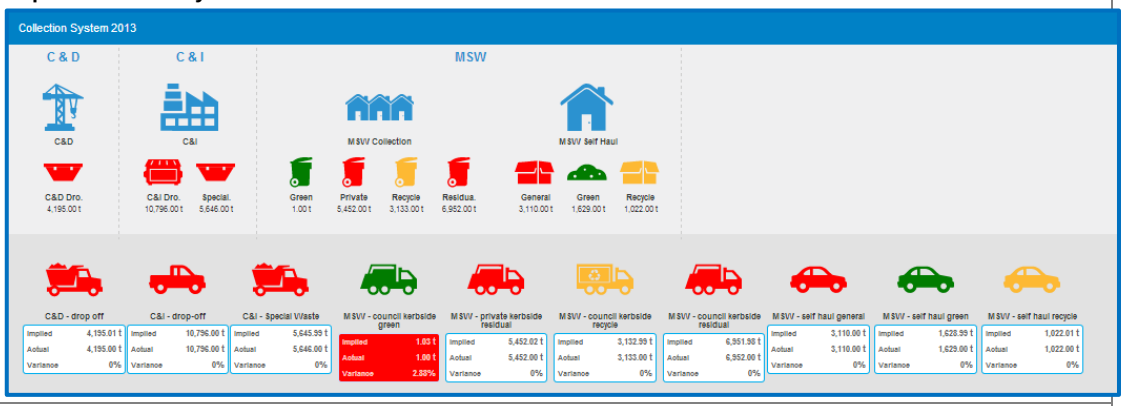




B.3 Option C. Mechanical Biological Treatment

Key assumptions for Option C include:

- The Mechanical Biological Treatment plant is located at the Omarunui Landfill (alternative locations include Redclyffe and Henderson Road Transfer Stations)
- The plant is configured to recover metals and a portion of plastics and card prior to treatment
- In addition to recovered materials the plant will produce two materials streams that will require landfill disposal.
  - Reject materials (approximately 30% of incoming residual waste), unsuitable for biological processing will be disposed of direct to landfill.
  - Degradable material (over 60% of the incoming residual waste) will be subjected to biological processing (to reduce volume by about 40% and stabilise the material).
- Implementing MBT in 2020 would extend the life of the existing valley at Omarunui by 2-3 years.
- Implementing MBT for 50% of the waste stream in 2020 would extend the life of Omarunui by 1-2 years.

Option C Residual Waste to Mechanical Biological Treatment	
Collection System	Residual waste - Existing bag based collection Recycling - optimised collection system Transfer stations - optimised layout **Hastings collection system**  **Napier collection system** 
Processing	As per current (garden organics to BioRich, Kerbside Recycle to GreenSky sort-line) Residual waste processed via Mechanical Biological Treatment process focussed on materials recovery (plastics, metals, timber) and volume reduction (degradable material and drying). Facility to be located at one of the Transfer Stations or at the Omarunui Landfill.
Disposal/Market	Residual (stabilised waste) to Omarunui Valley D to 2021 or 2026 Residual to Omarunui Valley B or C once Valley D is completed.

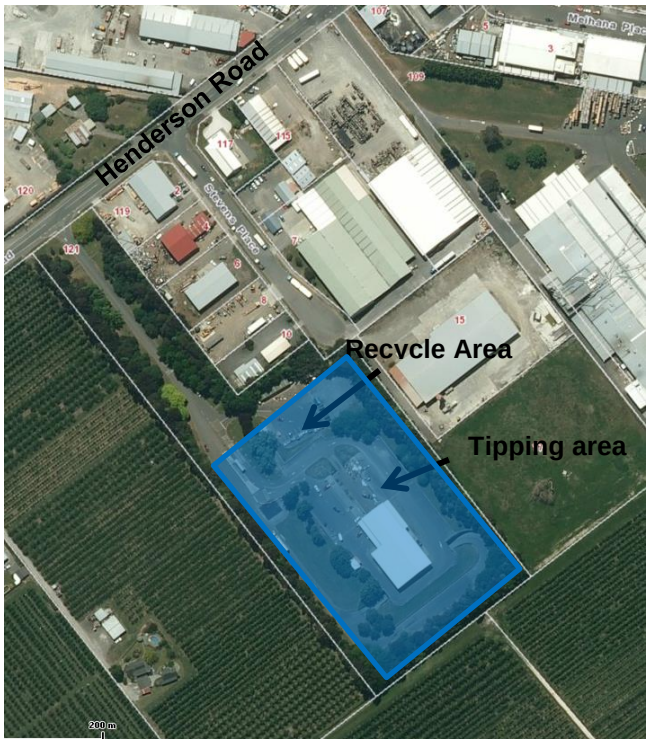
Option C Residual Waste to Mechanical Biological Treatment	
Technology issues	Performance of mechanical separation component of MBT process Performance of biological stabilisation (bio drying) component of MBT process - multiple technology solutions and suppliers. Assuming 25% moisture loss, 2 % metals recovery, 5% aggregate (glass, rubble), and remainder (68%) residual. Potential for additional 25% to be recovered as fuel (<20% moisture) Waste composition risk –composition variability due to seasonal or long term trends (e.g. changes in disposer habits) in waste compositional changes could impact on recycling levels (or quality of recyclables) or MBT process operational performance (e.g. throughput or reliability). This risk is best mitigated through the selection of MBT equipment with the flexibility to handle a range of incoming waste compositions. The risk can also be assessed by waste composition modelling projections to test the sensitivity of the plant to such changes. If end use is land fill then this option may be less sensitive in terms of output quality requirements than end use in an EfW, however a fully bio-stabilised product output would be preferred. Equipment selection should consider processes suited to producing a bio-stabilised waste for landfilling, as MBT processes for fuel production can differ materially. Future use of MBT output in an EfW may also be worthy of consideration, in terms of provision of space for equipment to either produce a transportable fuel (e.g. densified) or to consume the fuel onsite in an EfW facility. The MBT plant will require an industrial sized power import connection to run waste shredders, bio-drying equipment, screens, conveyers, fans and other equipment, which could be of the order of hundreds of kilowatts or up to around one megawatt. The exact quantity will vary depending on the process equipment selected and capacity adopted. Shredders may have a high starting current so the capacity of the incoming feeder will need to consider this auxiliary load. New grid connections can be a significant cost if the connection point is distant, so this aspect should be investigated further at the preferred option stage when considering the appropriateness of the site. Electricity use will also be a significant ongoing OPEX cost of the facility. Bio-drying of the waste results in a waste stream which is dry and can be dusty, so it can present a fire risk if dust is allowed to build up in the plant. Appropriate containment of dust and design of conveyers, handling and storage systems should be appropriate to mitigate this risk. The bio-drying of the waste will generate a leachate wastewater stream. In some cases, much of the leachate can be recycled as process water, but in many cases it is likely that this type of plant would produce some leachate wastewater which could be treated in a nearby landfill type leachate treatment system or a wastewater treatment plant. Trucking leachate to a suitable treatment facility may be an option for smaller plants. The plant will also consume some fresh process water so a water supply connection will also be needed. The capacity and water quality will depend on the equipment selected. Process impacts: **Noise** – most of the process plant could be enclosed within a plant building but the main external noises will be incoming and outgoing vehicles delivering and taking away waste and recyclables. There may also be a noise emission point at the bio dryer exhaust. **Odour** – this is normally controlled by keeping the process building under negative pressure with the use of an extractive system that passes the outgoing air through a bio-filter to recue odour in the emitted air. This is normally effective, but if there is any unplanned downtime of the bio-filter odour may become a problem, so a redundant system may be advisable. **Space requirements** - (waste management, aerobic decomposition, biofilter) – A 70,000 to 80,000 tonne per annum facility as a guide for a layout may require between 1.5 and 2 hectares. A 40,000 tonne per year plant may occupy something like 1.0 to 1.5 hectares, however this does not account for space for future expansion at the same site. Whether the process requires a maturation step for the bio-dried output and for how long can affect the layout required for the plant as maturation can require extra footprint. Each MBT technology provider will adopt a different typical layout and arrangement, but there would be some degree of flexibility around dimensions and footprint from project to project, such that plant can be fitted into an existing brownfield site. A similar UK facility of 65,000 tonne capacity occupies an approximately 2 Ha required site (EcoDeco MBT process at Dumfries); however this site area incorporates some landscaping and ponds. The main plant area at Dumfries and vehicle roads is around 1.6 ha, and the main building dimensions are 115 meters long, 44 meters wide at the widest point, and 17.5 meters high. In addition to the main building, the arrangement of the site access roads for deliveries and despatches is important in determining the overall site requirements. It is noted that 1.5 hectares is available at Henderson Rd (so this would be perhaps tight but perhaps not impossible fit of for the 80,000 tonne plant if carefully designed, and would probably fit a 40,000 tonne plant). There would appear to be plenty of space at Redclyffe for either capacity plant).

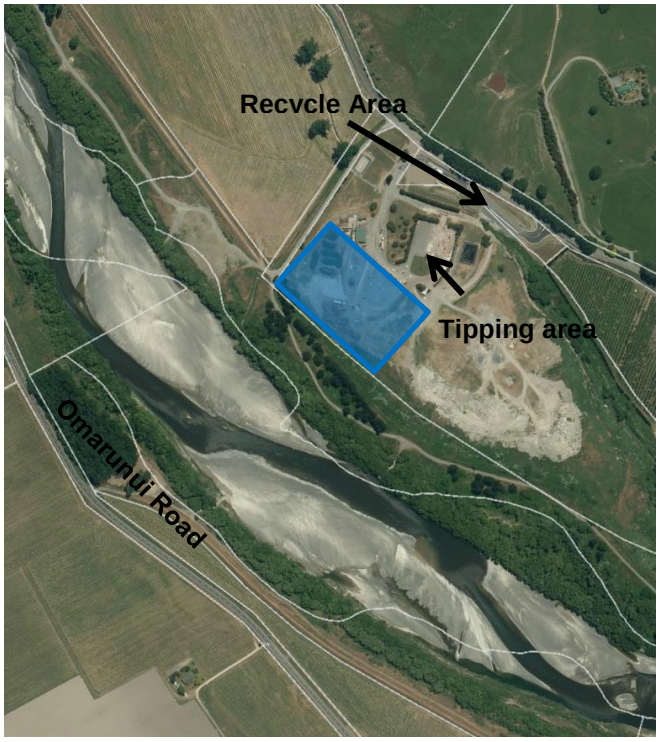
Option C Residual Waste to Mechanical Biological Treatment		
Planning and Environmental issues - MBT at Omarunui	Key Impacts	• Visual Impact (building) • Noise • Odour • Traffic generation
	District	Hastings
	District Plan Requirements	• Existing Designation – subject to specific Management Plan
	HBRC Requirements	Rural location has less main infrastructure services such as water supply and waste water mains. This results in additional discharge and water take permits required; • Air Discharge Permit • Water Permit (existing) • Discharge to land (leachate)
	Consentability	• Expect an amendment to the existing designation would be required to provide for the proposed building housing the plant equipment (up to 17.5m high and footprint of 5000m2 or greater). • Possible alteration to designation to include MBT process. • If not accepted as a minor alteration under s181 then a new NOR application would be required.
	Overall Comment	MBT process requires associated significantly large building. The designation management plan does not provide for MBT or a building of this size. Visual impact in the rural zone would be a factor. The effect would be determined by location and screening mitigation.
Planning and Environmental issues - MBT at Henderson Road	Key Impacts	• Noise • Odour • Traffic generation • Parking & access
	District	Hastings
	District Plan Requirements	• Resource Consent Process • Industrial 2 Zone • Performance Standards • Permitted Activity Rule 10.7.2.1 provides for activities as permitted subject to meeting standards at 10.8 and 10.9. • Trade Waste Permit for disposal of leachate etc from tipping hall and process plant
	HBRC Requirements	Mains infrastructure available thus potentially providing for trade waste connections for leachate and water supply connections. Therefore regional consents could be limited to; • Air Discharge Permit
	Consentability	• Restricted Discretionary Activity has **non-notification** provision. • Zone provides for a range of activities subject to performance standards • Bulk and location requirements allow for building up to 30m high, no site coverage restriction, but 5.0m side yard setback from west boundary. • Traffic impacts would be subject to standards at 14.1 of Plan, on-site parking and manoeuvring requirements may be challenging. • No residentially zoned land immediately adjacent reducing applicable bulk and location performance standard requirements.
	Overall Comment	Zone provides for a wide range of activities subject to performance standards through consent process – could be notified if deemed a Discretionary Activity (inability to meet one or more matters of discretion). Non-notification would not apply in that case.

Option C Residual Waste to Mechanical Biological Treatment		
Planning and Environmental issues - MBT at Redclyffe	Key Impacts	Limited to matters for schedule site.
	District	Napier
	District Plan Requirements	• Resource Consent process • Scheduled Site (S113) • Main Rural Zone (Rule 34.15) • Sheet J1 • Appendix 12 • Trade Waste Permit for disposal of leachate etc from tipping hall and process plant
	HBRC Requirements	Rural location has less main infrastructure services available, such as water supply and waste water mains. This results in additional discharge and water take permits required; • Air Discharge Permit • Water Permit • Discharge to land (leachate)
	Consentability	Rule 55.5 states any use of a scheduled site for the purpose described in Appendix 12 is a Permitted Activity subject to complying with relevant conditions in chapter 55. Purpose of schedule site is for "transfer station, composting … solid waste disposal facility."
	Overall Comment	Principle of proposed MBT activity could be considered permitted with no relevant conditions identified. Underlying Rural zone rules provide for permitted activities subject to meeting scheduled site provisions.
Commercial issues	Potential for competing transfer arrangements to be established (to CHBDC Landfill, 60-70km, to Bonny Glenn 210 km away). When compared with EfW, this option has less diversion from landfill so future changes in landfilling costs will have a more significant impact on the overall operating cost of the facility. Solid recovered fuel (SRF) markets, if developed in the future within New Zealand (e.g. cement kiln users), could offer an alternate outlet for the stabilised output.	

Figure 9-4 : Omarunui Landfill with MBT approximate footprint

Figure 9-5 : Henderson Road and Redclyffe Transfer Stations with approximate MBT Footprint

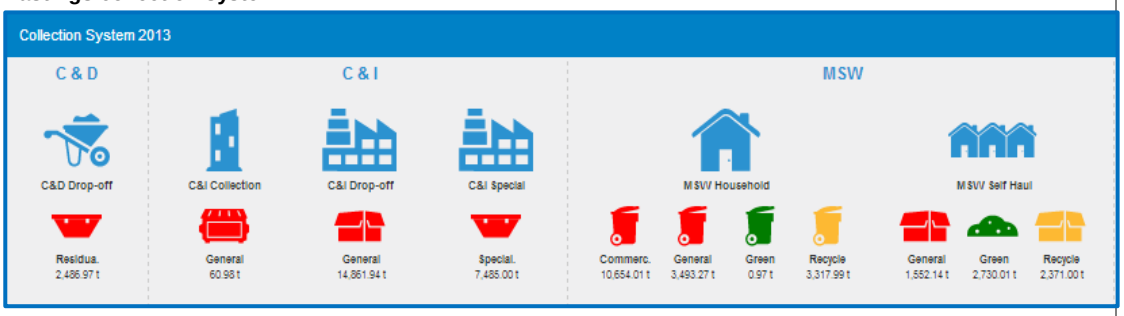
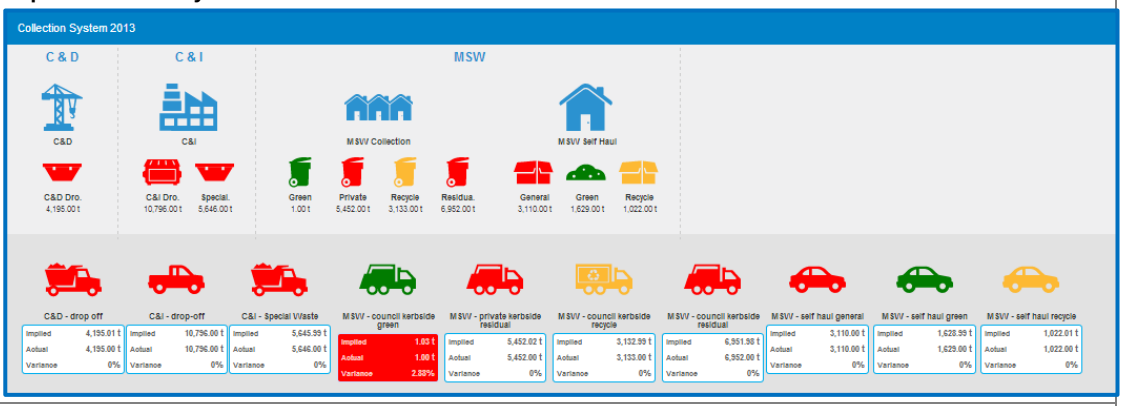




B.4 Energy from Waste (Gasification)

Key assumptions for Option D include:

- The Gasification plant is located at the Omarunui Landfill (alternative locations include in the Whakatu Industrial area, Redclyffe Transfer Station and Henderson Road Transfer Station)
- The plant is configured to recover metals and a portion of plastics and card prior to treatment
- In addition to recovered materials the plant will produce:
  - Char (approximately 14.5% of incoming material)
  - Air pollution control residues (approximately 3.5% of incoming materials from managing emissions form the gasification process)
- Implementing gasification in 2021 would extend the life of the existing valley at Omarunui to more than 15 years.
- Implementing gasification for 50% of the waste stream in 2021 would extend the life of the current valley at Omarunui to by 7-8 years.

Option D Residual Waste to Energy from Waste (Gasification)	
Collection System	Residual waste - Existing bag based collection Recycling - optimised collection system Transfer stations - optimised layout **Hastings collection system**  **Napier collection system** 
Processing	As per current (garden organics to BioRich, Kerbside Recycle to GreenSky sort-line) Residual waste processed via Mechanical Biological Treatment process focussed on materials recovery (plastics, metals, timber) and volume reduction (degradable material). Facility to be located at one of the Transfer Stations or at the Omarunui Landfill.
Disposal/Market	Residual (reject and char) to Omarunui Valley D to 2021 or 2026 Residual to Omarunui Valley B or C once Valley D is completed.

Technology issues	Gasification requires a fairly homogenous feedstock when applied to municipal waste, which requires some front end mechanical treatment (whereas grate combustion plants do not need pre-treatment). The exact requirements of pre-treatment depend on the process adopted. Typically, this may entail at a minimum shredding the residual waste delivered to the plant and separation of metals for recycling prior to the thermal treatment. If the mechanical pre-treatment is located on the gasifier site, fuel densification (e.g. pelletisation) for transport is not necessarily required and this simplifies the overall front end process. There are a large number of variations of gasification technologies available but there are a considerably shorter list proven commercially with MSW as the feedstock. Those technologies that are proven tend to adopt a process whereby the gas produced in the gasifier is combusted on-site and the heat recovery entails a steam boiler and steam turbine plant (i.e. not dissimilar to a combustion technology EfW heat recovery concept). Jacobs assumes in the following text that a gasifier/combustion/steam turbine arrangement would be adopted. A number of MSW gasification projects internationally have tried to utilise the gas produced in a gas engine or gas turbine without long term commercial operational success. Selection of the main equipment supplier and energy recovery method is key to the success of a gasification project, and due diligence of the potential technology track record is very important at an early stage of the project development. Plant performance will be a function of the waste composition and the waste average (and range) of calorific value and moisture content are very important parameters to estimate at the preliminary design stage of the project so that the plant design can be correctly specified for the intended fuel. Fuel quality is normally considered a key risk for waste to energy projects due to the potential variability of composition. Energy output and plant capacity are a function of the waste calorific value, such that the same tonnage of one waste can require a very different plant thermal capacity than another waste. Waste composition of MSW will always vary to an extent however so adopting a flexible design in terms of waste composition is advisable. A 40,000 tonne per annum plant may produce of the order of 2 to 3 MW of electricity. And 80,000 tonne per annum plant will be roughly double that amount. The project site will need to have access to the electricity grid for both export and import (for start-up), and this can be an important criteria for selecting a suitable site for an EfW, such that establishing a grid connection does not become cost prohibitive to the project. Investigation of grid connection is a recommended early study at the feasibility stage of an EfW project. Some plants may require an auxiliary fuel for start-up, which is normally either a diesel fuel oil or natural gas. If natural gas was readily available from the grid pipeline that may be cheaper in the long term, otherwise most plants of this scale use fuel oil for this purpose. EfW plants using a steam turbine require a cooling system to condense the steam exhausting the turbine. This can be done either by air cooling or water cooling. If air cooling is adopted, which is common for small EfW plant, the water and wastewater needs of the facility are considerably simplified. If water cooling is adopted (slightly more energy efficient), then the plant will consume a significant water quantity and also discharge water, which is often perceived as undesirable from a plant of this type. With an air cooled plant, a clean water supply will still be required for process water make-up; however it will not be a significant consumption for a plant of this scale. On-site water treatment is normally supplied as part of the overall power plant package. For an air cooled plant, waste water generated from the process can often be recycled back into the process for ash quenching and conditioning, such that significant process water discharge can be avoided. Only if waste is found to have a very high moisture content (observed in some Asian countries) is there a possibility that some leachate will be generated in the waste bunker that requires treatment. In western countries this would be considered atypical. Adopting a dry or semidry lime and activated carbon dosing system for flue gas treatment prior to emission from the chimney is considered standard practice for EfW's of this type. Dry or semidry systems do not generate a water effluent. The particulate matter collected from the flue gas bag filters is known as air pollution control residues (APC residues) which is a fine ash powder with high alkalinity that normally requires disposal in a hazardous landfill (approximately 2 to 5 % of the incoming waste volume). The balance of the non-combustible material (~20% of the incoming volume) exits the bottom of the gasifier (bottom ash) and is a relatively inert material that can be used in some countries as construction aggregate material, thus increasing the recycling levels of the facility. Key impacts **Noise** – an EfW process is normally enclosed almost entirely in a building which assists containment of noise. There will however be machine noise such as the turbine and fans that penetrates the enclosure and is audible outside the building. Some plants locate flue gas fans outside the main building which could be a noise emission source. Otherwise the most significant noise issue will be the vehicle movements delivering waste and other consumables to and from the site.

Option D Residual Waste to Energy from Waste (Gasification)		
	Odour - The waste tipping hall and storage bunker of an EfW is normally enclosed with automatic roller doors controlling entry and exit of vehicles. The storage bunker normally sits within this same hall, which is maintained under negative pressure continually by extracting air from the hall into the thermal treatment process such that any odour is destroyed when the air is consumed. There are no other significant odour points in the process other than the waste tipping hall. **Vehicle movements** – In addition to waste delivery vehicles, there will be vehicle movements relating to ash removal (bottom ash and APCs) which in total would represent around 20- 25 % of the incoming waste tonnage, noting ash is a higher density residue than MSW. There will also be occasional deliveries of lime and activated carbon required for the air pollution control system **Space requirements** - A 40,000 tonne per annum plant may require an overall plant footprint of around 1 hectare and an 80,000 tonne per annum facility may require around 1.25 to 1.5 hectares. This area estimate makes the assumption that a single 40,000 thermal treatment line technology such as the Energos technology is adopted for the gasification plant. For the 80,000 tonne unit it is assumed of two units of this type are required operating in parallel. If smaller modular type gasifier units were to be employed, the space footprint may be greater. This assumption also assumes a simple shredder and metal separator pre-treatment system only. If a more complex pre-treatment is required this will occupy more space. The process plant main building dimensions for a gasifier plant like Energos would be around 75 meters long by 30 wide and 25 meters high for a 40,000 tonne unit. The building width would be approximately doubled for a two line 80,000 tonne capacity plant. A chimney stack would be the highest structure on-site and the height would normally be determined by stack dispersion assessment, however similar plant of this scale have stack heights between 45 to 75 meters high. When compared with other options, the EfW option may have a higher public perception risk, which may influence planning timescales and community consultation requirements.	
Planning and Environmental issues - EfW at Whakatu Industrial Area	Key Impacts	• Visual Effects (building) • Noise • Odour • Traffic generation
	District	Hastings District
	District Plan Requirements	• Resource Consent Process • Industrial 2 Zone • Map 41 (a & b) • Performance Standards • Permitted Activity Rule 10.7.2.1 provides for activities as permitted subject to meeting standards at 10.8 and 10.9. • Trade Waste Permit for disposal of leachate from tipping hall and process plant
	HBRC Requirements	Mains infrastructure available thus potentially providing for trade waste connections for leachate and water supply connections. Therefore regional consents could be limited to; • Air Discharge Permit
	Consentability	Zoning provides for this activity in principle (noting the definition of 'industrial activity includes production of energy"). Flood hazard overlay identified on some industrial zoned properties adjacent to Karamu Stream. Traffic, noise and bulk and location requirements would be likely key triggers for consent.
	Overall Comment	Resource consent is likely to be required given scale and size of proposed buildings and activity. This is determined by the eventual site characterised once selected.
Planning and Environmental issues - EfW at Omahu Rd Industrial Area	Key Impacts	• Visual Effects (building) • Noise • Odour • Traffic generation
	District	Hastings

Option D Residual Waste to Energy from Waste (Gasification)		
	District Plan Requirements	• Resource Consent Process • Industrial 2 Zone • Map 38 (a & b) • Performance Standards • Permitted Activity Rule 10.7.2.1 provides for activities as permitted subject to meeting standards at 10.8 and 10.9. • Trade Waste Permit for disposal of leachate from tipping hall and process plant
	HBRC Requirements	Mains infrastructure available thus potentially providing for trade waste connections for leachate and water supply connections. Therefore regional consents could be limited to; • Air Discharge Permit
	Consentability	Zoning provides for this activity in principle (noting the definition of 'industrial activity includes production of energy"). Depending on location there is General Residential zone to the south of the Industrial zone which could be a more sensitive receiving environment compared to other potential sites. Traffic, noise and bulk and location requirements would be likely key triggers for consent.
	Overall Comment	Resource consent is likely to be required given scale and size of proposed buildings and activity. This is determined by the eventual site characterised once selected.
Planning and Environmental issues - EfW at Redclyffe	Key Impacts	Limited to matters for schedule site.
	District	Napier
	District Plan Requirements	• Resource Consent process • Scheduled Site (S113) • Main Rural Zone (Rule 34.15) • Sheet J1 • Appendix 12 • Trade Waste Permit for disposal of leachate etc from tipping hall and process plant
	HBRC Requirements	Rural location has less main infrastructure services available, such as water supply and waste water mains. This results in additional discharge and water take permits required; • Air Discharge Permit • Water Permit • Discharge to land (leachate)
	Consentability	Rule 55.5 states any use of a scheduled site for the purpose described in Appendix 12 is a Permitted Activity subject to complying with relevant conditions in chapter 55. Purpose of schedule site is for "transfer station, composting … solid waste disposal facility." As such, Restricted Discretionary Activity consent could be required.
	Overall Comment	Proposed EfW activity likely to require resource consent. Consent matters are identified at in table 55.7 of the District Plan
Planning and Environmental issues - EfW at Omarunui	Key Impacts	• Visual Impact (building) • Noise • Odour • Dust • Traffic generation
	District	Hastings
	District Plan Requirements	Existing Designation – subject to specific Management Plan

Option D Residual Waste to Energy from Waste (Gasification)		
	HBRC Requirements	Rural location has less main infrastructure services available, such as water supply and waste water mains. This results in additional discharge and water take permits required; • Air Discharge Permit • Water Permit • Discharge to land (leachate)
	Consentability	• Expect an amendment to the existing designation would be required to provide for the proposed building housing the plant equipment (up to 25m high and footprint of 5000m2). • Possible alteration to designation to include EfW process. • If not accepted as a minor alteration under s181 then a new NOR application would be required.
	Overall Comment	EfW process requires associated large building. The designation management plan does not provide for EfW activity or a building of this size. Visual impact in the rural zone would be a factor. The effect would be determined by location and screening mitigation.
Commercial issues	Potential for competing transfer arrangements to be established (to CHBDC Landfill, 60-70km, to Bonny Glenn 210 km away) It is likely that the EfW operating company will need to negotiate a power purchase agreement with an electricity transmission/distribution company for the sale of the electricity to the grid. Undertaking electricity market studies or discussions with potential power purchasers is advisable at the feasibility stage to better understand the potential revenue that would be generated for the project from the electricity output. Typically in Europe, power revenue is a significant income stream but is normally of a smaller magnitude than the income of the plant from waste gate fees, which are required to make such a plant economic. Another potential method of enhancing energy revenues is to co-locate the EfW adjacent to a significant industrial process heat demand (i.e. steam or hot water user). This allows the production of both heat and power from the plant and would increase the overall thermal efficiency of the process (e.g. from ~20% up to circa 65 % if sufficient demand exists), and increase commercial benefits of the energy produced. It would require some changes to the design of the turbine, and some connective heat delivery pipe to the industrial process plant, which are issues worth considering at the site selection and feasibility stage of the project.	

Figure 9-6 : Omarunui Landfill with MBT approximate footprint

Figure 9-7 : Henderson Road and Redclyffe Transfer Stations with approximate MBT Footprint

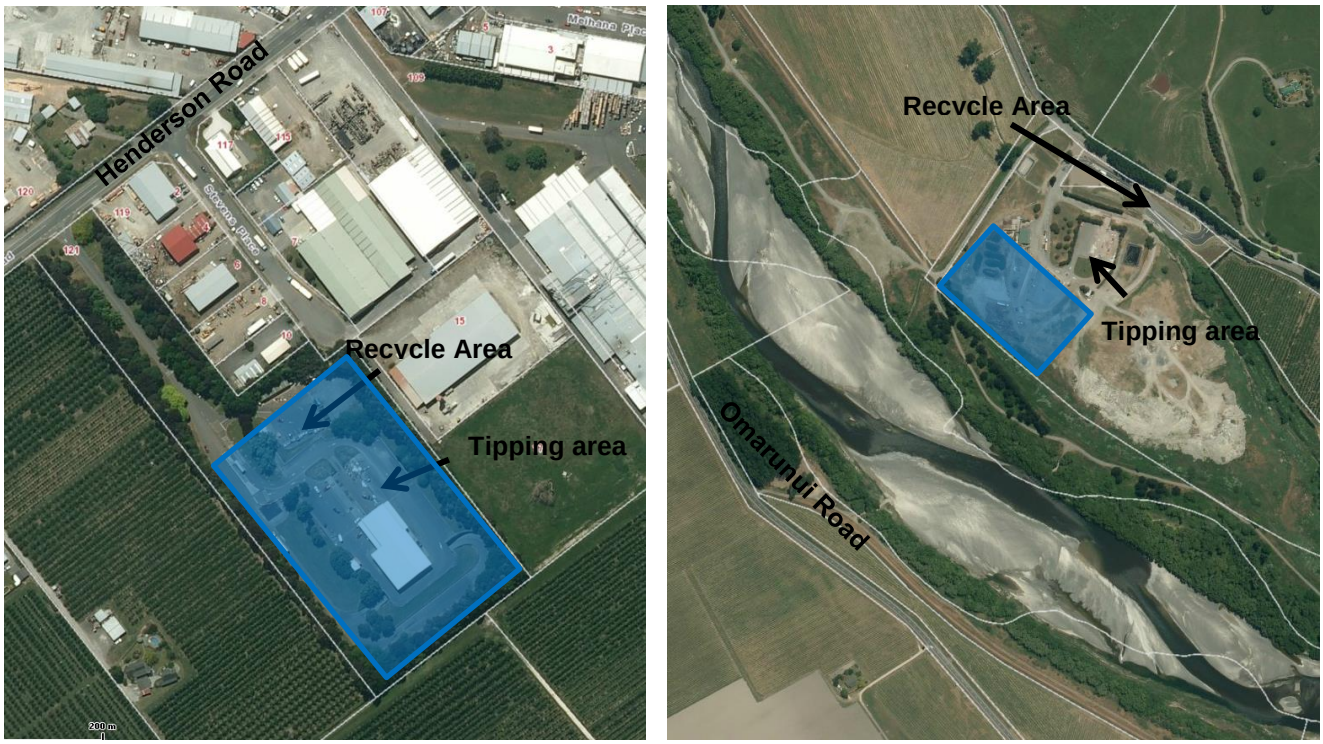
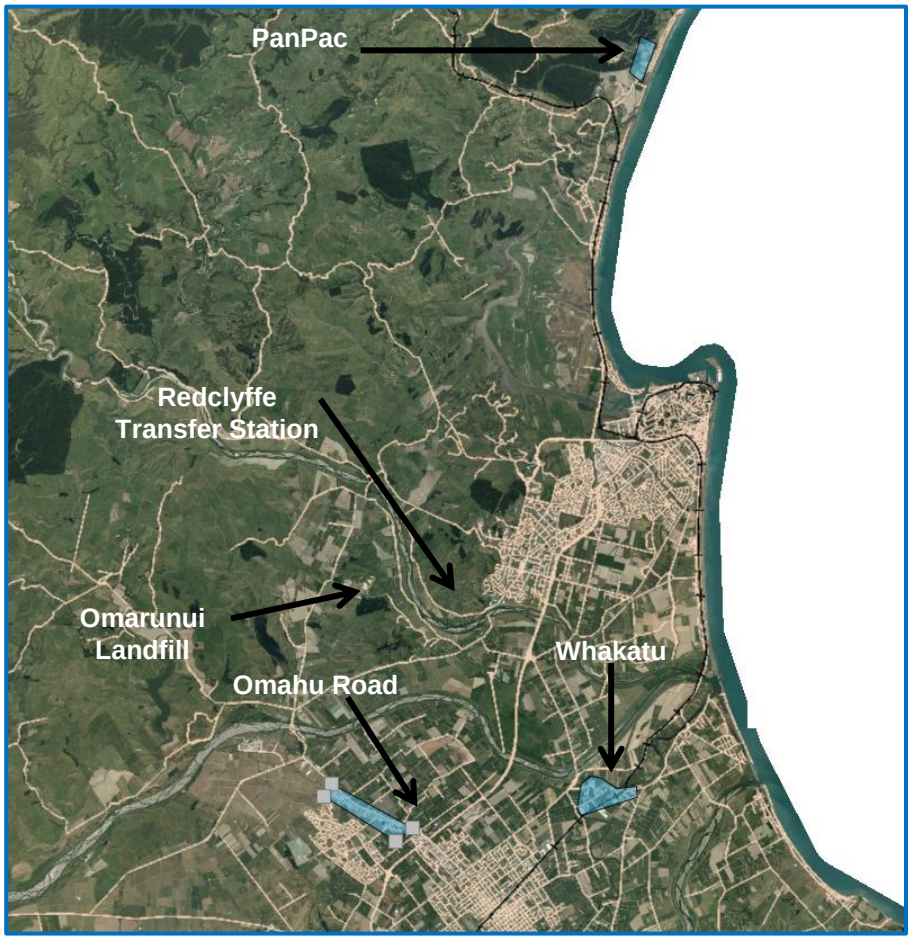


Figure 9-8 : Potential locations for Waste to Energy (Gasification) Plant



JACOBS

Appendix C. Analysis outcomes

Evaluation Criteria	Performance		Cost	Implementation					Other	
	Diversion from landfill	Recycling rate	Total System Cost $M/Yr	Tech Risk	Resilience/ Adaptability	Market Risk/ Opportunity	Community acceptance	Env Impact	Compatability with system	Broader economic impact
Weighting	1	1	3	1	3	2	2	1	1	1
A. Omarunui Landfill	23.3%	23.3%	$10.9	It has been done before in NZ	Res Score 4	Market score 4	Stakeholders likely to be broadly supportive of change - community benefit	Env score 3	Add or remove components but some components used in the same way	No change in economic impact
B.(i) Commercial Landfill (from 2025)	23.3%	23.3%	$12.9	It has been done before in NZ	Res Score 4	Markets for products secure	Stakeholder 2	No change from env perspective	Add or remove components but some components used in the same way	No change in economic impact
B.(ii) Commercial Landfill (50% from 2020)	23.3%	23.3%	$12.9	It has been done before in NZ	Res Score 4	Markets for products secure	Stakeholder 2	No change from env perspective	Add or remove components but some components used in the same way	No change in economic impact
C.(i) MBT (from 2025)	16.9%	16.9%	$23.6	It has been done before in Australasia	Requires committed tonnage and composition	Market score 4	Stakeholders likely to be broadly supportive of change - community benefit	Local environmental benefit	Significant change to system	Broader economic Impact 4
C.(ii) MBT (from 2020)	48.5%	28.5%	$23.6	It has been done before in Australasia	Requires committed tonnage and composition	Market score 4	Stakeholders likely to be broadly supportive of change - community benefit	Local environmental benefit	Significant change to system	Broader economic Impact 4
C. (iii) MBT (50% from 2025)	48.5%	28.5%	$17.1	It has been done before in Australasia	Requires committed tonnage and composition	Market score 4	Stakeholders likely to be broadly supportive of change - community benefit	Local environmental benefit	Significant change to system	Broader economic Impact 4
C. (iv) MBT (50% from 2020)	36.3%	25.9%	$17.1	It has been done before in Australasia	Requires committed tonnage and composition	Market score 4	Stakeholders likely to be broadly supportive of change - community benefit	Local environmental benefit	Significant change to system	Broader economic Impact 4
D.(i) Gasification (from 2025)	36.3%	25.9%	$24.4	It has been done before globally (succeeded)	Requires committed tonnage and composition	Market score 4	Stakeholder 2	Local environmental benefit	Significant change to system	Broader economic Impact 4
D.(ii) Gasification (from 2020)	86.0%	29.2%	$24.4	It has been done before globally (succeeded)	Requires committed tonnage and composition	Market score 4	Stakeholder 2	Local environmental benefit	Significant change to system	Broader economic Impact 4
D.(iii) Gasification (50% from 2025)	86.0%	29.2%	$17.6	It has been done before globally (succeeded)	Technically able to scale up/down	Market score 4	Stakeholder 2	Local environmental benefit	Significant change to system	Broader economic Impact 4
D.(iv) Gasification (50% from 2020)	54.6%	26.2%	$17.6	It has been done before globally (succeeded)	Technically able to scale up/down	Market score 4	Stakeholder 2	Local environmental benefit	Significant change to system	Broader economic Impact 4

Appendix D. Preliminary Risk Assessment

D.1 Optimised Collections

Employing pricing, education, methodology changes and regulation to improve the capture of materials through kerbside collection (council provided and commercial) and transfer stations.

Opportunities

- Risk - *Potential mitigation strategies*
- Full Community Support/Involvement - *Clear, consistent messages, involve communications team(s), use council facilities*
- Very high capture achieved - *Pricing, increase council market share*
- Support from the waste industry - *Communications, agreed shared objectives*
- Easy systems to use - *Clear, consistent messages, involve communications team(s), use council facilities*
- Improved health and safety outcomes - *Informed councillors and community regarding H&S risks*
- Job opportunities in Hawkes Bay - *Local processing/use via procurement of collection and processing services and as part of procurement of general goods and services by Councils*
- Accessible/sustainable end markets - *Education leading to quality materials, council buy recycle content material*
- Seen as leaders, enhances reputation – *Communications about project, inform decisions in other parts of NZ*
- Community engagement and benefit - *Working with cultural leaders within the community to have community lead champions for behaviour change around waste.*
- Affordable, value for money - *Fundamental part of assessment/project*
- Waste has a high profile - *Education, pricing*
- Waste seen as a resource - *Education, pricing*
- Reduced illegal dumping - *Communications and enforcement*

Threats

- Political backlash - commercial impacts - *Communications, clear business case, align to waste industry objectives, offer and promote improvements*
- Public perception (don't like changes) - *Simple process, simple message*
- Too complex (collection methodology) - *Simple process, simple message*
- Impact on rates - *Business case*
- Lack of understanding of the big picture - *Business case*
- H&S or broader regulatory requirements - *watch developments and test sensitivity of solutions to change*
- Commercial or market impacts - *Sensitivity test, risk allocation (procurement strategy)*
- Induced waste/increased generation e.g. garden organics, shift from RTS to collection - *planning, sensitivity testing, risk allocation*
- Market requirements change - *Watch and sensitivity testing*
- Energy prices (EfW) - *Business case*
- Streetscape, impact of bins including storage - *Business case*
- Planning for collection (new developments) - *District Planning team involvement*
- Pricing council out of the market - *Tracking market prices, partnership*
- Cleanfills/C&D waste sites - *Monitoring, regulation, HBRC enforcement*

- Theft of materials - *Not significant, contract model, projections, risk allocation*
- Contamination - *Communications, enforcements*
- Industry getting too good a deal - *Value for money, procurement strategy*
- Legal uncertainty - *Analysis (opinion)*
- Emission Trading Scheme change in pricing – *Economic Business case analysis of risk to change in pricing relevant to other technologies*

Appendix E. Marlborough DC CIF