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Report on Waste Disposal Levy Investment Options

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1. Executive Summary

The Ministry for the Environment (the Ministry) commissioned Grant Thornton to develop an investment plan that makes recommendations on how Waste Disposal Levy funds could be allocated in a more efficient and effective way. The investment plan should help to reduce the environmental harm from waste and to catalyse growth in New Zealand's resource recovery and waste minimisation sector.

New Zealanders are sending increasing quantities of waste to landfill. Since 2009, disposal to municipal landfills have increased by around 40%. Since 2009 the Waste Levy has been used to fund investment through territorial authorities (50%) and waste minimisation projects (50% less costs) including through the contestable Waste Minimisation Fund (WMF).

The investment of the Waste Disposal Levy (Levy) since 2009 has not resulted in reduced waste to landfill or significant increases in resource recovery rates. While some metro centres, such as Auckland have ambitious plans (Zero waste by 2040) and have achieved reduction in the volume of household waste produced per person, the growth in population and a growth in commercial waste to landfills[1] has seen the volume of waste going to landfill continue to increase.

The inability of Levy funded investments to decrease the volume of waste going to landfills is due to a number of factors including:

- The amount of Levy revenue collected is an order of magnitude lower than required to have significant impact;
- In optimising these limited funds, the small scale and wide spread of investments has proven ineffective at a system level;
- Waste Minimisation Fund (WMF) applications go through a unified and slow process, delaying impact;
- Half the Levy revenue goes to Territorial Authorities (TAs) where further dilution makes the funds ineffective for step change investment;
- A lack of targets in the Waste Strategy[2] means there could be no incentive to improve; and
- A lack of data, and hence ability to measure against real targets.

The current New Zealand waste system is fundamentally a commercial construct with many private and public sector entities operating in the system. Key elements of the system, such as recycling, are dependent upon a commercially viable end-market for the recycled or reprocessed material. This system is similar to much of the world, where both selling onto the international waste markets and waste to energy are common methods for diverting waste from landfills. The challenges posed by the recent changes in export markets are testament to this fact.

What should be done?

New Zealand's waste problem does not have a simple solution. A multifaceted investment approach is required to address a raft of potentially conflicting priorities within a rapidly changing environment. New Zealand's waste problem, as in other jurisdictions is, in part, a case of market failure. Therefore, where required investments are not commercially viable, investment of Levy revenue will need to balance the public benefit of the investment against the cost.

[1] Auckland Council. Auckland Waste Management and Minimisation Plan 2018.
[2] This topic is the subject of several prior reviews and papers, hence will not be re-examined exhaustively in this paper

To maximise the benefit from the potential increased revenue, there is a need for a long-term strategy to guide many different workstreams across time and geography. It must address the currently limited resource recovery infrastructure and services, plus the willingness and ability of households, individuals and the public and private sectors to reduce waste or utilise a waste system that maximises resource recovery.

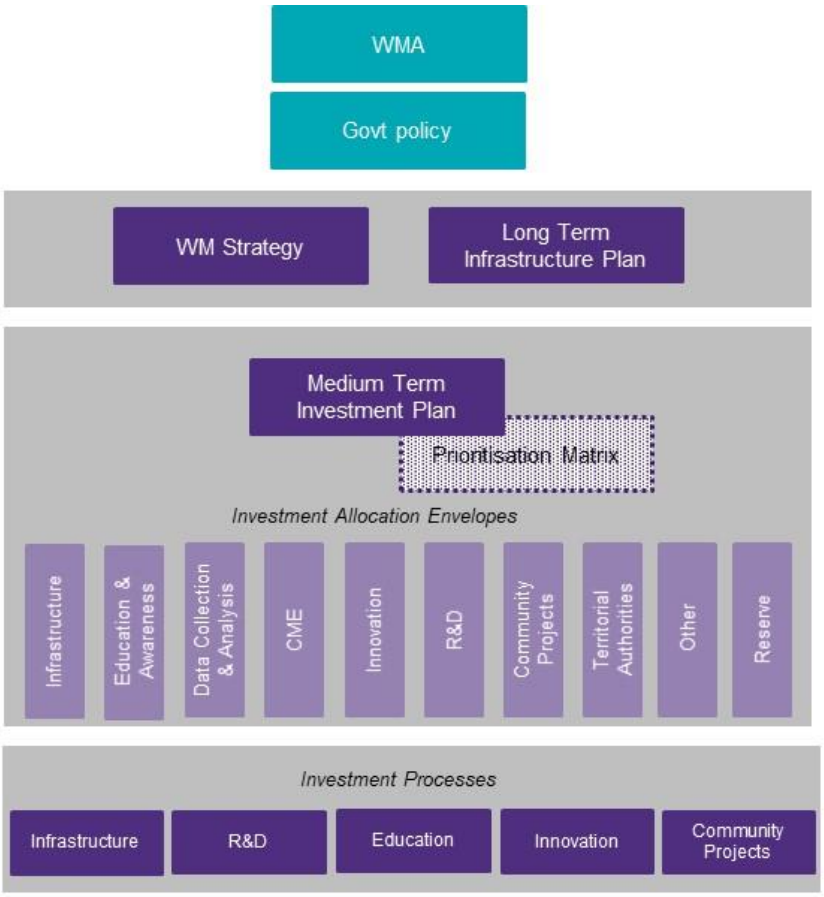
The long-term strategy needs to develop a coherent and consistent plan to address identified weakness in the waste system through a series of medium-term investment plans focused on the priority waste streams and waste system gaps.

Preventing the dilution of the investment funding will require a high level of coordination between the Ministry for the Environment (the Ministry), TAs and the waste sector in how and when investments are made. Alternatively, the investment decisions could be made centrally with consultation with TAs and the waste sector. The latter approach is potentially the more effective approach but would require a change in legislation.

What do we recommend?

The Waste Minimisation Framework we are proposing has a mix of long-term and medium-term elements. The output of the medium elements is a series of allocation envelopes for funds which are then applied through a series of investment processes, some of which use existing public sector architecture. The Investment Plan is intended to operationalise the Waste Strategy which in turn is intended to achieve the outcomes established by Government Policy and the Act.

Figure 1 Waste Minimisation Investment Framework



The first element in the Framework is the Waste Strategy, supported by the Long-Term Infrastructure Plan (LTIP). From the perspective of the Framework the Waste Strategy is important in establishing the boundaries of the investment process, establishing the principles and mechanics of the investment process and establishing principles for the prioritisation framework for the Investment Plan.

In the Medium-Term Investment Plan (MTIP), a Prioritisation Matrix weighs each waste streams' volume and harm. The output is used to allocate the projected Levy revenue in a coherent way into a variety of investment processes. The primary mechanism we are proposing is a series of investment envelopes which ring-fence funding for specified activities.

Table 1 Proposed 2023-26 MTIP investment allocations[3]

Investment Envelope	2023 $M	2024 $M	2025 $M	2026 $M	Total investment over period $M
Infrastructure	30.0	90.0	150.0	150.0	420.0
Compliance, Monitoring and Enforcement (CME)	7.5	7.5	7.5	9.0	31.5
Data collection and analysis	2.0	2.0	2.0	2.3	8.3
Research & Development	5.0	5.0	5.0	5.0	20.0
Innovation	10.0	10.0	10.0	10.0	40.0
Territorial Authorities	22.5	22.5	22.5	25.0	92.5
Community Projects	15.9	16.7	16.0	15.0	63.6
Education & Awareness	3.0	3.0	3.0	5.0	14.0
Other	-	-	-	9.2	9.2
Reserve	5.1	8.3	11.3	0.3	25.0
Total	**101.0**	**165.0**	**227.3**	**230.8**	**724.1**

In the third Framework element, different Investment Processes will be required for the different investment types. The Ministry should seek to use existing investment processes and expertise from across the public sector to avoid duplication and maximise efficiency.

[3] We note that, subject to Cabinet decisions, the revenue from an increased Levy is projected to flow from 1 July 2021, however the restrictions on the use of Levy funds created by the WMA are expected to remain in place until 1 July 2022, subject to the outcome of the current Levy consultation process and government willingness to revisit the WMA.

The investment processes will also need to recognize that Māori and Iwi contribute and play a major role in New Zealand's economy. Māori contribution to the New Zealand economy is multi-faceted and includes the primary sector, natural resources, small and medium enterprises and tourism and have a role in minimizing waste.

The Crown–Māori Economic Development Strategy, He kai kei aku ringa, provides an organising framework to drive an all-of-government focus on achieving positive economic outcomes for Māori. "He kai kei aku ringa, literally, to provide the food you need with your own hands – or in today's world, to be responsible for the resources and capability you need to grow and develop"[4], is an intent, and as part of a wider framework, seems well aligned to the waste minimisation framework we propose.

Our recommendations on how Waste Disposal Levy funds should be allocated in a more efficient and effective way include:

- **Implementing funding envelopes** targeted in specific areas such as infrastructure, innovation, education/behaviour change, enforcement/compliance, feasibility studies/research, and data for example
- Implementing a **consistent method to prioritise** a wide range of urgent needs and investment opportunities
- Using **different funding approaches** for different kinds of investments such as a grant scheme similar to the current WMF approach for smaller community-led projects combined with a more structured approach for significant infrastructure investments
- Using **decision making structures for different levels** of investment, to increase the efficiency of decision making while retaining appropriate Ministerial control
- **Implementing advisory/consultation processes** into the decision making at both the strategic and operational funding envelope level
- **Creating opportunities for collaboration** and/or aggregation of levy funds with other established investment funds (e.g., the New Zealand Green Investment Fund)
- **Improving the quality and quantity of data** and insights available to the sector through enhanced data collection and analysis capabilities.

Indicative analysis shows potential infrastructure funding needs of approximately $2.1 to $2.6 billion and other enabling service funding needs of approximately $0.9 billion over the next 10 years which is significantly larger than the projected Levy revenue over the same period. The investment required to address the infrastructure deficit will need to be weighed against the investment needed for the equally important need for improved data, enhanced compliance monitoring, education to promote behavioural change or investments in research and development, innovation or community projects.

The proposed increase in Waste Levy revenue has created a unique opportunity for New Zealand to begin to address the issues underlying the increase in the volume of waste going to landfills and the associated environmental costs.

[4] "Strategy to 2040", Maori Economic Development Panel (2010), MBIE website

2. Recommendations

A summary of our recommendations at various levels of the Framework, to assure that Waste Disposal Levy funds are allocated in a more efficient and effective way by central and local government (territorial authorities) thereby reducing environmental harm from waste and catalysing growth in New Zealand's resource recovery and waste minimisation sectors.

The Waste Minimisation Act

The following recommendations in regard to the **Waste Minimisation Act** are intended to increase the flexibility available to the Ministry to implement the proposed Framework:

1. Under Section 30(c) (ii)

   Consideration should be given to removing the requirement for the Minister to approve all levy funded projects and establish a three-tier approval delegation:

   - Up to $1,000,000 Chief Executive of the Ministry's decision (able to be delegated to other Ministry personnel or other agencies as appropriate)
   - Between $1m and $10m Environment Ministers' decision
   - Greater than $10m Cabinet Decision.

2. Under Section 30

   Consideration should be given to broadening the purpose of levy funds, for example developing and maintaining a National Infrastructure Plan, developing and implementing the Medium-Term Investment Plans and other activities needed to support the effective management of the increased levy, such as CME and Data.

3. Under Section 31

   Consider removing the mandated Territorial Authority share of the Levy and replace with a requirement the Ministry allocate Levy funds in accordance with the Waste Strategy and Medium-Term Investment Plans.

4. Under Section 32

   Consideration should be given to allowing Territorial Authorities to use levy funds to pay for waste and recycling collection, storage and transportation to recycling or reprocessing facilities.

5. Under Section 38

   Consideration should be given to ensuring alternative funding approaches (in addition to grant funding) can be utilised across the broader investment objectives proposed in the Medium Term Investment Plan.

Waste Strategy

We are aware the Ministry is in the process of reviewing and refreshing the NZ Waste Strategy and recommend the following elements are considered in that process:

6. Investment Envelopes

It is recommended the Waste Strategy establishes a series of Investment Envelopes which will be funded through the Medium-Term Investment Plans (MTIP). Investment envelopes targeted in specific areas such as infrastructure, innovation, education/behaviour change, enforcement/compliance, feasibility studies/research, and data for example. The refreshed Strategy should establish the investment envelopes, as a concept rather than a quantum, with the quantum allocated through the Investment Plan.

7. Delegation of decision-making

We recommend splitting investment envelope responsibilities amongst different organisations to maximise the use of expertise and experience already within the public sector and minimising duplication of effort amongst public sector entities. This approach will also maximise the opportunities for collaboration and/or aggregation of levy funds with other established investment funds. Within the bounds of the proposed decision-making delegations (above) it is proposed that as part of the “outsourcing” of some investment processes a limited decision-making delegation will also be given to the relevant agency.

8. Investment Principles

The Strategy should establish the Investment Principles to guide the development of the MTIPs and direct the investment managers (both internal to the Ministry and external agencies).

9. Access to Relevant Expertise

It is recommended the Ministry establish a representative panel of experts from across the Waste Sector to provide input and insight into the development of the Waste Strategy, the Long-Term Infrastructure Plan and the Medium-Term Investment plans.

The Ministry should determine whether the current Waste Advisory Board (WAB) has the required skills and, if not, whether additional expertise is needed to supplement or replace the WAB.

We also recommend the expert panel retains an oversight role on the effectiveness of the investments undertaken and makes recommendations on potential changes to the funding allocations for the next MTIP.

10. Prioritisation Principles

The Strategy should establish the prioritisation principles to be utilised in the MTIPs. We are proposing that waste streams are prioritised based on a determination of the relative impact of volume and environmental harm. Other principles might include the need for a balanced portfolio of investments across all of the Investment Envelopes. It is recommended that subjective factors are avoided, such as current visibility of the waste stream (e.g. what would the public notice) as it might lead to sub-optimal decisions.

Long-Term Infrastructure Plan

11. Duration

While the LTIP should have a 10-year horizon to be consistent with the Waste Strategy, it is recommended that the LTIP is revisited periodically to ensure it remains valid in the face of changing market conditions, waste behaviours and waste volumes and infrastructure development.

12. Purpose

The LTIP is intended to establish what waste infrastructure is required to improve the waste system and to give the Sector a view of when investments are expected to be made over the period of the plan. It is recommended the LTIP process includes seeking input from the market on how identified infrastructure gaps could be filled.

Medium-Term Investment Plans

13. Duration

We recommend a series of 4-year Medium-Term Investment Plans are created to operationalise strategy and provide a clear signal to the market of Ministry intentions for the period. A key element of the MTIP will be the prioritisation of funds across the investment envelopes for the period.

14. Investment Allocations

We have recommended the investment envelope funding allocations for the first MTIP, including detailing the priorities for infrastructure investment, these indicative investment allocations should be reviewed by the Ministry and the Ministry should consider consulting with the sector on these priorities.

15. Process for major infrastructure

It is recommended the process for major infrastructure investments includes seeking input from the market on how identified infrastructure gaps could be filled, through an Expression of Interest/Request for Information process before a contestable Request for Proposal process is undertaken. It is also recommended that before any major infrastructure projects are considered a Market Impact Analysis is undertaken to ensure the investor understands the impact upon existing market participants.

16. Compliance and Monitoring

The CME Investment Envelope is expected to fund compliance and enforcement activity to address this priority. We note we are recommending this activity is partly outsourced to a regulatory agency such as the Environmental Protection Agency and partly retained in-house.

17. Reporting

We recommend the current reporting system (OWLS) is reviewed to determine if it is capable of meeting the broader information needs to both the Ministry and EPA.

18. Prioritisation

The relative prioritisation between investment envelopes is a judgement by the Ministry based on the prioritisation processes described and the advice of the expert panel. It is recommended that the investment envelopes for each medium-term Investment Plan are consulted on with the sector, as should the major infrastructure decisions.

19. Market approach

It is recommended that early market involvement method such as an EOI/ROI are used as the first step to understand what solutions are available and who the key players in the market are. The information gained will allow an RFP to be developed and issued.

20. Conservative allocation

If the Ministry does not have confidence in the revenue projections (particularly in the initial stages as the system data quality and quantity are being improved) it is recommended the total amount committed to investment is a proportion of the projected revenue.

21. Innovation

Green Investment Finance Ltd (GIFL) has been established with a fixed capital investment amount ($100m) which is intended to be maintained and grown through their investment activities. It is recommended a similar approach is taken for waste innovation, with a fixed amount of funding provided. This amount could be increased over time to create a permanent waste innovation investment fund.

22. Community grants

We recommend the application process and funding model for community grants is streamlined, with escalating requirements for larger and more complex investments.

23. Regional approach

We recommend the regional approach is adopted as this has the benefit of directly involving the local community in making decisions about local solutions for local issues, it retains central oversight for consistency and process integrity and through the Ministry will allow effective actions to be replicated in other regions.

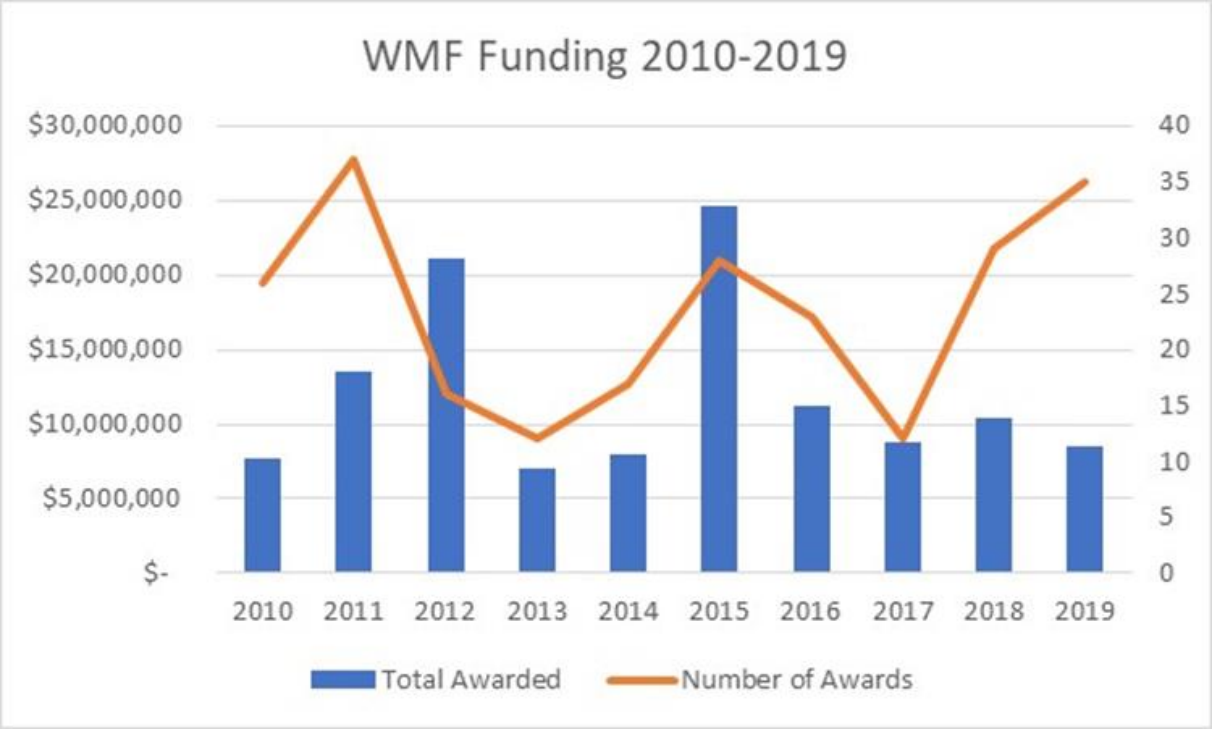
3. Situation

Funding by the Waste Minimisation Fund since 2010

The Ministry has operated the Waste Minimisation Fund (WMF) since 2010. Over the period of the WMF's operations the volume of waste going to landfills has increased. The Ministry has stated that waste going to landfill has increased 48 percent in the last decade (to 30 June 2019) increase from 570kg per capita in 2009 to 740kg per capita in 2019. While the WMF has not caused this increase, it is apparent that the grants provided by the WMF have not made a noticeable impact on the volume of waste going to landfill.

The Ministry has been established and operated the Waste Minimisation Fund (WMF) since 2010. An overview of the activity of the WMF is shown in Figure 2.

Figure 2 Waste Minimisation Fund Award (source MfE)



In the last decade, the average amount awarded has varied between $1.3m (in 2012) to $245k (in 2019). The largest investment was a $13.5m infrastructure investment in 2015, part of a total of 23 grants of more than $1m over the period. The smallest grant during the period was $15,000.

Since 2010 the WMF has funded 235 projects to the value approximately $120m. To put this number in perspective Eunomia[5] estimate it would cost $600m for a fibre plant big enough to take the rest of NZ's fibre (beyond what is currently processed).

[5] Eunomia. 2018. National Resource Recovery Project – Situational Analysis Report

The reasons why investment of the Waste Disposal Levy since 2009 has not resulted in reduced waste to landfill.

Five main reasons for the lack of impact are:

1. Scale and spread.
2. A slow approval process.
3. Dispersion and dilution of the TA hypothecated funds.
4. A lack of targets in the Waste Strategy[6]
5. A lack of data, and hence measurement against real targets.

A factor in the lack of impact of the WMF has been the scale and spread of its investments. The WMF has spread its grants across infrastructure, education, feasibility studies, community projects, and other themes, for a range of groups including industry, small to medium enterprises, iwi, research organisations, training institutions, industry bodies, community groups, industry and local government but the quantum of the funding available has been insufficient to accelerate adequate investment in the waste system or to address gaps in waste infrastructure.

In 2018 WMF applications sought funding of $106m as a contribution to projects worth $251m, and in 2019 $144m was sought as a contribution to projects worth $275m. These numbers contrast sharply to the approximately $10 - $15m available per annum through the WMF.

The current structure of WMF processes requires all applications to submit the same information, undertake the same assessment processes and go through the same approval processes (Waste Minimisation Fund Panel recommendation to the Minister for approval). This has resulted in a gap between application and funding of between 8 and 12 months for the majority of applications, with more complex applications taking up to 18 months. In contrast, the Ministry for Primary Industry's Sustainable Food & Fibre Futures fund states on their website that grant applications will be decided upon in 2 months with another 2 months for contracting with more complex 'Partnership' applications taking up to 6 months for development of a business case, 2 months for a decision and 4 months for contracting.

Approximately half of the Waste Levy collected is paid to Territorial Authorities (TAs) under the requirements of the Waste Minimisation Act 2008 (the Act). The Ministry state in their report[7] that spending on existing services"…indicates that some councils may be using levy money to offset the cost of running existing waste minimisation services (such as kerbside

[6] This topic is the subject of several prior reviews and papers, hence will not be re-examined exhaustively in this paper. In summary:
Early reporting in "Targets in the New Zealand Waste Strategy: 2006 Review of Progress" (2016), MfE showed encouraging progress towards the 2002 targets.
Four years later "The New Zealand Waste Strategy: Reducing Harm; Improving Efficiency" (2010) MfE, discusses a "change in context" and a "revised strategy". Progress against the targets is not discussed in detail, however a single statement that "many of the targets were unable to be measured or achieved" is made – somewhat at odds with the prior review. In this review, the thirty targets are not mentioned in detail and two new broad goals are introduced.
Five years later the "Review of the effectiveness of the waste disposal levy", (2014) did not discuss the targets either and instead used a comparison against an outcomes framework introduced in 2011 for the purpose of "setting out a consistent and durable approach to future reviews". Outcomes "9 People dispose of less waste and minimise more waste, particularly harmful waste" and "10 Waste minimisation is achieved" in the framework are key. The report concludes, as prior reviews did, that a lack of meaningful data and baselines limit firm conclusions and "it is impossible to determine whether the outcomes have been achieved".
The effect upon waste minimisation during the span of this period is examined in "(Un) Changing Behaviour: NZ's delay & dysfunction in utilising Economic Instruments and Management of Waste" (2018), Open submission to the new Parliamentary Commissioner for the Environment, NZ Produce Stewardship Council, Zero Waste Academy (Massey University) which forms a conclusion the lack of effective targets is a key reason for the failure to effectively minimise waste in this country.

[7] Ministry for the Environment. 2014. Review of the effectiveness of the waste disposal levy.

recycling), with no additional net waste minimisation benefit resulting from the additional levy funding." The Waste Levy is distributed to TAs through a population-based formula, which equates to approximately $4.00 per individual[8]. While this has allowed some of the larger TAs to create contestable waste minimisation funds, some TAs need to accumulate the Waste Levy funds over time to allow for meaningful investment in waste minimisation and some smaller TAs receive minimal funding from the Waste Levy.

Tax Working Group

In February 2019 the Tax Working Group (TWG) released its final report entitled The Future of Tax. Section 4 of this document deals with environmental and ecological taxes, including the Waste Disposal Levy.

The TWG observes; i. there are short term opportunities to better use environmental taxes to price negative environmental externalities, ii. medium-term (5-10 years) opportunities to use environmental tax revenue to help fund a transition to a more sustainable, circular economy, and iii. long-term (10 years +) environmental taxes could extend New Zealand's tax base in a regenerative economy. The TWG considered there is scope, in the longer term, for environmental taxes to broaden New Zealand's current tax base sitting alongside income tax, GST and excise tax.

The TWG supported the revisiting the current approach to hypothecation, i.e. the allocation of the Waste Disposal Levy, especially if there were significant increases in funds raised, to ensure they are being used to move towards a more circular economy.

The TWG identified that overseas experience has shown that landfilling is very responsive to price signals. Waste taxes also have the potential to raise significant revenue in the short to medium-term. The TWG also note that, in the long run, the price elasticity of waste means that waste taxes may not be a sustainable tax base.

We consider the proposed Waste Levy increase is consistent with the TWG's opportunity to price negative environmental externalities. We consider the proposed Waste Minimisation Investment Framework to be consistent with the TWG's medium-term opportunity to use environmental tax revenue to help fund a transition to a more sustainable, circular economy.

The increase in waste going to landfill shows that New Zealand's current waste minimisation infrastructure is inadequate to deal with current waste volumes. As noted in a following section, work is currently being undertaken to assess the size of New Zealand's waste infrastructure gap. While the government's commitment to reducing the volume of waste going to landfill is not in question, it is unclear what priority waste minimisation infrastructure would get if hypothecation was ended and Waste Levy funds were paid into the general tax pool.

This consideration, combined with the expectation of a decline in Levy revenue driven by a combination of waste's price elasticity and successful waste minimisation initiatives, leads us to support the continued hypothecation of Waste Levy funds for waste minimisation investments.

[8] TAs share of the Waste Levy is approximately $18m per year, divided by New Zealand's population of approximately 4.5m gives approximately $4.00 per person.

4. Framework Overview

The Waste Minimisation Investment Framework we are proposing has a mix of long-term and medium-term elements. The medium-term elements include a series of allocation envelopes for funds which are then applied through a series of investment processes, some of which use existing public sector architecture. The Investment Plan is intended to operationalise the Waste Strategy which in turn is intended to achieve the outcomes established by Government Policy and the Act.

The Waste Minimisation Investment Framework (the Framework) has been developed to assist the Ministry for the Environment (the Ministry) by making recommendations on how Waste Disposal Levy funds could be allocated in a more efficient and effective way by central and local government to reduce environmental harm from waste and to catalyse growth in New Zealand's resource recovery and waste minimisation sectors.

The Framework has been developed against the backdrop of a public consultation of the desirability of increasing the Waste Levy. The investment plan is a key element of the Framework and is intended to guide how increased revenue would be spent if one of the Levy increase proposals being consulted upon is implemented. We also understand that initial work is underway to scope a review of the Waste Minimisation Strategy. This document makes a number of recommendations in regard to issues which should be considered if the Strategy is refreshed.

Underlying the Framework is the understanding that this plan will not be operating in a vacuum and the current New Zealand (NZ) waste management system is fundamentally a commercial system with a number of private and public sector entities operating in the system. Key elements of the system, such as recycling, are dependent upon a commercially viable end market for the recycled or reprocessed material. The challenges posed by the recent changes in export markets is testament to this fact. Where required investments are not commercially viable, the decision whether to invest levy revenue will need to balance the public benefit of the investment against the cost.

Three main elements in the Framework are used to operationalise the outcomes intended by higher level Policy and the Act.

The first elements in the Framework are the Waste Strategy, supported by the Long-Term Infrastructure Plan (LTIP). From the perspective of the Framework, the Waste Strategy is important in establishing the required outcomes of investment, the boundaries of the investment process, establishing the principles and mechanics of the investment process and establishing principles for the prioritisation framework for the Investment Plan.

In the Medium-Term Investment Plan (MTIP), a Prioritisation Matrix weighs each waste stream's relative volume and harm to determine priority. The output is used to allocate the expected levy revenue in a coherent way into a variety of internal and external investment processes. The primary mechanism we are proposing is a series of investment envelopes which ring-fence funding for certain activities.

In the third element, different Investment Processes will be required for the different investment types. The Ministry should seek to use existing investment processes and expertise from across the public sector to avoid duplication and maximise efficiency.

The long-term horizon of the strategy and LTIP is intended to give certainty to the sector and to reflect the fact that there are no quick fixes to resolve the identified issues. Ideally the Waste Strategy and LTIP would be available to TAs to allow them to take account of government initiatives in their own Waste Minimisation and Management Plans and Long-Term Infrastructure Plans.

The proposed Waste Minimisation Investment Framework is illustrated in Figure 3. More details on the elements of the proposed Waste Minimisation Framework and their components are shown in Table 2.

Figure 3 Waste Minimisation Investment Framework

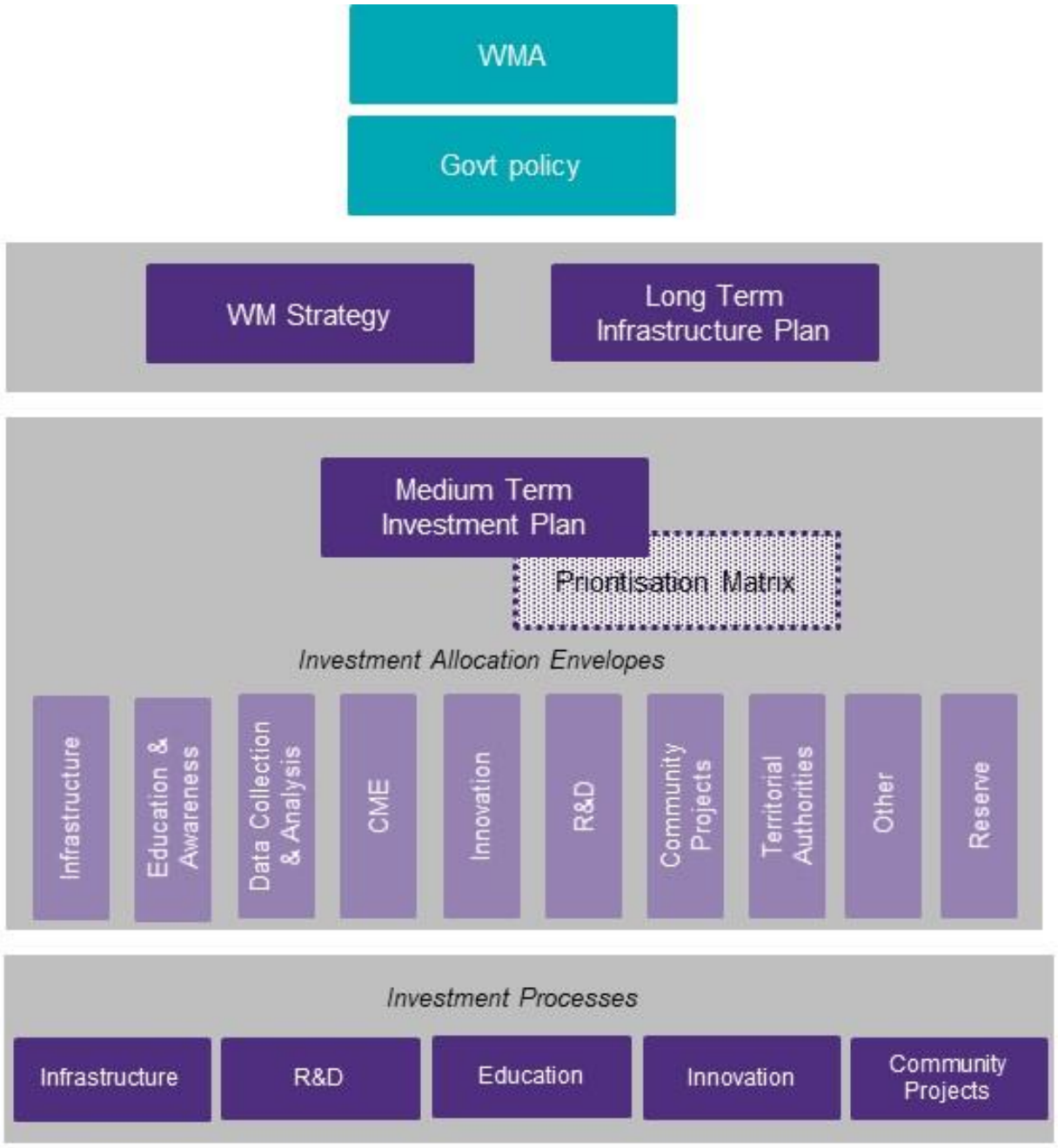


Table 2 Key Elements of the Waste Minimisation Investment Framework

Element	Description
Waste Minimisation Act (WMA or Act)	The purpose of the Act is to encourage waste minimisation and a decrease in waste disposal, to protect the environment from harm and provide environmental, social, economic and cultural benefits. The Act creates the Waste Levy, the hypothecation of Levy funds for waste minimisation activities and an allocation to Territorial Authorities (TAs). We understand consideration is being given to reviewing and refreshing the Act. We have identified potential issues to consider as part of the review process in Appendix 1.
Government Policy	The policy of the Government of the day needs to be consistent with the Act but will influence how the Act is operationalised. *In the proposed Framework, Government policy will influence the Medium-Term Investment Plan.*
NZ Waste Strategy	We also understand that initial work is underway to scope a review of the New Zealand Waste Strategy (Waste Strategy). The updated Waste Strategy should establish the desired outcomes, including targets and performance measures. It should also establish the high-level priorities and principles for transforming the waste system and then informing the Medium-Term Investment Plan (MTIP). We also recommend the refreshed Waste Strategy should establish the investment envelopes, as a concept rather than a quantum, with the quantum allocated through the MTIP. The Waste Strategy should also establish the principles underlying the Prioritisation Matrix and the Investment Principles. *The Strategy should have a 10-year horizon.*
Long-Term Infrastructure Plan (LTIP)	The proposed LTIP needs to include a gap analysis to establish what infrastructure is required, where it is required and the priority. The LTIP should also identify the critical enabling infrastructure required to make a national plan/system effective. The primary purpose of the LTIP is to inform the MTIP as to the infrastructure required to address priority waste streams. *The LTIP is a new framework element*
Medium-Term Investment Plan (MTIP)	The MTIP needs to utilise the Prioritisation matrix and establish investment principles for allocation of funding within the investment Envelopes. The MTIP should establish the size of the investment envelopes for the period. It also needs to consider who is best to deliver the plan e.g. whether functions should be outsourced. The MTIP should be a medium-term plan with a 3-year investment horizon. *The MTIP is a new framework element*

Element	Description
Prioritisation Matrix	The Prioritisation Matrix is the key driver of the MTIP. The Prioritisation Matrix is required to allow waste streams to be prioritised for investment. The volume of waste and the environmental harm of the waste stream are proposed as the key prioritisation factors. *The Prioritisation Matrix is a new framework element*.
Investment Processes	The Investment Processes are the mechanics of how funding options are assessed and how funding is allocated and contracted. The processes required will differ given the potential difference in the size and complexity of investments across a range of investment types. Processes should be able to handle a range of investment options beyond grant funding. Consideration should be given to creating investment processes which are proportionate to the amount being invested. *The majority of the proposed investment processes are new framework elements*.

Existing Ministry Workstreams

The Ministry has a significant body of work currently underway, including the National Resource Recovery (NRR) Projects. The relevant NRR Projects are shown in Table 3. There is an obvious correlation between these projects and the information required to inform the Long-Term Infrastructure Plan and the Medium-Term Investment Plan, and it is expected that upon completion the information will be used to finalise the LTIP and MTIP.

Table 3 Current Ministry for the Environment Workstreams

	Initiative
1	New Zealand Container Return Scheme
2	Investigate the recyclability of plastic packaging
3	Investigate feasibility of increasing domestic plastic reprocessing
4	National resource recovery infrastructure and service stock take and gap analysis
5	Increasing domestic fibre mill capacity
6	Increasing construction and demolition diversion
7	Review of domestic kerbside and commercial recycling collections
8	Co-design product stewardship schemes (up to 3 products)
9	Develop and deliver education to consumers and businesses

As stated above, we understand that initial work is underway to scope a review of the Waste Strategy and we expect this report to inform that review.

5. Waste Strategy

The first element in the Framework is the Waste Strategy, supported by the Long-Term Infrastructure Plan. From the perspective of the Framework, the Waste Strategy is important in establishing the boundaries of the investment process, establishing the principles and mechanics of the investment process and establishing principles for the prioritisation framework for the Investment Plan.

The 2002 Waste Strategy defines waste as: *any material, solid, liquid or gas, that is unwanted or unvalued, and discarded or discharged by its owner*[9]*.* The 2010 Waste Strategy defines waste as anything discarded or disposed of, includes a type of waste that is defined by its composition or source and includes any component or element of diverted material, if the component or element is disposed of or discarded. The 2002 Waste Strategy goes onto state *This comprehensive approach to minimisation and management helps avoid policies that might encourage transfer of waste form one disposal medium to another, rather than reducing or removing the waste problem itself*[10]*.*

We endorse the concept of the Waste Strategy addressing all forms of waste.

New Zealand currently has very limited resource recovery infrastructure, which limits the effectiveness of other levers, such as education, because people have few options to change their behaviour even if they wanted to. Therefore, to the initial focus for investment will be on establishing the infrastructure required to prevent waste going to landfills, this approach reflects where the Levy is generated from.

The Waste Strategy has a series of recommended components, which we describe further in this section:

- **Boundaries**. The boundaries will be derived from the strategic objectives which we can assume will remain, at least in the short to medium-term, to produce less waste, divert more resources from going to landfill and minimise harm from waste
- **Investment envelope concept**. The Waste Strategy will establish the principle of managing ring-fenced investment envelopes across key areas.
- **Investment principles**. The Waste Strategy will establish the investment principles which will underly the subsequent investment activity for the strategic period. As some investment management activity might be outsourced to other agencies it is important that core principles are established and shared with the relevant agencies
- **Decision hierarchy**. In the Investment Principles, we are proposing an amended decision hierarchy centered around delegating decision making. The proposed delegations are based upon those employed by the Provincial Growth Fund (PGF) and are intended to streamline decision making while ensuring the appropriate people are involved in the key decisions.
- **Waste hierarchy**. Underpinning the Waste Strategy should be the widely recognised Waste Hierarchy, which is consistent with prior iterations of the Waste Strategy.

[9] 2002 NZ Waste Strategy: Ministry for the Environment page 7
[10] 2002 NZ Waste Strategy: Ministry for the Environment page 7

The Waste Strategy is supported by the Long-Term Infrastructure Plan. The LTIP will need to identify what the additional infrastructure requirements are. This gap can then be prioritised through the Prioritisation Matrix and operationalised through the MTIPs.

5.1 Investment Boundaries

The investment boundaries will be derived from the strategic objectives which we can assume will remain, at least in the short to medium-term, to produce less waste, divert more resources from going to landfill and minimise harm from waste.

The Waste Strategy will be consistent with the requirements of the Act. However, we would support broadening the remit of the Act and therefore the Waste Strategy to include aspects such as managing/limiting the environmental impacts of both landfills and diversion from landfills. For example, an option could be to burn most waste for energy, but we assume large scale incineration will not be in line with core principles in the revised strategy to reduce the volume of material in the waste stream prior to considering energy recovery or disposal options

The Waste Strategy will create boundaries for the Investment Plan which include:

A preference for New Zealand-centered solutions that add resilience given the risks of over-reliance on exporting our waste streams overseas. This means establishing onshore reprocessing of NZ waste streams rather than relying on exporting waste products, or potentially looking to a regional solution (such as exporting waste to Australia for reprocessing).

Investment priority will be given to waste streams which lack a viable international market. Where a viable international market exists for a waste stream (e.g. some metals) investment will not be used to disrupt that market.

A commitment to the optimal solutions for New Zealand as a whole, even where this may lead to a sub-optimal solution at a regional or local level.

A commitment to commercially viable solutions where possible, avoiding public and private infrastructure competing as far as possible while avoiding making public infrastructure the recycler/reprocessor of last resort. Where a commercially viable end-market does not exist for diverted/reprocessed material the societal benefit of the diversion/reprocessing versus any harm from energy recovery and/or landfilling will need to be considered.

Investment will leverage other central, local and/or private sector finance as far as possible, given the extent of the total investment required. In pursuit of this objective, investment should:

- seek out commercially viable solutions that might not otherwise attract mainstream investment (i.e. there is a market failure of investment finance)
- make investments that are additional or serve to accelerate existing limited investment
- facilitate co-investment wherever possible, and
- avoid crowding-out private investment.

Align with other central government funds to avoid or minimise duplication of effort across the public sector.

A prioritisation framework for waste streams. Weighing the relative priority of volume, environmental harm, ability to reprocess, value of diverted material (reprocessed or otherwise). The Waste Strategy will reflect the Waste Hierarchy as a prioritisation methodology.

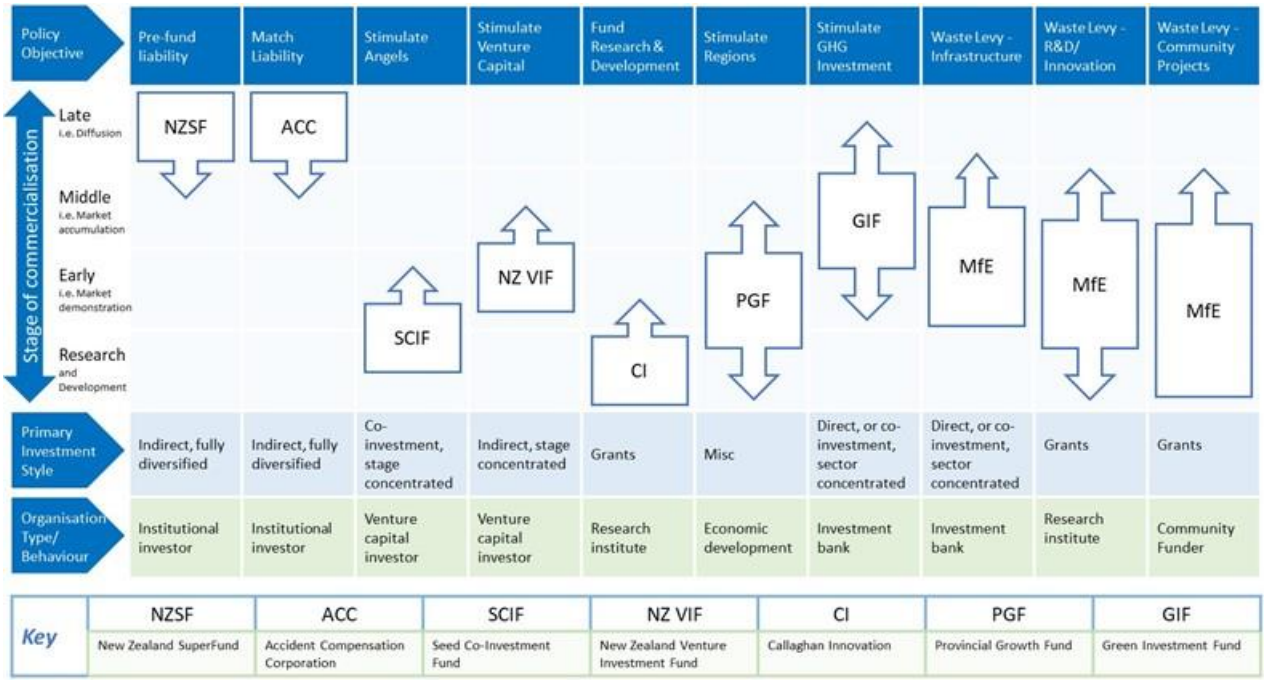
A waste volume reduction focus will inherently favour metro over provincial waste streams (concentrating on metro will address the largest proportion of waste but may be viewed as inequitable).

Need to address all elements of the waste system: production, collection, sorting, bulking, transportation, reprocessing and end markets.

A commitment to implement the Long-Term Infrastructure Plan.

As stated above, the Waste Levy investments need to align with other central government funds to avoid or minimise duplication of effort across the public sector. We have mapped our initial view of where the Waste Levy investments will fit within the current government funding landscape in Figure 4.

Figure 4 Mapping of Current Government Funding Landscape



We have amended a diagram included in a Cabinet Paper[11] to illustrate where we consider three indicative investment types (final three columns showing Infrastructure, R&D/Innovation and Community Projects) sit in comparison to existing government investment funds.

[11] Cabinet Paper Dev-18-SUB-0257: Establishing New Zealand Green Investment Finance Limited.

5.2 Investment Envelope Concept

The Waste Strategy will establish the principle of managing ring-fenced investment envelopes across key areas.

One of the issues identified with the current WMF Fund investments, is their small scale and limited duration. In order to maintain a balance of investment across a series of waste system needs, across time and across geography we recommend a series of investment envelopes. Each investment envelope will be able to flex up and down over time. Over longer time frames an investment envelope might be replaced with another to reflect changing priorities. By keeping investment ring-fenced inside an investment envelope directly linked to the strategic objectives, more impact will be produced. The proposed investment envelopes are:

Table 4 Proposed investment envelopes

Investment Envelope	2023-26 Medium-Term Investment Plan Investment Proportion	2022-32 Waste Strategy Investment Proportion
Infrastructure	50%	53%
Education/Awareness	2%	2%
Compliance, Monitoring and Enforcement (CME)	5%	4%
Data collection, Analysis and Reporting	1%	1%
Innovation	6%	4%
Research and Development	3%	2%
Community Projects	12%	9%
Territorial Authorities (TA) Funding[12]	17%	14%
Other	0%	10%
Levy Reserve	5%	1%

The 2022 Waste Minimisation Fund allocation is included in the Community Projects Investment Envelope above. The prioritisation of each of the investment envelopes will be managed through the shorter horizon Medium-Term Investment Plan, as the priorities, and therefore the allocation of investment, will change as infrastructure and core services are established and become operational.

The relative priority of the allocation envelopes for funding will determined after considering:

i. services or activities which need to be in place to manage the waste system (CME and Data)

ii. the current state of the waste system across the waste streams (infrastructure), the dependence of TAs and community organisations for continuing funding to perform their role in the system (Territorial Authorities and Community Projects)

[12] This is a recommendation only and is not presupposing the outcome of consultation with territorial authorities and other stakeholders (as well as legislative review) that would be required to alter the territorial share of levy revenue.

iii. future proofing the waste system by assisting the development and implementation of new technologies and approaches (Research & Development and Innovation) and

iv. changing behaviours to support the waste minimisation strategy (Education & Awareness).

The allocation judgement will be subjective, even where based on the best information available.

5.3 Investment Principles

The strategy will establish the investment principles which will underlie the subsequent investment activity for the strategic period. As some investment management activity might be outsourced to other agencies it is important that core principles are established and shared with the relevant agencies.

We are proposing the following principles to guide investment over the initial strategic period:

- While the draft objectives of a refreshed Waste Strategy are expected to be to produce less waste, divert more resources from going to landfill and minimise harm from waste, these objectives are addressed in the initial strategic period by focusing on the current volumes of solid waste going into landfill.
- All investments make a measurable contribution to the achievement of the strategy, strategic objectives and targets.
- Other (non-target) outcomes achieved through investment will be recorded but are not a criterion for investment nor a measure of investment performance (e.g. jobs created)
- Responsibility for any or all parts of the investment management and administration processes can be delegated to other agencies, while the Ministry will retain accountability for performance of all delegated operations and the performance of the overall fund in achieving strategic objectives.
- Investments will be a mix of short, medium and long-term funding with the requirement that the longer term the funding the closer the required alignment to strategic objectives.
- Investments can include, but are not limited to, grants, loans, equity or any combination of these instruments. Small and/or short-term investments, and public sector investments are expected to be grants.
- Investments can be for capex or opex or any combination of the two, but the Ministry will try, as far as possible and practical, to avoid creating permanent subsidies for on-going operations of infrastructure or services.
- Investments will use a variety of methods including direct approaches including, Expressions of Interest (EOI), Requests for Proposal (RFP) and applications to source investments.
- The decision-making delegations are:
    - Up to $1,000,000 Chief Executive of the Ministry’s decision (able to be delegated to other Ministry personnel or other agencies as appropriate)
    - Between $1m and $10m Environment Ministers’ decision
    - Greater than $10m Cabinet Decision.

- Application information and reporting requirements will be scaled to be reflective of the size of the investment amount as well as the purpose of the investment, for example a community grant for $50k will have minimal application information requirements and outcome reporting requirements but will need to prove community support for their project.
- Investments can be made in necessary enabling infrastructure (e.g. transport links) to support the viability of national or regional waste infrastructure.
- Territorial Authorities are able to use their share of funding to subsidise waste operations where they clearly contribute to strategic objectives contained with the NZ Waste Strategy.

5.4 Decision Hierarchy

In the above Investment Principles, we have recommended an amended decision hierarchy centered around delegating decision making. The proposed delegations are based upon those employed by the Provincial Growth Fund (PGF) and are intended to streamline decision making while ensuring the appropriate people are involved in the key decisions.

Given the significantly increased value and volume of decisions potentially required through the anticipated increased funding, we are recommending the Minister for the Environment is freed from having to be involved with lower level funding decisions. The delegation of $1m to the Chief Executive (CE) of the Ministry is not intended to require the CE to review and approve all funding decisions below $1m. It is proposed that as part of the “outsourcing” of some investment processes a limited delegation will also be given to the relevant agency. For example, if Callaghan Innovation is contracted to manage the Research and Development investment processes a delegation of (say) $200k would also be given to Callaghan Innovation to utilise in their existing approval processes. Decisions above this delegation would come back to the Ministry.

Note we are proposing that each agency the Ministry contracts to undertake an investment process, would be required to establish an appropriate expert panel to ensure appropriate waste expertise is utilised in decision making, which is consistent with the current approach of the proposed agencies. Our expectation is that the Ministry will be represented on these expert panels and the Ministry would receive appropriate levels of reporting on the use of the allocated investment funding.

The possible exception to this proposal may be infrastructure investments which, due to their potential size, we expect the vast majority will require approval from the Minister for the Environment or Cabinet.

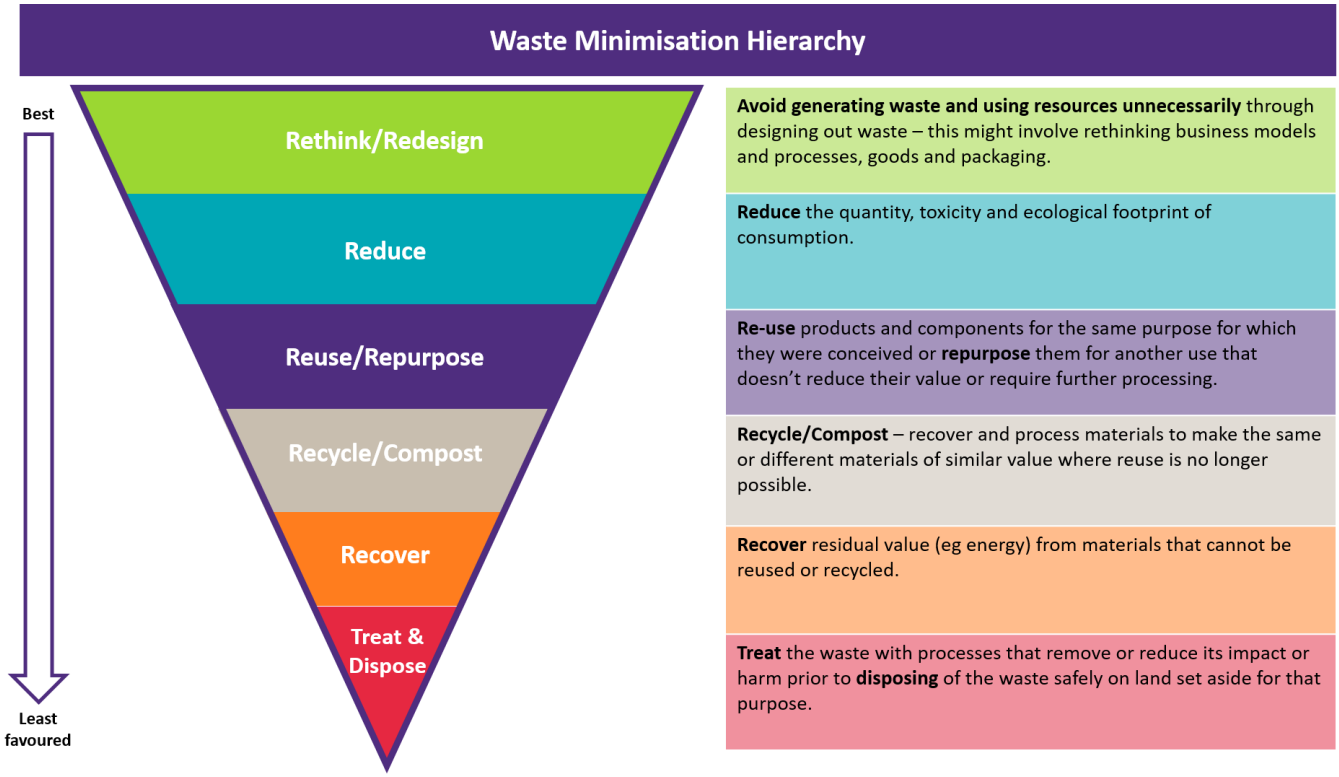
5.5 Waste Hierarchy

Underpinning the Waste Strategy should be the widely recognised Waste Hierarchy, which is consistent with prior iterations of the Waste Strategy.

However, the priority for the Waste Strategy and supporting MTIPs should be addressing the current volumes of waste going to landfill and establishing the infrastructure required for the diversion and disposal (treatment) steps in the waste hierarchy. This priority reflects:

- New Zealand currently has very limited resource recovery infrastructure, which limits the effectiveness of other levers, such as education, because people have few options to change their behaviour even if they wanted to;
- New Zealand continues to produce increased volumes of waste going to landfill; and initiatives for reducing the waste produced will require working with the manufacturers of selected products. While intuitively an effective way to reduce waste, such an approach may be slow in making a measurable impact on the 11 million tonnes of waste disposed of in landfills annually.

Figure 5 Waste Minimisation Hierarchy (Ministry for the Environment)



Waste Reduction (Rethink/Redesign and Reduce)

Reducing the amount of waste produced is an obvious way to minimise the amount of waste the system needs to manage.

The proposed Research & Development and Innovation investment envelopes should be available to manufacturers and intermediaries (such as supermarkets) to develop and implement initiatives to reduce the waste associated with their products or processes.

The Education and Awareness investment envelope could also be utilised to support waste reduction initiatives through seeking to change public behaviour, opinions and purchasing behaviors.

A second lever available to the Ministry is through legislation (for example through banning certain plastic types or imposing a duty on the use of selected virgin materials where a recovered alternative is available). It is noted there is the potential that the replacement material substituted for banned materials could still enter the waste stream and might end up in landfills. If legislative actions are taken, the MTIPs will need to adapt to recognise the changed environment it operates within.

Waste Diversion (Re-Use/Repurpose, Recycle/Compost and Recover)

The Waste Strategy should be focused on the waste diversion steps (reuse, recycle and recover) to deal with the current volumes of waste produced and the expectation that waste will continue to be produced in the medium to long-term no matter how effective the waste reduction actions are.

All of the proposed investment envelopes (with the exception of the supporting CME and Data envelopes) could be utilised in waste diversion activities.

Waste Disposal (Treat and Dispose)

While reducing the amount of waste created is the objective of the Framework, the MTIPs need to address disposal options. Examples are the drying of sewerage sludge to reduce the volume of waste going into landfill or burning waste for energy. While disposal options are unlikely to be considered a preferred option, the MTIPs should be open to considering such projects as an option while taking full account of the potential environmental impact.

5.6 Long-Term Infrastructure Plan

The Long-Term Infrastructure Plan (LTIP) will need to identify what the required additional infrastructure requirements are. This gap can then be prioritised through the Prioritisation Matrix and operationalised through the Medium-Term Investment Plans. The LTIP is expected to be consistent with Treasury's Long-Term Investment Plan methodology.

Expert Group to guide

Consideration should be given to establishing an expert group of representatives from the Waste Industry, Territorial Authorities (TAs), Iwi and the Ministry. The task of the group is to identify and agree what infrastructure is required and where the infrastructure is required. It is expected the expert group's considerations will include;

- the effectiveness of current infrastructure, whether current infrastructure is underutilized
- the viability of transport options, whether national, regional or local infrastructure is required
- the impact of new infrastructure upon both landfills and end markets for diverted/processed material, etc.

The expert group should consider all parts of the waste system (from collection to disposal) and the priority waste streams.

Initial Focus will shift over time

The LTIP is expected to initially be focused on the Waste Diversion and Waste Disposal sections of the Waste Hierarchy to address the waste currently generated and minimizing harm from this waste. The impact of waste reduction initiatives and changing behaviours on waste streams should also be considered as the LTIP is refreshed over time. As infrastructure gaps are closed and waste volumes are reduced, the LTIP should also consider other waste types (liquid and gaseous) as well as the Reduction section of the Waste Hierarchy.

While the LTIP should have a 10-year horizon to be consistent with the Waste Strategy, it is recommended that the LTIP is revisited periodically (as a precursor to the development of the 4 year MTIPs) to ensure it remains valid in the face of changing market conditions, MTIP is created for each 4 year period. To assist in the development of the MTIPs the Ministry needs to ensure that the Waste Infrastructure Stock take is kept current.

LTIP influence on Territorial Authority Plans

TAs undertake a variety of medium and long-term planning, most relevant being the 6-year Waste Minimisation and Management Plans, the 10 Year Plans and the 30 Year Infrastructure Plans. It is expected that the Ministry's LTIP will directly influence the TA's investment planning and decisions, if for no other reason than the quantum of the additional funding available for national and regional waste infrastructure projects. Similarly, the TA's plans and intentions will influence both the LTIP and the MTIPs. We note this relationship and interdependency will exist regardless of any decision on the hypothecation of Waste Levy funding to the TAs. The Minister also has the power to direct TAs in relation to the content of their Waste Management and Minimisation Plans, as well as to set performance standards for the implementation of these plans.

LTIP role in national system

The LTIP is expected to identify the critical enabling infrastructure required to make a national plan/system effective. An example of this could be regional waste solutions which require the development of local collection, sorting and bulking infrastructure connected to a regional reprocessing facility through a transport network. Such a solution may only be viable if appropriate transport infrastructure is able to be utilised. We are aware that the PGF has invested in both roading and rail projects to facilitate their objective of stimulating regional economic growth.

Where the Ministry is looking to fund transport infrastructure there will be a need to work closely with the relevant agencies (for example NZTA and KiwiRail) to develop solutions which meet the needs of all parties. NZTA are understood to utilise detailed cost/benefit analysis to prioritise which transport projects are funded, there is the potential to use Levy funding to improve the cost/benefit of waste transport projects and increase the priority of these projects.

The LTIP would join a range of existing and planned government infrastructure investments. The NZ Infrastructure Commission has been established to coordinate this investment and to flag to the market the projected project pipeline, as well as to provide best practice guidance on infrastructure procurement and delivery. It is expected the Ministry would need to work with the NZ Infrastructure Commission on the proposed infrastructure investments.

5.7 Revenue Projections

There are a number of factors which will influence revenue expectations, the most obvious being the rate the Levy is set at, and whether the Levy will be increased in the future.

We have based the following discussion of revenue expectations on the Ministry's 2019 consultation document *Reducing waste: a more effective landfill levy*, and the 2019 NZIER report *Waste Levy Extension Estimates of Extending and Raising Levy*.

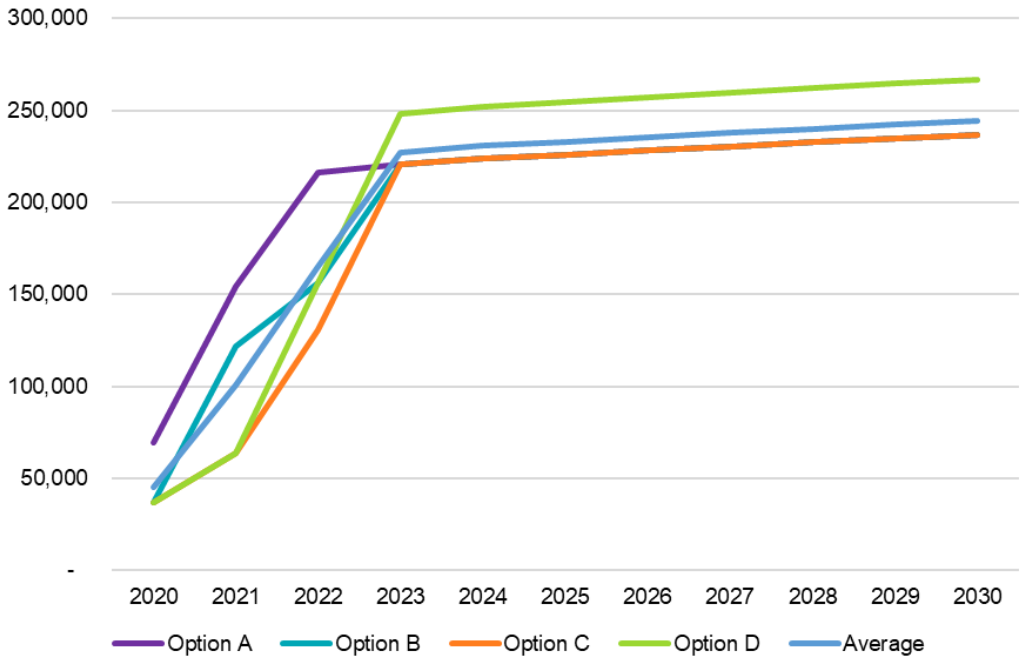
We have outlined below the NZIER revenue projections of the four options being consulted on, as well as the average of the four options. We utilise the average of the options being consulted on, as the consultation is yet to be completed and a decision on whether the Levy will be increased and which, if any, option is preferred is outstanding.
In their report NZIER note their projections are based on uncertain (e.g. regarding the number of operating landfills) and dated information (NZIER waste volumes are based on Eunomia's 2017 report, utilising estimated data from 2015) to which they've applied various assumptions. Accordingly, our use of an average of the NZIER projections should be treated as an estimate only.

Table 5 Revenue Projections of the four consultation options (units $M)

Year	Option A	Option B	Option C	Option D	Average
2020	69,345	36,912	6,912	6,912	45,020
2021	54,305	122,060	63,787	63,787	100,985
2022	216,430	156,418	130,706	156,418	164,993
2023	220,435	220,436	220,435	248,126	227,358
2024	223,738	223,739	223,738	251,928	230,786
2025	225,940	225,940	225,940	254,461	233,070
2026	228,167	228,167	228,167	257,024	235,381
2027	230,420	230,420	230,420	259,617	237,719
2028	232,655	232,655	232,655	262,189	240,039
2029	234,869	234,655	234,869	264,737	242,283
2030	236,510	236,510	236,510	266,625	244,039
Total	**2,272,814**	**2,147,912**	**2,064,139**	**2,321,824**	**2,201,672**

The NZIER revenue projections show a steady increase over time linked to population growth. Eunomia[13] have also projected increased volumes going to landfill based on a strong correlation to the growth in GDP. We note there are a number of initiatives which have the potential to impact waste volumes and therefore Levy income. Below (Figure 6) we have graphed the four revenue projections developed by NZIER and included in the Ministry's Levy consultation document. We have also included the average revenue projection.

Figure 7 Levy Revenue Projections (NZIER)



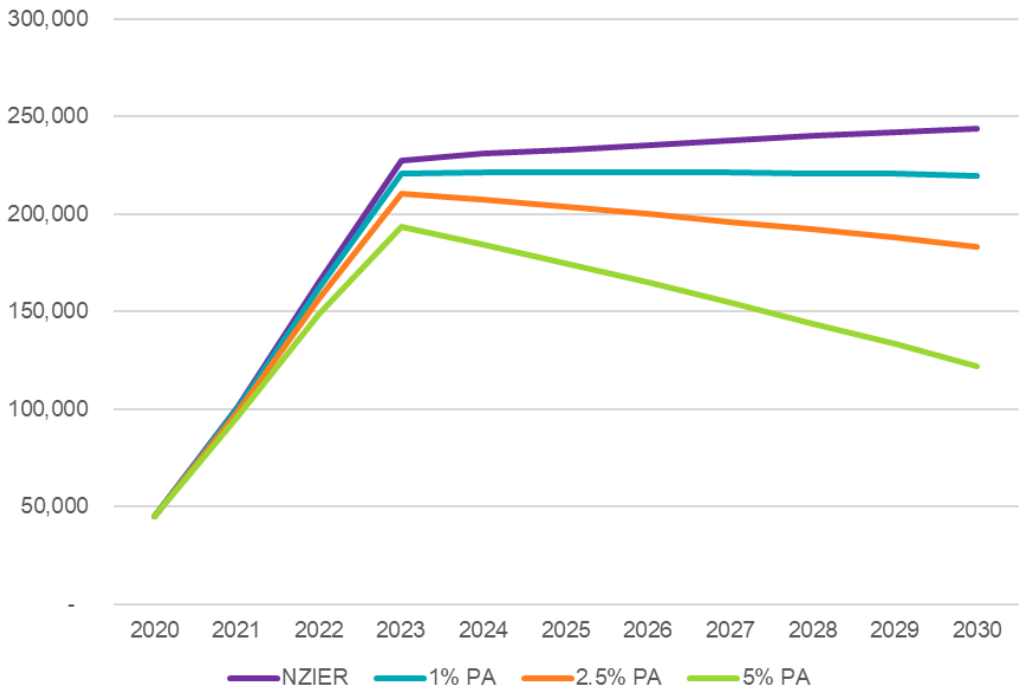
The investments made under this plan are also expected to impact waste volumes and therefore Levy revenue. The Tax Working Group noted in their report Future of Tax, that in the long run, the price elasticity of waste means that waste taxes might not be a sustainable tax base.

This has a potentially significant impact on the funds available to the MTIPs and the underlying investment envelopes. If we expect Levy revenue to fall in the future, we will require a different investment strategy than if we expect revenue to remain steady or increase over time.

In their report NZIER state "*indirect effects, such as the impacts of levy-funded initiatives to support material recovery, are excluded from the analysis to concentrate on the effects of levy changes alone.*" Therefore, to understand the potential impact of successful initiatives which could reduce Levy revenue we have modelled the impact of reducing waste by 1% per year, 2.5% per year and 5% per year on the average of the NZIER revenue projections (Figure 8)

[13] Eunomia. The New Zealand Waste Disposal Levy. 2017. Page 93

Figure 8 Impact of Waste Minimisation Success on Levy Revenues



The above analysis is indicative only as it assumes a steady decline year on year from the first year of operation of the investment plan. The actual fall would likely be a more complex curve, rather than a straight line.

Despite the shortcomings of this simple analysis it is reasonable to assume the Levy revenue available for investment could be significantly reduced if planned future interventions are successful. We have detailed the revenue impact of a steady 2.5% decline in waste volumes in Table 6.

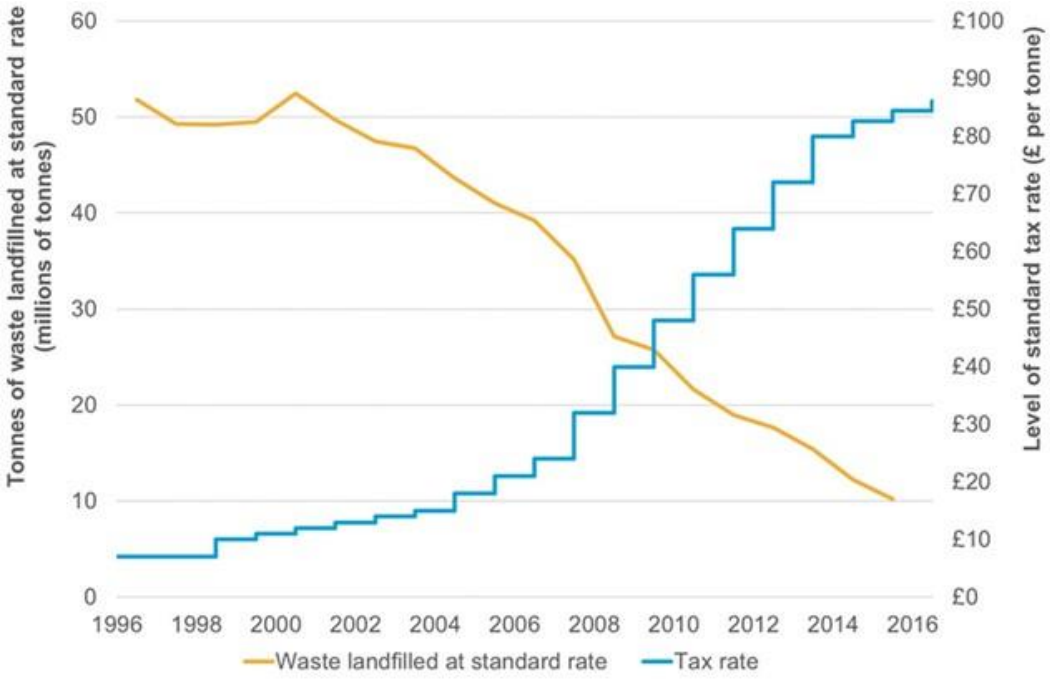
Table 6 Revenue Shortfall with 2.5% decline

Year	NZIER Projection	2.5% PA Reduction	Revenue Shortfall
2020	45,020	45,020	-
2021	100,985	98,460	2,525
2022	164,993	156,743	8,250
2023	227,358	210,306	17,052
2024	230,786	207,707	23,079
2025	233,070	203,936	29,134
2026	235,381	200,074	35,307
2027	237,719	196,118	41,601
2028	240,039	192,031	48,008
2029	242,283	187,769	54,514
2030	244,039	183,029	610,010
Total	**2,201,672**	**1,881,195**	**320,477**

In the following section we have modelled both the average of the NZIER scenarios which were consulted on in 2019 and the impact of the 2.5% Levy revenue reduction in example allocation models shown in Section 6.6. Uncertainty around expected Levy revenue is compounded by the lack of currently available information of what the waste infrastructure gaps are and the cost of filling these gaps. To recognise the level of uncertainty around both revenue and costs, it is important the investment plans are flexible and that improving information is a priority investment.

We note that allowing the Levy to be increased over time could mitigate the risk of falling Levy revenues. This was an option included in the Levy increase consultation document. For example, the UK Landfill Tax is generally seen to have been successful in its objective of reducing material disposed to landfill. Since its introduction in 1996 the standard rate has increased from £7 to £94 currently (£84 in 2015/16 when the following graph was completed). The increasing rate has resulted in total revenue of approx. £400m in 1997/98, increasing to a peak of £1.2 billion in 2013/14, and subsequently reducing to £757m in 2017/18. During this time volumes to landfill have reduced by approx. 38m tonnes pa, from 50m tonnes pa in 2001/02 to 12m tonnes in 2015/16, as depicted in the following graph from the Tax Working Group report[14]:

Figure 9 UK Levy increase "staircase" and reduction in landfill (from Tax Working Group report)



[14] Future of Tax Final Report Volume 1. Tax Working Group. 2019.

6. Medium-Term Investment Plans

The Medium-Term Investment Plan operationalises the Waste Strategy by prioritising investment of the Levy funds for a four-year period and allocating funding across a range of competing requirements.

The MTIP has a 4-year investment horizon, which allows each successive MTIP to be responsive to the changes in the waste system (including international markets) and Levy revenue.

The MTIP will be operationalised by the relevant investment processes, a number of which may utilise outsourced investment managers. We recommend splitting investment envelope responsibilities amongst different organisations to maximise the use of expertise and experience already within the public sector and minimising duplication of effort amongst public sector entities. We detail the proposed investment processes for each investment envelope in the following section.

The MTIP will need to weigh the relative priority of the allocation envelopes for funding in the MTIP period based on:

i. services or activities which need to be in place to manage the waste system (CME and Data)
ii. the current state of the waste system across the waste streams (infrastructure), the dependence of TAs and community organisations for continuing funding to perform their role in the system (Territorial Authorities and Community Projects)
iii. future proofing the waste system by assisting the development and implementation of new technologies and approaches (Research & Development and Innovation) and
iv. changing behaviours to support the waste minimisation strategy (Education & Awareness).

The allocation judgement will be subjective, even if based on the best information available.

6.1 Expert panel

We recommend an expert panel is established with representation from the Ministry, industry, territorial authorities and Iwi.

We have recommended above that the Ministry utilise an expert panel in the development of the Waste Strategy and the LTIP. The expert panel should also be tasked with reviewing the available information and determining the priority and funding allocation for each investment envelope. The Ministry has established the Waste Minimisation Fund Investment Panel (WMFIP) to review applications to the WMF, therefore the current mandate, skills and experience of the WMFIP has been in response to the specific needs of the WMF.

Given the increased size and, potentially, breadth of possible Waste Levy investments, consideration should be given to establishing a new expert panel to support the Ministry develop and implement the MTIP. We note the current WMFIP could be utilised in a role similar to their current role in regard to the Community Projects investment envelope.

6.2 Prioritisation Matrix

In the MTIP a Prioritisation Matrix considers each waste steam's relative volume and harm to determine the priority of each waste stream. The output is used to allocate the expected Levy revenue in a coherent way into a variety of investment processes. The primary mechanism we are proposing is a series of investment envelopes which ring-fence funding for certain activities.

In the 2002 Waste Strategy the Ministry set out criteria for prioritising action to achieve the strategy's vision and goals. These criteria were:

1. Volume and harm
2. Achievability
3. Public concern
4. Cost-effectiveness

In the 2002 Strategy the Ministry demonstrated the relationship between volume and harm (environmental risks and harm to human health) with an illustrative diagram showing the relative quantities and harm shown in Figure 10.

Figure 10 The relationship between quantity and harm of various waste streams (MfE)

We note volume and harm are useful criteria for determining the priority of the problem waste streams while the other criteria suggested in the 2002 Waste Strategy (achievability, public concern and cost-effectiveness) are useful criteria for determining the most appropriate solutions or actions. In the following section we outline the criteria we recommend for firstly prioritising the waste streams and secondly the potential solutions.

Our prioritisation approach is premised on addressing the current waste streams as the priority because New Zealand will continue to produce waste in unacceptable quantities for at least the medium-term.

6.2.1 Waste Stream Prioritisation

The key prioritisation factor should be the waste stream itself. It is unrealistic to suggest that all waste streams can be addressed concurrently therefore we need to prioritise which waste streams we address, with the intention of working from highest to lowest priority.

We have adopted the waste streams identified by Eunomia as the basis for the following analysis. The approximate volumes of waste produced and recovered per waste stream (from the Eunomia Report[15] based on 2015 volumes to all Landfill Classes) are shown in the following table:

Table 7 Volumes of waste processed and recovered (units tonnes '000)

Type	Volume to Landfills	Recovered	Total	Recovered %
Rubble	6,071	1,668	7,739	21.6
Putrescible	1,724	1,176	2,900	40.5
Timber	1,271	163	1,434	11.4
Paper	352	435	787	55.3
Ferrous Metals	192	560	752	74.5
Plastic	575	39	614	6.4
Glass	135	164	299	54.6
Potentially Hazardous	286	11	297	3.7
Nappies & Sanitary	157	-	157	-
Textiles	158	8	166	5.0
Rubber	81	15	96	15.3
Non-ferrous Metals	22	50	72	69.3
Total	**11,024**	**4,289**	**15,313**	**28.0**

The relative volume and harm of waste streams are key factors in determining where to focus resources. This approach immediately raises the question of how to weigh the relative importance of volume and harm? For example, organic waste accounts for approximately a third of all landfill waste and generates methane and leachate within a landfill. However, modern landfills are designed to prevent leaching and capture the methane gas produced for energy. Conversely, the large quantities of inert waste earthworks, building and demolition activities produce don't usually impact heavily on the environment.[16]

In the 2002 Waste Strategy the concepts of Materials Impacts Per Service (MIPs) and ecological rucksack are discussed as methodologies which could be utilised to calculate the environmental impact of various materials and products. While these methodologies might be too granular to assess a complete waste stream, there is a requirement to objectively measure the harm of the various waste streams to allow comparison and prioritisation. We are aware the UK EPA has published carbon equivalent factors for various gases produced and NZ has the Climate Change (Unique Emissions Factors) Amendment Regulations 2010.

[15] Eunomia. May 2019. The New Zealand Waste Disposal Levy
[16] Ministry for the Environment- 2002 Waste Strategy page 22

While we are not endorsing a particular approach, we recommend the Ministry develop a methodology to determine the relative environmental harm of each kind of waste. As we are prioritising actions to reduce waste going to landfill, we recommend that the environmental harm of the waste when disposed of is used as the measurement base[17].

As stated above, the 2002 Waste Strategy included other prioritisation criteria of public concern, achievability and cost-effectiveness. In our view, these criteria are more useful in prioritising solutions than the nature of the waste streams themselves. The potential exception to this is public concern, however objective measurement of the volume and harm of waste streams should prove a more effective measurement of priority than trying to gauge shifting public opinion.

Below we have identified some factors which have been considered for prioritising waste streams. Besides volume and harm, we are proposing current market measures (recovered currently and value) as where a viable market solution exists, it is potentially more efficient and government intervention is less critical.

The prioritisation will need to be reconsidered for each 4-year MTIP as prior actions and external environment changes will impact the scoring and priority. It is recommended that subjective factors such as current visibility of the waste stream (e.g. what would the public notice) are avoided as it might lead to sub-optimal decisions and potentially cuts across the long-term nature of the investments.

We propose the following four factors are considered for determining priority:

Volume	Total waste volume is important as the highest volume waste streams present the largest opportunity for diversion and will have the largest impact upon landfill use. However, if volumes are a key driver this would prioritise metro waste streams rather than provincial or rural waste streams, which might raise equity issues.
Environmental Harm	There is a need to have a definitive view on the relative environmental harm of each waste stream, as (all other things being equal) priority should be given to the waste stream with the greatest environmental harm (from either a whole-of-life perspective or a harm when disposed of perspective).
Recovered Currently	What is currently recovered will give some insight into the current infrastructure and the potential challenges of both the waste stream itself and the viability of waste recovery options. It might also indicate technological issues with recovery.
Value	The greater the value of the recovered/reprocessed material the easier it will be to find a commercial solution to recovery. Waste streams with low or no value will need to rely on social good to justify investment. We also need to consider the impact of increased volumes of reprocessed material impacting existing markets. An obvious example is compost. Currently it is a commercial venture but if we divert all green waste to compost, the supply will increase by a factor of 10 which may make it crowd out producers unless new markets can be found.

[17] The final prioritisation criteria, aligned with the objectives of the revised Waste Strategy, are likely to include other criteria such as wider environmental harm (e.g. when disposed incorrectly) or the ease and potential economic value of recovering resources that might have otherwise been disposed to landfill or the environment.

6.2.2 Prioritisation Matrix Output

To illustrate the use of the proposed criteria we have drafted the following indicative prioritisation table based on estimated values to demonstrate how prioritisation might occur.

We have made the following assumptions:

- The primary prioritisation drivers are current volume to landfill and the environmental harm of the waste stream. We have multiplied these factors together to create an initial weighting, to balance high volume but relatively low harm versus low volume but hazardous waste streams.
- Secondary 'market based' factors are also included to assist determine whether intervention is warranted or whether market forces are likely to develop, or could be incentivised to develop, a solution.

The factors could then be combined into a matrix to weigh the various factors and derive a priority (Table 8).

Table 8 Prioritisation Matrix

Waste Stream	Volume %	Environ-mental harm	Volume x Harm	Recovered Currently	Value	Matrix rating	Priority
			Weighting				
			60%	20%	20%		
Putrescible	22.56	5	112.80	2	2	68.5	**1**
Plastic	7.52	10	75.20	0	3	45.7	**2**
Hazardous	3.73	10	37.30	0	3	23.0	**3**
Rubble	35.21	1	35.21	1	3	21.9	**4**
Paper	4.60	5	23.00	3	3	15.0	**5**
Sanitary	2.05	10	20.50	0	3	12.9	**6**
Timber	16.62	1	16.62	1	2	10.6	**7**
Textiles	2.07	5	10.35	0	3	6.8	**8**
Rubber	1.06	5	5.30	0	3	3.8	**9**
Ferrous Metals	2.51	1	2.51	3	1	2.3	**10**
Glass	1.78	1	1.78	3	1	1.9	**11**
Non- Ferrous Metals	0.29	1	0.29	3	1	0.97	**12**

Based on the above illustrative values, putrescibles and plastics receive the highest priority. We also note rubble, due to its high volume, and hazardous wastes rank within the top five. For hazardous wastes there may be value in unbundling what is grouped as hazardous waste to better identify where the priority waste streams are and what initiatives would be effective. We note that the identified 5 priority waste streams account for 82% of the volume of waste going to landfill.

We also stress that the above table is based on estimates and further work will need to be undertaken to develop an accurate prioritisation, particularly in determining the relative harm of the waste streams. The waste streams shown are based on the available information rather than representing a definitive view of how waste should be categorised. Included at Appendix 2 are current state summaries for six of the higher priority waste streams, where initial investment is recommended.

6.3 Investment Envelopes

The investment envelopes are expected to be a mixture of permanent allocations (e.g. a set funding amount for the provision of CME services) and variable allocations (e.g. to resolve infrastructure gaps) adjusted in each 4-year period.

There are two key principles behind the suggestion of allocation envelopes:

1. Maintaining a mix and balance of areas for funding, and,
2. Being able to utilise existing expertise from other parts of the public sector as much as possible rather than recreating processes and expertise within the Ministry.

As discussed above, the final determination of the number and focus of the investment envelopes will be established through the Waste Strategy based on advice from the expert panel. The Waste Strategy is expected to be subject to consultation with the sector given the potential impact of the changes being considered. We recommend the expert panel retains an oversight role on the effectiveness of the investments undertaken and makes recommendations on potential changes to the funding allocations for the next MTIP.

The proposed allocation envelopes are shown in Table 9.

Table 9 Proposed Investment Envelopes 2023-26 MTIP

Investment Envelope	2023 $M	2024 $M	2025 $M	2026 $M	Total Investment over period $M
Infrastructure	30.0	90.0	150.0	150.0	420.0
Compliance, Monitoring and Enforcement (CME)	7.5	7.5	7.5	9.0	31.5
Data collection and analysis	2.0	2.0	2.0	2.3	8.3
Research & Development	5.0	5.0	5.0	5.0	20.0
Innovation	10.0	10.0	10.0	10.0	40.0
Territorial Authorities	22.5	22.5	22.5	25.0	92.5
Community Projects	15.9	16.7	16.0	15.0	63.6
Education & Awareness	3.0	3.0	3.0	5.0	14.0
Other	-	-	-	9.2	9.2
Reserve	5.1	8.3	11.3	0.3	25.0
Total	**101.0**	**165.0**	**227.3**	**230.8**	**724.1**

We have proposed a mix of fixed allocations and variable allocations, with the largest expenditures being for infrastructure and Territorial Authorities. The allocations reflect our conviction that the priority for this first MTIP is addressing New Zealand's limited resource recovery infrastructure, which limits the effectiveness of other levers, such as education, because people have few options to change their behaviour even if they wanted to. Therefore, to the initial focus for investment is on establishing the infrastructure required to prevent waste going to landfills.

6.4 Investment Envelope Allocations

We have set out below the proposed allocations to each of the investment envelopes, together with the rationale for the investment.

We note the costing information presented below is drawn solely from publicly available sources. We note the investment needed to fill the infrastructure deficit and met the other system funding requirements is significantly larger than the projected funding available. The allocations are effectively a form of rationing between competing demands.

6.4.1 Infrastructure

The infrastructure investment envelope is intended to help fund the development of the infrastructure required to collect, consolidate, transport and reprocess the priority waste streams. It is not intended to develop infrastructure to address 100% of the waste produced as this risks over-investing should waste volumes be reduced.

The critical driver of the infrastructure allocation will be the LTIP. This will inform the infrastructure investor on what infrastructure is required, where this infrastructure is required and, based on the prioritisation, which infrastructure should be invested in first.

Market consultation will help mitigate higher risk investments

It is expected infrastructure investments will be slow as they will require a more extensive assessment process, plus resource consent challenges and construction will both be time consuming. Due to these factors the spend on infrastructure is expected to grow over the first 4-year period. Over the longer term, infrastructure investment is expected to grow and contract as infrastructure gaps are filled and investments in new technologies are required.

It is noted infrastructure investments are high risk due to the expected scale of the investments, the public profile of large investments and the potential for infrastructure to be superseded by new technologies and changes to external markets, waste streams or consumer preferences. Infrastructure investments can be expected to impact both the availability of feedstock (selected waste streams) as well as potentially impacting end markets due to increased supply of processed material.

It is recommended the process for major infrastructure investments includes seeking input from the market on how identified infrastructure gaps could be filled, through an Expression of Interest/Request for Information process before a contestable Request for Proposal process[18] is undertaken. Before any major infrastructure projects are considered, a Market Impact Analysis should be undertaken to ensure the investor understands the impact upon existing market participants.

Supporting infrastructure will be required in addition to the primary investments

As discussed, the Infrastructure Stock take (part of the current NRR Taskforce programme) is expected to identify the waste system infrastructure gaps for each of the waste streams. However, any infrastructure investment needs to consider the infrastructure required to transport materials to places where treatment at scale can make sense. It should also include investment in the facilities and equipment to collect and sort prior to transport. Investments in collection, sorting, compaction and baling will all help to make it possible for viable facilities to be created that wouldn't otherwise be economic at a town or district scale. We envisage these supporting infrastructure investments being able to be used by multiple waste streams.

[18] Advanced procurement practice such as Early Contractor Involvement (ECI) and Competitive Dialogue, both common in NZ now for large infrastructure, are expected to be used.

We should manage our geography, maximising existing investments by connecting nodes. Several waves might be needed.

We envision it will make commercial and engineering sense for a series of smaller regional investments to collect and process materials within defined radii encompassing the majority of New Zealand's population. We imagine this might proceed in waves, much as the rollout of ultrafast broadband has, with wave 1 addressing major nodes, and wave 2 (underway) addressing smaller nodes in the network.

Given the aspect ratio of the nation, and assuming collection, sorting and compaction are put in place, the volumes of material are still likely to be substantial enough that moving them by road is infeasible considering emissions, congestion and safety. Therefore, the location of facilities for collection and processing could be sited with a view to using rail links as much as possible. Given the specialist nature of the trucks required for collection, we think additional trucks for movement of compressed bales and sorted material, could be used for efficient multi-modal transport where a population radius is simply too far from rail links.

We note that coastal barging can be cost effective for bulky, low value cargo and don't discount that it might have utility for transport of stable materials between the two islands, for example fibre and plastics.

The Infrastructure investment envelope must consider utilisation of existing infrastructure, transport networks and nodal points to achieve economic scale, where possible. Investments in infrastructure should score more highly if they take advantage of existing transport flows, the nodes created by the population clusters in NZ and how the main rail and roading networks are currently, and

- augment existing logistics infrastructure by filling in missing links either with physical assets or financing solutions
- parallel the natural flows of the existing New Zealand transport networks to provide higher utilisation and
- create and foster viable markets and exchanges.

Summary of investments

The projected revenue model (see Section 6.6 below) allocates a total of $1.32 billion for infrastructure investment over the ten-year period to 2032. During this period, we estimate the potential need for infrastructure investments to be within a **range of $2.1 billion to $2.6 billion** for the critical supporting infrastructure and the three priority waste streams, as summarised in Table 10 below.

Table 10 Summary of investment demand in infrastructure and three priority waste streams

Investment areas	Estimated Investment Demand $M	MTIP Allocated Investment $M	Total Investment (incl. industry contribution) $M	Unmet Demand $M
Waste system	$368m to $430m	$170m	$205m	$176m to $213m
Supporting infrastructure	$280m to $310m	-	-	$280m to $310m
Waste stream: Putrescibles	$450m to $650m	$130m	$260m	$230m to $340m
Waste stream: Plastics	$440m to $610m	$56m	$112m	$346m to $480m
Waste stream: Paper	$600m	$30m	$60m	$540m

Investment areas	Estimated Investment Demand $M	MTIP Allocated Investment $M	Total Investment (incl. industry contribution) $M	Unmet Demand $M
Waste stream: Rubble	Undetermined	$4m	$8m	Undetermined
Waste stream: Hazardous	Undetermined	$30m	$30m	Undetermined
Total	**$2.1bn to $2.6bn**	**$420m**	**$675m**	**$1.6bn to $1.9bn**

It is not intended that investment is limited to the priority waste streams and future MTIPs will need to prioritise the unmet investment needs of these waste streams as well as the other waste streams. Based on our current understanding of the priority waste streams and the associated investment needs we are proposing the following investment allocation for infrastructure:

Table 11 Initial MTIP Investment Profile

Infrastructure Investment	2023 $M	2024 $M	2025 $M	2026 $M	Total Investment over period $M
Waste System:					
Kerbside Collection	24	11	-	7	42
Kerbside Putrescibles	6	16	24	-	46
Material Recovery Facilities	-	43	28	11	82
Putrescibles	-	20	40	70	130
Plastics	-	-	28	28	56
Paper	-	-	-	30	30
Rubble	-	-	-	4	4
Potentially Hazardous	-	-	30	-	30
Total	**30**	**90**	**150**	**150**	**420**

More detail on potential priority infrastructure investment areas in the waste system, supporting infrastructure and the identified priority waste streams are outlined below.

A. Waste system

Separate to the individual waste streams there are infrastructure requirements for the overall waste system, including improving quality of feedstock for paper and plastics recycling and better sorting. It is our expectation that other waste streams will be able to utilise the supporting infrastructure developed for the priority waste streams, therefore we would expect the investment in supporting waste system infrastructure would be able to be reduced in subsequent MTIPs.

Kerbside collection infrastructure

Improving NZ's recycling capacity will require investment in improving the quality of feedstock available for paper and plastics reprocessing plants. Kerbside collection services for 49% of households are currently comingled[19] with some industry participants interviewed refusing to accept feedstock from comingled collections. Implementing separated kerbside collection services for the 873k households currently with comingled collection is estimated to cost **$42m**[20]. This excludes ongoing operational costs.

Table 12 Kerbside collection costing assumptions

Regions	Households	Cost per Household $	Total Cost $M
Auckland	500,000	48	24
Christchurch	225,000	48	11
Other	148,000	48	7
Total	**873,000**		**42**

We have allocated funding to implement separated kerbside collection in Auckland in 2023 ($24m), followed by Christchurch in 2024 ($11m), with the remaining councils completed in 2026. We have assumed 100% funding, reflecting kerbside collections role as essential infrastructure to support improved feedstock for plastics and paper processing, and assuming that the trucks will be owned by the TAs.

Putrescibles will also require an investment in collection infrastructure. Using the same data for trucks and cartons[21] as above but dedicated to putrescibles will require an additional **$76m**. This excludes ongoing operational costs.

Table 13 Kerbside collection costing assumptions - Putrescibles

Regions	Households	Cost per Household $	Total Cost $M
Tranche 1 (urban)	1,210,000	38	46
Tranche 2 (wider urban)	167,000	79	13
Rural	209,000	79	17
Total	**1,586,000**		**76**

[19] National Resource Recovery Project – Situational Analysis Report, Eunomia, 20 September 2018
[20] Based on cost assumptions per "Costs of Recycling" Ministry for the Environment website, accessed Feb 2020 – 1 truck costing $120k per 4,286 households plus 2 crates per household at $10 per crate
[21] Based on cost assumptions per "Costs of Recycling" Ministry for the Environment website, accessed Feb 2020 – for urban: 1 truck costing $120k per 4,286 households plus 1 crate per household at $10 per crate, for wider urban and rural: 1 truck costing $220k per 5,333 households plus 1 bin per household at $38 per bin

Refer the Putrescibles section below for further details, however during this first MTIP we have allocated funding to address the Tranche 1, urban areas only. Based on our costing assumptions this equates to 282 trucks at a cost of $34m and 1.2m crates costing $12m. We have allocated the spend across three years from 2023 to 2025, with the timing linked to the rollout of processing capacity. This assumes the ability to capitilise on work already underway by some TAs but that planning and consenting processes are likely to take some years. As above, we have assumed 100% funding reflecting kerbside collections role as essential infrastructure, and assuming the trucks will be owned by the TAs.

Material Recovery Facilities

Per Eunomia[22], 367,739 tonne of material is recovered via domestic kerbside collection each year. Excluding putrescibles of 64,685 tonne, leaves 303,054 tonne of recovered material (paper, plastics, metals and glass) to be processed through Material Recovery Facilities (MRFs). This volume approximates the estimated existing capacity of MRFs of 291,115[23].

Eunomia also estimate 1,110,432 tonne of material is disposed to Class 1 landfills from domestic kerbside collections[24]. Of this, paper, plastics, metals and glass comprise 32.4%[25] or 359,780 tonne. Material which with investment in education, consumer awareness and improved kerbside collection infrastructure can instead be expected to be processed through MRFs. We do not however envision 100% diversion and have adopted the 'Technically recoverable' rates per Covec[26] (75% for paper, 58% plastics and 85% for metals and glass) to estimate target diversion volumes for these materials. This results in an additional 253,656 tonne of material to be processed via MRFs each year, approaching double current capacity.

Based on an estimate of $1m to $1.25m per 1,000 tonne of capacity for MRFs[27], increasing capacity by 250k tonne (rounded) results in required investment of **$250m to $313m**.

Our initial allocation for MRFs in 2024 and 2025 follows the implementation of separated kerbside collections in Auckland and Christchurch. We have assumed increasing Auckland's MRF processing capacity by 55k tonne pa to 200k tonne and increasing Christchurch's capacity by 35k tonne pa to 90k tonne. Costed at an average of $1.125m per 1,000 tonne of capacity equates to a total spend of $101m. We assume 70% funding, or an investment of $71m, reflecting MRFs' role as essential infrastructure within the waste system, and although these will be commercial operations, many operators have advised they are struggling with current market conditions.[28] The allocation of $11m in 2026 will increase capacity by a further 14k tonne pa, with the location to be determined but likely within the Otago region (following improving kerbside collections in the region).

B. Supporting infrastructure

As noted above, as a long skinny country with several large urban clusters plus widely distributed smaller towns and more rural areas, there will likely be a series of infrastructure interventions at various scales.

Therefore, the infrastructure investment should include consideration of not just treatment facilities, but the infrastructure required to transport materials to places where scale can make sense. It should also include investment in the facilities and equipment to collect and sort prior to transport. Investments in collection, sorting, compaction and baling will all help to make it possible for viable facilities to be created that wouldn't otherwise be economic at a town or district scale.

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[22] Eunomia, The New Zealand Waste Disposal Levy, May 2017, pg. 84
[23] 283,115 tonne per Eunomia, National Resource Recovery Project – Situational Analysis Report, September 2018, pg. 18 plus 8,000 tonne new Waikato based facility we have been advised is planned to open June 2020.
[24] Eunomia, The New Zealand Waste Disposal Levy, May 2017, pg. 79
[25] Eunomia, The New Zealand Waste Disposal Levy, May 2017, pg. 86
[26] Covec, Recycling: Cost Benefit Analysis, April 2007
[27] Based on 2019 application to the WMF to build a new MRF costing $10m for 8,000 tonne processing capacity
[28] Eunomia, National Resource Recovery Project - Situational Analysis Report, September 2018

While the detailed work is yet to be done, we envision it will make commercial and engineering sense for a series of smaller regional investments to collect and process materials within defined radii encompassing the majority of New Zealand's population.

As examples in the North Island, Palmerston North and environs is a nodal point. Many existing road and rail links already pass this way. Many logistics companies have Distribution Centres (DCs) or Fulfilment Operations there. Collection systems along the main trunks and highways in the lower North Island could feed into recycling centres established on existing brownfields land close to the rail network, perhaps in junctions in smaller towns like Marton. Such a centre could provide a useful collection point for log haulers and other transport providers seeking an on-cart.

Similarly, in the Bay of Plenty a junction point would lend itself to a processing centre. Northland might see a centre located in a median point where the backhauls from trips taking consumer goods north from Auckland to the top, and currently empty trucks returning from taking logs and other commodities to Northport overlap.

In the South Island the Alps is a challenging geographic feature but a rail feed to a centre in the upper south could create enough scale, as well as one in the Otago/Southland area.

We note applications to PDU for funding for this type of supporting infrastructure have included:

- Construction of a rail hub $4m
- Rail corridor upgrades $3m and $6.2m
- Roading upgrades, to support trucking services $20.1m and to seal existing roading $10m
- Purchase of a new site to enable a new rail freight facility to be fully integrated with air and road $40m.

Due to the range of factors and their variability (size, number and location of facilities; intended catchment area and distance feedstock will need to be transported; condition and extent of existing infrastructure in the location; etc.) it is difficult to provide an accurate estimate at this stage. However, based on our assumption of a series of regional nodal points across both islands, with a level of investment in rail, roading and facilities required, we estimate a potential investment requirement of **$280m to $310m.**

The initial MTIP focuses on infrastructure within the major urban centres, accordingly we do not see a need for supporting infrastructure during this period and no funding has been allocated.

C. Putrescibles

Current state

In NZ approximately 41% of the putrescibles produced are recovered, leaving 59% going to landfill (Table 14).

Table 14 Organic waste production and recovery

	Tonnes[29]	%
Produced (2017)	2,900,000	
Recovered	1,200,000	41%
Landfill	1,700,000	59%

[29] The New Zealand Waste Disposal Levy, Eunomia, May 2017

Class 1	800,000	28%
Class 2	41,000	1%
Class 3	1,000	0%
Class 4	61,000	2%
Farm dumps	818,000	28%

The priority volumes therefore are those going to Class 1 and, secondarily, farm dumps[30].

New Zealand is an urban nation[31]: 72% of the population live in large urban (greater than 30k people) and a further 14% in smaller urban centres. Only 1% of the population is highly remote, leaving 13% in rural areas.

Planned investment

Main technologies are well defined. In NZ and globally, this is usually either anaerobic digestion (AD) or windrow composting. Some smaller centres have demonstrated higher temperature composting. AD is attractive as it produces a high-quality compost and clean water (assuming tertiary treatment) plus the generation of gas for energy usually used for the treatment plant.

With 60% of the organics not currently collected, the national problem is up to 1.7m tonnes. Major metros have defined investment for the capture and treatment of organics in their ten-year plans. For the purposes of this study we think the existing metros will at least keep pace with population growth and make modest inroads into collection and processing. We also note some of the smaller regions have made great progress in reduction of organics to landfill notably Raglan and Opotiki.

Some notable planned investments are also at advanced stages. Auckland has signed a 20-year contract with Ecogas for a facility to process 100,000 tonnes per annum. Christchurch plans to expand their current 55,000 tonne per annum capacity in the medium-term with a 22% increase in the number of tunnels at the site (taking them to approximately 72% of organics processed). The PDU has financed a pilot scheme (again with Ecogas) in the central North Island which if successful will consume 20,000 tonne per annum.

Dealing with identified gaps

Start with education. The largest portion of the organic waste (certainly in metro areas) is food. Study findings that a large portion of the food that is wasted is due to the failure to adequately plan food purchases, suggests that education to prevent the initial generation of food waste has a significant part to play in waste minimisation. In parallel with the investment in collection and sorting (see below) further education for consumers on how to sort for collection will be required.

The investment amount is captured in the section below dealing with Education.

Minimise close to source (compost). Many local composting schemes and solutions have appeared in the NZ landscape. With increasing awareness of the benefits, funds could be used to spur these local efforts to manage waste reduction by composting close to production. These funds could be disbursed via the Territorial hypothecation or as Community Funds.

[30] The landfill classifications used by Eunomia (May 2107) were changed in August 2018 with the publication by WasteMINZ of the updated Technical Guidelines for Disposal to Land Landfills are now classified into five types, with the old Class3 (controlled) split into Class 3 (managed and Class 4 (Controlled) with the old Class 4 (Cleanfill) becoming the new Class 5 (Cleanfill).
[31] Statistics NZ

The investment amount is captured in the section below dealing with Community Grants.

Work in tranches from metro to rural. The dilemma to resolve is while much of the putrescibles are produced rurally, it is much harder to collect and process economically, given the mass to be transported. The proportion of the population in the major metros is 72%. Considering the population immediately adjacent gives areas[32] in NZ that account for 76% of the population. These classifications are where any investments should be targeted in the first MTIP for the largest effect.

Investment in sorting and collection is required. Typically, the technology to deal with putrescibles is a mix of mechanical sorting (M) followed by some kind of accelerated biological (B) process. The larger metros have either existing investment in organic management or are planning large scale trials. What is often missing is a good system for collection and management in the household, followed by collection and transportation to the treatment. Many TAs have considerable knowledge either from having invested, or in completing the research. Levy funds could be utilized to acquire and share this information, including recompense to the pioneers for their investment which would now be used for national benefit.

The investment amount is captured in the section above dealing with Waste System.

R&D to investigate liquid and solid management methods. It is claimed that AD and MBT/composting can produce negative flux of greenhouse gas due to displacement of the fossil fuel or fertiliser that would otherwise be required[33]. Funds should be disbursed to complete feasibility studies for extension of existing waste-water treatment in combination with in-home size reduction as an alternative to collecting and processing solid materials.

The investment amount is estimated to be $2-3m and is captured in the section below dealing with R&D.

R&D for rural solutions. Some funds need to be allocated for an investigation of the types, volumes and locations of rural organic waste, followed by investigation of viable treatment solutions.

Required investment

Assuming the education plan can achieve a 5% reduction in volumes, and composting close to source another 5% in urban areas and 10% in rural, and that the plans the TAs have in place can raise collection of the remainder then the national gap in required infrastructure is approximately 1.5m tonnes capacity, see Table 15 below **Error! Reference source not found.**. Using data from the Ministry[34] plus a recent large urban analysis[35] produces the estimates shown in the tables below.

Table 15 National putrescibles infrastructure gap analysis

Area	Collected 000 tonne	Gap (post education and local composting) 000 tonne
Urban	976	740
Wider urban	142	83
Rural	0	670
Total	**1,118**	**1,493**

[32] Appendix 2, Section 7
[33] "Waste Management Options and Climate Change", 2001, report to European Commission.
[34] https://www.mfe.govt.nz/publications/waste/recycling-cost-benefit-analysis/6-costs-recycling
[35] SLR 2017 Auckland Waste Modelling Appendix 1

***Note**: this analysis used factoring to spread the baseline volumes from the Eunomia 2017 study across the current population. A factor of 2x was used for rural so that total rural volume was 800,000 tonne (see Table 18). The metro factor to balance the volume to a total of 2.9m tonnes was 0.84. It also assumes worst case for rural locations, with zero collection. The urban area collection amounts are adjusted to achieve the collection percentages in Table 16.*

By targeting the main metros, an initial tranche would deal with 740,000 tonne pa, at a cost of $220m to $300m in plant capital (Table 16). In combination with the reduction from education and composting, this would lift the percentage diverted (2017 baseline) to 66%.

Table 16 Putrescibles infrastructure tranche 1

NZ Population[1] (Statistics NZ)	2019		Organics Produced (t per annum)	Education reduction	Local composting	Current collection[2] (t per annum)	Gap (t per annum)	Trucks	Trucks and Crates Capex ($m)	Plant Capex[4] ($m)		Collection[3] ($m p.a.)		Indicative organic waste collection and treatment costs (using urban rates) [5] ($m p.a.)	
Base		urban	x 0.84	5%	5%	54%		number	$m	per 50,000 t processed		Low ($/t)	High ($/t)	major urban ($/t)	large urban ($/t)
		rural	x2	5%	10%	0%				15	20	80	120	369	485
Whangarei District	96,000	2%	48,665	2,433	2,312	26,279	17,641	7.0	1.1	5.3	7.1	1.4	2.1	6.5	8.6
Auckland	1,642,800	33%	832,784	41,639	39,557	449,703	301,884	124.0	20.18	90.6	120.8	24.2	36.2	111.4	146.4
Hamilton City	169,500	3%	85,925	4,296	4,081	46,399	31,148	13.0	2.11	9.3	12.5	2.5	3.7	11.5	15.1
Tauranga City	144,700	3%	73,353	3,668	3,484	39,610	26,590	11.0	1.79	8.0	10.6	2.1	3.2	9.8	12.9
Rotorua District	75,100	2%	38,070	1,904	1,808	20,558	13,801	6.0	0.96	4.1	5.5	1.1	1.7	5.1	6.7
Gisborne District	49,300	1%	24,992	1,250	1,187	13,495	9,059	4.0	0.64	2.7	3.6	0.7	1.1	3.3	4.4
Hastings District	85,000	2%	43,089	2,154	2,047	23,268	15,620	6.0	0.99	4.7	6.2	1.2	1.9	5.8	7.6
Napier City	65,000	1%	32,950	1,648	1,565	17,793	11,945	5.0	0.81	3.6	4.8	1.0	1.4	4.4	5.8
New Plymouth District	84,400	2%	42,785	2,139	2,032	23,104	15,510	6.0	0.99	4.7	6.2	1.2	1.9	5.7	7.5
Palmerston North City	88,300	2%	44,762	2,238	2,126	24,171	16,226	7.0	1.12	4.9	6.5	1.3	1.9	6.0	7.9
Kapiti Coast District	56,000	1%	28,388	1,419	1,348	15,330	10,291	4.0	0.66	3.1	4.1	0.8	1.2	3.8	5.0
Porirua City	59,100	1%	29,960	1,498	1,423	16,178	10,860	4.0	0.67	3.3	4.3	0.9	1.3	4.0	5.3
Upper Hutt City	46,000	1%	23,319	1,166	1,108	12,592	8,453	3.0	0.51	2.5	3.4	0.7	1.0	3.1	4.1
Lower Hutt City	108,700	2%	55,103	2,755	2,617	29,756	19,975	8.0	1.31	6.0	8.0	1.6	2.4	7.4	9.7
Wellington City	210,400	4%	106,658	5,333	5,066	57,595	38,664	16.0	2.60	11.6	15.5	3.1	4.6	14.3	18.8
Tasman District	54,800	1%	27,780	1,389	1,320	15,001	10,070	4.0	0.66	3.0	4.0	0.8	1.2	3.7	4.9
Nelson City	52,900	1%	26,817	1,341	1,274	14,481	9,721	4.0	0.65	2.9	3.9	0.8	1.2	3.6	4.7
Christchurch City	385,500	8%	195,421	9,771	9,283	55,000	121,368	29.0	4.72	36.4	48.5	9.7	14.6	44.8	58.9
Timaru District	47,900	1%	24,282	1,214	1,153	13,112	8,802	4.0	0.63	2.6	3.5	0.7	1.1	3.2	4.3
Queenstown-Lakes District	41,700	1%	21,139	1,057	1,004	11,415	7,663	3.0	0.49	2.3	3.1	0.6	0.9	2.8	3.7
Dunedin City	131,700	3%	66,763	3,338	3,171	36,052	24,201	10.0	1.62	7.3	9.7	1.9	2.9	8.9	11.7
Invercargill City	56,200	1%	28,489	1,424	1,353	15,384	10,327	4.0	0.66	3.1	4.1	0.8	1.2	3.8	5.0
New Zealand	3,751,000	76%	1,901,493	95,075	90,321	976,279	739,819	282	45.9	222	296	59	89	273	359

A second wave encompassing the adjacent (or wider urban) areas would require $25m to $33m plant capital to address the gap and would lift the percentage of organics collected to 75 %

Table 17 Putrescibles infrastructure tranche 2

NZ Population[1] (Statistics NZ)	2019		Organics Produced (t per annum)	Education reduction	Local composting	Current collection[2] (t per annum)	Gap (t per annum)	Trucks	Trucks and Crates Capex ($m)	Plant Capex[4] ($m)		Collection[3] ($m p.a.)		Indicative organic waste collection and treatment costs (using urban rates) [5] ($m p.a.)	
Base		urban	x 0.84	5%	5%	54%		number	$m	per 50,000 t processed		Low ($/t)	High ($/t)	major urban ($/t)	large urban ($/t)
		rural	x2	5%	10%	0%				15	20	80	120	369	485
Waikato District	79,900	2%	40,504	2,025	3,848	21,872	12,759	5.0	2.08	3.8	5.1	1.0	1.5	4.7	6.2
Matamata-Piako District	36,000	1%	18,249	912	1,734	9,855	5,749	2.0	0.88	1.7	2.3	0.5	0.7	2.1	2.8
Waipa District	56,200	1%	28,489	1,424	2,706	15,384	8,974	3.0	1.35	2.7	3.6	0.7	1.1	3.3	4.4
Western Bay of Plenty District	53,900	1%	27,324	1,366	2,596	14,755	8,607	3.0	1.32	2.6	3.4	0.7	1.0	3.2	4.2
Whanganui District	47,300	1%	23,978	1,199	2,278	12,948	7,553	3.0	1.24	2.3	3.0	0.6	0.9	2.8	3.7
Rangitikei District	15,750	0%	7,984	399	758	4,311	2,515	1.0	0.41	0.8	1.0	0.2	0.3	0.9	1.2
Manawatu District	31,700	1%	16,070	803	1,527	8,678	5,062	2.0	0.83	1.5	2.0	0.4	0.6	1.9	2.5
Tararua District	18,650	0%	9,454	473	898	5,105	2,978	1.0	0.45	0.9	1.2	0.2	0.4	1.1	1.4
Marlborough District	49,200	1%	24,941	1,247	2,369	13,468	7,856	3.0	1.26	2.4	3.1	0.6	0.9	2.9	3.8
Waimakariri District	62,800	1%	31,835	1,592	3,024	17,191	10,028	4.0	1.65	3.0	4.0	0.8	1.2	3.7	4.9
Selwyn District	65,600	1%	33,255	1,663	3,159	17,957	10,475	4.0	1.68	3.1	4.2	0.8	1.3	3.9	5.1
New Zealand	517,000	11%	262,083	13,104	24,898	141,525	82,556	31	13.2	25	33	7	10	30	40

The third tranche would be for the remaining rural areas.

Table 18 Putrescible infrastructure rural

NZ Population[1] (Statistics NZ)	2019		Organics Produced (t per annum)	Education reduction	Local composting	Current collection[2] (t per annum)	Gap (t per annum)	Trucks	Trucks and Crates Capex ($m)	Plant Capex[4] ($m)		Collection[3] ($m p.a.)		Indicative organic waste collection and treatment costs (using urban rates) [5] ($m p.a.)	
Base		urban	x 0.84	5%	5%	54%		number	$m	per 50,000 t processed		Low ($/t)	High ($/t)	major urban ($/t)	large urban ($/t)
		rural	x2	5%	10%	0%				15	20	80	120	369	485
Far North District	68,500	1%	82,678	4,134	7,854	-	70,690	4.0	1.7	21.2	28.3	5.7	8.5		
Kaipara District	24,100	0%	29,088	1,454	2,763	-	24,870	1.0	0.5	7.5	9.9	2.0	3.0		
Thames-Coromandel District	31,500	1%	38,020	1,901	3,612	-	32,507	2.0	0.8	9.8	13.0	2.6	3.9		
Hauraki District	21,000	0%	25,346	1,267	2,408	-	21,671	1.0	0.5	6.5	8.7	1.7	2.6		
Otorohanga District	10,500	0%	12,673	634	1,204	-	10,836	1.0	0.3	3.3	4.3	0.9	1.3		
South Waikato District	25,100	1%	30,295	1,515	2,878	-	25,902	2.0	0.7	7.8	10.4	2.1	3.1		
Waitomo District	9,490	0%	11,454	573	1,088	-	9,793	1.0	0.3	2.9	3.9	0.8	1.2		
Taupo District	39,300	1%	47,434	2,372	4,506	-	40,556	2.0	0.9	12.2	16.2	3.2	4.9		
Whakatane District	37,100	1%	44,779	2,239	4,254	-	38,286	2.0	0.9	11.5	15.3	3.1	4.6		
Kawerau District	7,490	0%	9,040	452	859	-	7,729	-	0.1	2.3	3.1	0.6	0.9		
Opotiki District	9,720	0%	11,732	587	1,115	-	10,031	1.0	0.3	3.0	4.0	0.8	1.2		
Wairoa District	8,680	0%	10,477	524	995	-	8,957	1.0	0.3	2.7	3.6	0.7	1.1		
Central Hawke's Bay District	14,850	0%	17,924	896	1,703	-	15,325	1.0	0.4	4.6	6.1	1.2	1.8		
Stratford District	9,860	0%	11,901	595	1,131	-	10,175	1.0	0.3	3.1	4.1	0.8	1.2		
South Taranaki District	28,600	1%	34,519	1,726	3,279	-	29,514	2.0	0.8	8.9	11.8	2.4	3.5		
Ruapehu District	12,750	0%	15,389	769	1,462	-	13,158	1.0	0.4	3.9	5.3	1.1	1.6		
Horowhenua District	35,000	1%	42,244	2,112	4,013	-	36,119	2.0	0.9	10.8	14.4	2.9	4.3		
Masterton District	26,800	1%	32,347	1,617	3,073	-	27,657	2.0	0.8	8.3	11.1	2.2	3.3		
Carterton District	9,690	0%	11,696	585	1,111	-	10,000	1.0	0.3	3.0	4.0	0.8	1.2		
South Wairarapa District	11,100	0%	13,397	670	1,273	-	11,455	1.0	0.4	3.4	4.6	0.9	1.4		
Kaikoura District	4,110	0%	4,961	248	471	-	4,241	-	0.1	1.3	1.7	0.3	0.5		
Buller District	9,840	0%	11,877	594	1,128	-	10,155	1.0	0.3	3.0	4.1	0.8	1.2		
Grey District	13,750	0%	16,596	830	1,577	-	14,190	1.0	0.4	4.3	5.7	1.1	1.7		
Westland District	8,960	0%	10,815	541	1,027	-	9,246	1.0	0.3	2.8	3.7	0.7	1.1		
Hurunui District	12,950	0%	15,630	782	1,485	-	13,364	1.0	0.4	4.0	5.3	1.1	1.6		
Ashburton District	34,800	1%	42,003	2,100	3,990	-	35,912	2.0	0.9	10.8	14.4	2.9	4.3		
Mackenzie District	5,140	0%	6,204	310	589	-	5,304	-	0.1	1.6	2.1	0.4	0.6		
Waimate District	8,080	0%	9,752	488	926	-	8,338	-	0.1	2.5	3.3	0.7	1.0		
Chatham Islands Territory	710	0%	857	43	81	-	733	-	0.0	0.2	0.3	0.1	0.1		
Waitaki District	23,200	0%	28,002	1,400	2,660	-	23,942	1.0	0.5	7.2	9.6	1.9	2.9		
Central Otago District	23,100	0%	27,881	1,394	2,649	-	23,838	1.0	0.5	7.2	9.5	1.9	2.9		
Clutha District	18,350	0%	22,148	1,107	2,104	-	18,937	1.0	0.4	5.7	7.6	1.5	2.3		
Southland District	32,100	1%	38,744	1,937	3,681	-	33,126	2.0	0.8	9.9	13.3	2.7	4.0		
Gore District	12,800	0%	15,449	772	1,468	-	13,209	1.0	0.4	4.0	5.3	1.1	1.6		
New Zealand	649,020	13%	783,351	39,168	74,418	0	669,765	41	17.0	201	268	54	80	0	0

The base assumption is a metro/large urban area one which has a 50,000 tonne baseline plant. The costs are likely to be higher dependent on scale in rural areas so the capex has been inflated from the analysis in Table 16 to Table 18.

To summarise the three waves, first major metro, then extended metro, followed by rural gives the following picture (Table 19).

Table 19 Summary of putrescibles infrastructure investment

	Education reduction (t per annum)	Local composting reduction (t per annum)	Existing collection (t per annum)	Gap addressed (t per annum)	Plant capex low ($m)	Plant capex high ($m)	Organics recovered
Tranche 1 (metro)	95,075	90,321	976,279	739,819	222	296	66%
Tranche 2	13,104	24,898	141,525	82,556	25	33	75%
Tranche 3 (rural)	39,168	74,418	-	669,765	*200-250*	*270-320*	99%
Total	**147,346**	**189,637**	**1,117,803**	**1,492,140**	**450-500**	**600-650**	

The total quantum involved is **$450 to $650 million**, approximately, for the plant to process the putrescibles.

The analysis above does not include the assets to collect the putrescibles. An allowance for the collection capex has been made in the Waste System section above.

During this MTIP we have allocated funding to address the Tranche 1 urban areas discussed above, in addition to funding for kerbside collection infrastructure (refer Waste System above). Based on a total average cost for the urban areas of $260m, we have assumed a 50% funding model for processing infrastructure with industry operators, resulting in an allocation of $130m across 2024 to 2026. This assumes the ability to capitilise on work already underway by some TAs but that planning and consenting processes are likely to take several years.

D. Plastics

Current state

In NZ only approximately 6% of the plastics produced are recovered, leaving 94% going to landfill, with approximately one third of this disposed in farm dumps (Table 20).

Table 20 Plastics waste production and recovery

	Tonnes[36]	%
Produced (2017)	614,000	
Recovered	39,000	6%
Landfill	575,000	94%
Class 1	362,000	59%
Farm dumps	213,000	35%

[36] The New Zealand Waste Disposal Levy, Eunomia, May 2017 (amounts rounded)

Plastics are classified into seven separate types, with only a few of these currently recycled in any material volumes. A recycling survey completed by Plastics NZ in 2005 showed the most commonly recycled plastic types for NZ were PET, HDPE and LDPE.

Table 21 Recovered plastics in NZ (2004) by type

Plastic type	Tonnes[37]	%
Type 1 – PET	8,000	23%
Type 2 – HDPE	8,900	25%
Type 4 - LDPE	12,400	35%
Types 3 & 5 to 7	6,000	17%

The Plastics NZ report notes approximately 60% of recycled plastics are sourced from industry and approximately 40% from households. The majority of recovered plastics (estimated at 90% per Eunomia, National Resource Recovery Project, Situational Analysis Report, September 2018) are exported, with PET and HDPE the most commonly recycled plastics in NZ.

We have estimated the volumes of plastics currently disposed to landfill, by type and focusing on the most commonly recycled types of PET, HDPE and LDPE, based on the volumes of each type manufactured in NZ[38].

Table 22 Estimated waste plastics volumes in NZ by type

Plastic type	Tonnes	%
Type 1 – PET	52,000	9%
Type 2 – HDPE	123,000	20%
Type 4 - LDPE	186,000	30%
Types 3 & 5 to 7	253,000	41%
Total	**614,000**	**100%**

Planned investment

Processing capacity for plastics in NZ is currently limited, estimated at 15.5k tonne pa[39]. Unlike fibre, plastics processing can be undertaken efficiently at relatively small scales.

In terms of domestic kerbside collection, with sorting via MRFs, most large-scale sorting systems in NZ only sort into three streams, clear PET, natural HDPE and mixed plastics (which includes coloured PET and HDPE, plus all types 3 to 7).

[37] Plastics NZ Research Project Report, Sustainable End of Life Options for Plastics in NZ, 2005 (amounts rounded)
[38] Plastics NZ Research Project Report, Sustainable End of Life Options for Plastics in NZ, 2005
[39] Eunomia, National Resource Recovery Project, Situational Analysis Report, September 2018, pg. 49

Following the China policy changes, only two plastic types, clear PET and natural HDPE, are now commercially recyclable by the large volume operators in NZ[40]. This does not include recovery of LDPE, which is sourced from industry suppliers.

We have adopted the 'Technically recoverable' rate per Covec[41] (58% for plastics) to estimate potential additional plastics processing capacity. This implies recoverable plastics volumes of 356k tonne pa (614k tonnes at 58%). We note this approximates recovering a majority of the PET, HDPE and LDPE produced, and some of the other (types 3 and 5 to 7) types, which is consistent with the current split for recovered plastics.

Excluding current processing capacity results in potential additional capacity requirement of 340k tonne pa.

We have based our costs for additional plastics processing infrastructure on recent applications to PGF and WMF, in particular:

- Cost of $24m to process 18.5k tonne pa of types 1 and 2, and some 4 and 5 - $1.3m per 1k tonne pa
- Cost of $25.4m to process 14k tonne pa of types 1 to 7 - $1.8m per 1k tonne pa
- Cost of $7m to process 5k tonne pa (specifically targeting farm dumps) - $1.4m per 1k tonne pa.

We estimate the investment required to increase plastics processing capacity by 340k tonne pa to be **$440m to 610m**.

During this MTIP we have allocated $56m to increasing plastics processing capacity, across 2025 and 2026. Based on the above costing (adopting an average rate of $1.55m per 1k tonne of processing capacity) and assuming a 50% funding model with commercial operators, equates to additional processing capacity of approx. 72k tonne pa. Specific locations and investments remain to be determined, potentially via an applications process. Based on recent applications to WMF and PGF this could comprise additional capacity for existing operators (e.g. Flight Plastics) or new operations.

Other actions and investment

An increase in plastics processing capacity of this magnitude will also require significant investment in supporting infrastructure, as detailed on A Waste system and B Supporting infrastructure above.

While the above analysis focuses on recycling, we also support investment in actions to promote reuse and redesign, for example as recommended in the Sustainable Business Networks, NZ's Plastic Packaging System: An Initial Circular Economy Diagnosis, November 2018 report. This also recommends six strategic areas of activity including education, innovation, regulation and policy. It is intended the allocations to the Research and Development, and Education and Awareness envelopes in particular, as discussed below would support these activities.

[40] Sustainable Business Network, NZ's Plastic Packaging System: An Initial Circular Economy Diagnosis, November 2018
[41] Covec, Recycling: Cost Benefit Analysis, April 2007

E. Paper

Current state

In NZ approximately 55% of the fibre waste produced is recovered, leaving 45% going to landfill (Table 23).

Table 23 Fibre waste production and recovery

	Tonnes[42]	%
Produced	787,000	
Recovered	435,000	55%
Landfill	352,000	45%
Class 1	324,000	41%
Class 2	3,000	0%
Class 3	-	-
Class 4	4,000	1%
Farm dumps	22,000	3%

The priority volumes therefore are those going to Class 1 and, secondarily, farm dumps. It should be noted that approximately 49% of households have co-mingled recycling collection per Eunomia. Fibre collected through co-mingled collection processes is unsuitable for reprocessing due to the presence of glass shards. There are 13 TAs who utilise co-mingled collections including the major urban areas of Auckland and Christchurch as well as smaller regional urban centres such as Invercargill, Timaru and Queenstown.

In the Waste System infrastructure requirements identified above we have $42m earmarked for investment in kerbside collection infrastructure which will address the glass/fibre contamination issue as well as the collection of Putrescibles.

Planned investment

We are not aware of any significant investments to reprocess waste fibre. A number of TAs previously sold waste fibre on the international markets, but recent market changes have limited the opportunities and have forced a number of TAs to stockpile recycled fibre. If an international market cannot be found, it is assumed this stockpile will need to be landfilled.

From discussions with industry we understand that there is a market for reprocessed Old Corrugated Cardboard (OCC) but not for wastepaper. It has been estimated that while OCC could be reprocessed this would leave over 100,000 tonnes of wastepaper being landfilled each year.

Required investment

In the Eunomia report[43] the estimated cost of another fibre mill capable of processing the un-reprocessed fibre was put at **$600m**. We note this estimate was for a single plant which would be processing fibre from around the country, a single plant

[42] The New Zealand Waste Disposal Levy, Eunomia, May 2017 (amounts rounded)
[43] National Resource Recovery Project – Situational Analysis Report, Eunomia, September 2018

would capture the available economies of scale. To support the viability of such a solution, we note that OJI Fibre currently transport waste fibre from a number of North Island centres to their current mills, so we are satisfied that fibre is able to be baled and transported for reprocessing. We are also aware that OJI Fibre does not take recycled fibre form Auckland Council due to the co-mingled collection system operated.

As there is a current market for reprocessed fibre we are assuming the Ministry is co-investing in a fibre plant rather than providing 100% grant funding. We have assumed the Ministry investment would be spread over a number of years as construction is undertaken.

As stated above, there is a significant volume of wastepaper which is not suitable (or economically viable) for reprocessing. In the medium to long-term (outside of the investment horizon of this MTIP) there may be the potential to utilise this unwanted wastepaper for conversion to either a biofuel or, more likely, as an additional fuel source for waste to energy plants.

We are aware that EECA has invested $10m to co-fund a number of waste to energy plants (for example eight schools and a hospital in Southland) converting coal plants into woodchip fired plants. The Southland project is estimated to reduce the amount of carbon produced by 3,000 tonnes per annum[44]. EECA have also funded a number of plants to manufacture wood pellets and briquettes as fuel for converted plants. The largest investment was part funding of an $8m plant expansion in Taupo.

We understand there is potential for wastepaper to be utilised as a fuel source for waste to energy plants, after conversion to a more energy dense form such as a pellet. While not mature enough to be considered as an infrastructure investment in this MTIP, a feasibility study or pilot project could be a viable candidate for development or innovation funding in this MTIP period.

Waste to energy would also appear to be a viable solution for the 1.4m tonnes pa of waste timber produced, if the challenges around separating or processing treated timber and transport can be resolved.

MTIP allocation

We have assumed a 50% funding model with a commercial operator, resulting in a total funding allocation of $300m. As noted above we also assume the investment will be spread over a number of years as construction is undertaken. Based on our prioritisation assessment and funds available for infrastructure investment, we intend that the majority of the funding for an additional fibre plant will occur during the next MTIP. We have allocated 10% of the investment during this MTIP, in 2026, to commence planning, consenting and construction.

[44] Government starts to take public sector off coal with eight schools and a hospital. Stuff. January 2020.

F. Rubble

Current state

In NZ approximately 22% of the rubble waste produced is recovered, leaving 78% going to landfill (Table 24).

Table 24 Rubble waste production and recovery

	Tonnes[45]	%
Produced (2017)	7,738,000	
Recovered	1,668,000	22%
Landfill	6,070,000	78%
Class 1	346,000	4%
Class 2	2,290,000	30%
Class 3	57,000	1%
Class 4	3,378,000	43%
Farm dumps	-	-

At approx. 7.7m tonne pa, rubble is the single largest contributor (approx. 50%) to the estimated 15.3m tonne of waste produced in NZ each year. As noted above, currently only 22% of this, or 1.7m tonne is recovered. Accordingly, in terms of minimizing waste to landfills a focus on rubble appears logical.

However, we have not prioritised any significant investment in infrastructure for the rubble waste stream during the term of this medium-term investment plan based on the following factors:

- Infrastructure currently exists to process rubble (crush, sift, clean, size and sort) throughout NZ, often with smaller quarry-based operators. However, data regarding the capacity of current operators and the location of any gaps in capacity is not complete.
- We are also advised this is not a particularly capital-intensive industry should further capacity be required, accordingly we have allowed a relatively modest allocation for rubble infrastructure investment only, as detailed below.
- Demand for recycled rubble is uncertain. A report prepared for the NZ Transport Authority[46] noted demand for aggregate fluctuates with economic prosperity. Aggregate production in 2015 was estimated at 39m tonne, including 18m tonne for road construction. However, the report also noted an 'unnecessary' demand for high grade aggregates with common practice to specify virgin rather than recycled product. The report included commentary that regulation might be required to enforce use of recycled materials in all construction to match rates achieved in other countries (use of recycled materials in NZ estimated at 5% versus 25% in USA and 45% in Japan). The low use of recycled material is supported by the abundance and low cost of alternative sources, e.g. river gravel in Canterbury
- The majority of rubble currently disposed to landfill goes to class 5 cleanfills, which are not proposed to be included in the increased Waste Levy. Accordingly, incentives to increase diversion of rubble from landfill may be limited, instead a shift from class 1 to 4 landfills into class 5 appears more likely.

[45] The New Zealand Waste Disposal Levy, Eunomia, May 2017 (amounts rounded)
[46] WSP Opus, Recycled aggregates on New Zealand roads: Barriers to uptake and drivers for change, 2018

- As the decision of whether to use virgin material or recycled material appears to be primarily an economic decision, consideration should be given to other actions such as a legislation change to require a certain percentage of material utilised to be recycled material, or imposing a tax of some form on virgin material. Such a change could be expected to stimulate activity in the recycling of rubble.

Based on the above we propose the focus on the rubble waste stream will be via TAs working with the industry, to raise education and awareness (as we are advised is currently underway with Auckland Council), and assess whether regulation is required to encourage desired behavior.

As noted above, we are not recommending a significant investment in infrastructure for rubble during this MTIP. We have made an allocation of $4m in 2026, allowing time for TAs to work with the Construction and Demolition (C&D) industry first, and assuming that any infrastructure gaps are likely to be within or near the main urban centres, where the majority of C&D activity occurs. We assume a 50% funding model with commercial operators and based on advertised equipment prices, estimate capital costs to process 25k to 50k tonne pa to be with a range of $500k to $1m. Accordingly the $4m allocation equates to an increase in processing capacity of approx. 400k tonne pa.

G. Potentially Hazardous

Current state

In NZ approximately 4% of the potentially hazardous waste produced is recovered, leaving 96% going to landfill (Table 25).

Table 25 Potentially Hazardous waste production and recovery

	Tonnes[47]	%
Produced	297,000	
Recovered	11,000	4%
Landfill	286,000	96%
Class 1	228,000	77%
Class 2	-	-
Class 3	-	-
Class 4	-	-
Farm dumps	57,000	19%

As the vast majority goes to Class 1 landfills this will be the priority for investment. The Eunomia report the waste stream classification are taken from does not provide a definition or breakdown of what constitutes potentially hazardous waste. We are aware that a number of TAs put sewage sludge into landfills, and in Wellington the proportion of other waste streams to sewage sludge is a condition of the landfill consent, limiting their ability to address waste streams. We are also aware this waste stream includes components such as asbestos, treated medical waste and contaminated soils.

[47] The New Zealand Waste Disposal Levy, Eunomia, May 2017

Given the nature of the potentially hazardous waste streams, consideration should be given to whether minimising disposal to landfills is the most appropriate goal or whether, as the Ministry is encouraging appropriate/safe disposal, disposal to Class 1 landfills may be the best option. Other levers available to the Ministry, such as refrigerant and agrichemical product stewardship schemes, might also be appropriate options for this waste stream.

Planned investment

We understand from discussion with Wellington City Council that the infrastructure required to process the sewage sludge to reduce the bulk (de-watering to dry to 95% solids) would carry a capital cost of **approximately $30m**. Once this infrastructure is operational Wellington would be able to redirect putrescibles to composting or other processing.

Required investment

In the absence of definitive information, we have assumed other TAs have similar issues with sewage sludge and would require investment to deal appropriately with this waste, where it cannot be utilised in putrescibles processing. This investment should be considered in subsequent MTIPs.

As noted above, during this MTIP we anticipate implementation of putrescibles collection and processing across the main urban centres. On the assumption that addressing Wellington's need to process sewage sludge is required to be completed for the processing of putrescibles to be successful, we have allocated $30m in 2025 to address this. Should alternative options be identified to resolve this, we intend the $30m investment will instead be allocated to increasing plastics infrastructure.

6.4.2 Compliance, Monitoring and Enforcement (CME)

The CME investment envelope in intended to ensure waste is directed to the appropriate landfill, the Waste Levy is fully charged and collected and potential risks of illegal disposal of waste are minimised.

The Ministry has stated "An effective compliance regime will help address any potential risks of illegal disposal of waste such as fly tipping. Central and local government both have roles to play in ensuring compliance with the landfill Levy."[48] We understand the proposed increase in the Waste Levy has raised a number of concerns in regard to the potential for adverse consequences such as illegal dumping, littering, or diversion to different classes of landfills with lower environmental controls.

International experience indicates that an increase in the Waste Levy requires an increase in CME to manage the environmental and financial impacts of illegal dumping. Funding allocations to this investment envelope would include anti-littering and dumping initiatives.

We view the implementation of effective compliance, monitoring and enforcement processes to be an essential initial step to support the proposed increase in the Waste Levy. There is a potential issue around how to fund the increased CME activity as the proposed Levy increase (projected to be implemented by 1 July 2021) will increase the flow of funds but there are limitations imposed by the WMA on how that funding can be utilised. In a following section we have outlined issues which the Ministry should consider if the WMA is reviewed.

Responsibility for CME is currently shared between the Ministry and TAs with the Environmental Protection Authority being the enforcement agency for hazardous waste. The Ministry's role has been mostly to guide and support TAs and operators of levied landfills[49]. There is a strong argument in favour of ensuring nationally consistent compliance and therefore stronger central management of CME activities.

Expanded Ministry responsibility for managing and monitoring compliance with landfill regulation, particularly in regard to illegal dumping should be considered, alternatively this increased CME role could go to another agency with greater experience of regulatory compliance or be left with the TAs. Consideration should be given to centralising responsibility for CME activities to ensure national consistency and prevent inter-regional transportation of waste for disposal. The Ministry should consider funding the Environmental Protection Agency (EPA) to increase their regulatory mandate to also cover compliance, monitoring and enforcement of the Waste Minimisation Act and the Waste Levy. Elements of CME should remain with the Ministry, most notably responsibility for Levy collection and for monitoring TA spending of the Levy funds consistent with the Ministry's current responsibilities. We note delegating regulatory responsibility to the EPA would require amendment to legislation. The EPA funding would be a fixed allocation of Levy funds.

MTIP Allocation

Initial estimate of $7.5m pa, increasing over time and allocated between the Ministry ($1.5m) and EPA ($6m). We consider this to be a conservative estimate based on:

- Eunomia estimate of $10m pa to manage illegal activity that might be stimulated by the increased Levy[50]
- EPA actual costs of $7m in 2018/19 and forecast of $7.7m for 2019/20 to perform their existing monitoring and enforcement functions[51].

[48] Ministry for the Environment – Reducing Waste: a more effective landfill levy (2019 Consultation Document)

[49] Ministry for the Environment. 2018 – Our Regulatory Stewardship Strategy 2018
[50] The New Zealand Waste Disposal Levy, Eunomia Final Report, 30 May 2017
[51] Environmental Protection Agency, Annual Report for the year ended 30 June 2019

6.4.3 Data Collection and Analysis

The data investment envelope is intended to improve the quantity and quality of waste data available to the Ministry and the broader waste sector to inform central, regional and local decision making and to allow the effectiveness of interventions to be monitored and measured.

The Ministry has stated “There is also significant room for improvement on the data that is collected on waste. Better waste data would make it easier to identify opportunities and assess the effectiveness of waste minimisation efforts.”[52] This is consistent with our observations and noted in several recent papers as well as prior reviews of the WMF. There is a generally acknowledged lack of quality and quantity of information in regard to waste, individual waste streams and the recycling and reprocessing sector. We note this is in part due to limited reporting requirements for non-Class 1 Landfills.

Both the Ministry and EPA will require access to timely, high quality data to execute their responsibilities effectively. A shared data resource should allow multiple organisations to access and utilise the required data in a seamless manner. Richer data will give the Ministry the ability to perform analysis on the waste sector, the impact of the increased Levy and the success or otherwise of Ministry initiatives such as the Levy investments, the Container Deposit Scheme and others.

There is a potential issue around how to fund the increased Data activity as the proposed Levy increase (projected to be implemented by 1 July 2021) will increase the flow of funds but there are limitations imposed by the WMA on how that funding can be utilised. In a following section we have outlined issues which the Ministry should consider if the WMA is reviewed.

It is envisaged the cost of the collection and analysis of data will be a fixed funding requirement, although higher funding is expected to be required initially as systems and processes are established.

MTIP Allocation

Initial estimate of $2m pa is based on the existing system in place for class 1 landfills, however this will need to be expanded if the Levy is extended across class 2 and 3 landfill sites. This also reflects the proposed centralisation of reporting to the Ministry with consolidated reporting to be provided back to the sector including TAs.

6.4.4 Research and Development

The research and development investment envelope is intended to facilitate increased research into NZ waste solutions as well as catalysing the investigation and adoption of waste solutions, particularly waste reduction solutions.

Investment in R&D can be viewed as future-proofing the waste sector by encouraging the implementation of more efficient and effective technologies and processes.

Funding of research and development (R&D) is well-established through agencies such as Callaghan Innovation and Scion Research, as well as a number of Government Departments and Ministries, including the Ministry through the WMF.

A key question in R&D is at what point in the continuum should investments be focused? The following diagram (based on the Green Investment Finance Limited [GIFL] 2019/20 Statement of Intent) illustrates the continuum:

[52] Ministry for the Environment – Reducing Waste: a more effective landfill levy (2019 Consultation Document)

Figure 11 Investment Continuum

GIFL's stated focus is the Mid-stage and the first part of the Mature stage. The risk with focusing on research is the research might not produce an outcome which is relevant to waste minimisation. Counter to this, if research is not funded then potentially valuable local solutions to waste issues might not emerge.

Development funding is generally considered to be lower risk than research funding as the technology/process has been established as viable and the funding is used to determine whether the technology or process can be commercialized. Development funding can be applied to both NZ developed and internationally developed technology and processes.

Callaghan Innovation and Scion Research are both involved in funding research and development. Scion reported that a major gap in NZ is access to a "pilot plant" which would allow pilot projects to be run to prove the ideas were commercially viable reducing the risk to investors.

Consideration should be given to funding Callaghan and Scion's existing R&D funding programmes with a heavy weighting towards development funding. The investment amount could be modest but would need to be enduring to provide certainty to the sector.

MTIP Allocation

As noted above, the allocation for Research & Development is intended to be a variable allocation to encourage the implementation of more efficient and effective technologies and processes. **Our estimate of $5m pa** is based on discussions with Callaghan Innovation and Scion Research and current appropriations for development funding.

6.4.5 Innovation

The innovation investment envelope is intended to catalyse the adoption of waste solutions, particularly waste reduction solutions.

The difference between innovation funding and development funding is potentially one of definition rather than substance. However, the establishment of GIFL has created a different approach to innovation funding for the NZ public sector. GIFL is a green investment bank established with the purpose of accelerating investment to lower greenhouse gas emissions activities in New Zealand, with a mandate to invest in projects that reduce New Zealand's greenhouse gas emissions.

GIFL is not a funding agency and does not accept applications for funding or grants. GIFL has initial capital of $100m with the stated intention of growing their capital pool via successful investments and the subsequent sale of these investments. GIFL is looking to invest between $5m and $25m into each project identified.

Extending GIFL's mandate to include waste projects would provide a useful adjunct to the grants-based R&D investments of Callaghan and Scion. Funding could be provided as a series of one-off amounts over time.

Another aspect of innovation funding which should be considered by the Ministry is providing financial support for companies looking to reduce waste in their products. Such funding would be consistent with the Waste hierarchy prioritisation by helping to reduce the amount of waste going into the system.

MTIP Allocation

Initial estimate is based on matching GIFL's existing capital funding of $100m, with the 'waste innovation fund' established over the initial ten-year period i.e. **funding of $10m pa**.

6.4.6 Territorial Authorities

The Territorial Authorities (TAs) investment envelope is intended recognise the critical role TAs play in the waste system and ensure this role is maintained.

TAs currently receive 50% of the Waste Levy funds, as required by the Waste Minimisation Act. The Ministry will need to work very closely with TAs to ensure investment is appropriately prioritised and coordinated. A range of tools are available to do so, including improved guidance to TAs about levy spending priorities; use of the NZ Waste Strategy (which councils must have regard to in developing their waste management and minimisation plans); and use of sections 48 and/or 49 of the WMA (to give directions to and/or set performance standards for TAs).

There is a risk that TAs will utilise the additional funding to address local waste issues, the solution to which is incompatible with, or not a priority from a national perspective.

The current TA Waste Levy allocation is population based, which approximately reflects how the Levy is generated. However, we understand this allocation formula leaves a large number of smaller (less densely populated) regions with limited funding from the Waste Levy making it more difficult to afford the capital or operating cost of larger initiatives such as required waste recycling infrastructure. We note that there will be an ongoing challenge weighing the effectiveness of Waste Levy spend (which will tend to focus on the largest waste streams) and the equity of treatment between metro and provincial areas.

Another challenge for the population-based funding formula is those regions which have to deal with waste not created by their populations, for example through tourism. Consideration should be given to revisiting the TA funding formula to bring other factors besides population into the calculation.

For example, a refreshed funding formula could include:

- A base amount to recognize that all TAs will incur certain minimum costs (e.g. a Waste Officer)
- A visitor component to recognize the waste actually generated in some regions (e.g. Queenstown) is not related to the size of the local resident population.
- A population component (i.e. as currently done) to recognize the fact that larger centres generate a larger amount of waste.

There is a strong argument to at minimum ensure the current level of TA funding is maintained to ensure current services can be maintained and to recognise the central role played by the TAs in the waste system. Such an allocation could be either a fixed amount of funding or a fixed percentage of Levy revenue to provide funding certainty to the TAs.

MTIP Allocation

Initial estimate is based on **maintaining the current funding formula** as required under the WMA (i.e. 50% hypothecation), pending review and updating of the WMA which we assume will come into effect from 1 July 2022. Subsequent to this TA

funding is maintained as a fixed quantum to ensure current services can be maintained and to recognise the central role played by the TAs in the waste system.

6.4.7 Community Projects

The Community Projects investment envelope is intended to encourage and support local solutions to local issues and share effective initiatives across regions.

Currently, the WMF funds a large number of projects with a local focus which are generally a combination of community infrastructure and education/awareness activities for small to medium enterprises, iwi, training organisations local government and community groups. These projects play an important role in the development and implementation of local solutions to local issues. The funding stream for such projects would be variable (although fixed for each medium-term period).

MTIP Allocation

Initial estimate of approx. $15m pa is based on the current WMF allocations and TA contestable funding (e.g. Auckland Council Waste Minimisation & Innovation Fund of up to $500k pa). While lower than current WMF and TA contestable funding levels, establishing separate Infrastructure, R&D, Innovation and Education allocation envelopes should make more funding available for Community Projects than currently.

6.4.8 Education and Awareness

The Education and Awareness investment envelope is intended to drive behaviour change particularly in the reduction of waste and to support the other investment steams.

The rationale for spending on education and awareness is to both inform and to change behaviors. A key consideration will be what messages to focus upon and at what stage. For example, raising awareness of Reduction should be able to be undertaken at any stage, while raising awareness of Recycling might carry a risk if the waste recycling system is incomplete. For example, there is a risk in raising awareness of recycling if the current processes continue to send the majority of the recycled material to landfills. An alternative could be to concentrate on regional messages as regional waste system solutions are implemented. We note a number of TAs already invest in education and awareness, including through the sector body WasteMINZ.

EECA has recently launched the Genless platform which is designed to deliver a long-term programme to change behaviours towards embracing a lifestyle which uses less energy and helps halt climate change. We understand the Ministry is currently working with EECA around climate change. As EECA has already made the initial investments in the Genless platform there may be efficiencies to be gained through utilising the same platform for waste minimisation education.

Education and awareness funding is considered variable, although consistent over the term of the MTIP, to ensure the priority of expenditure is appropriate and any significant gaps identified in the Waste Infrastructure Stock take can be addressed as the priority.

MTIP Allocation

Initial estimate of $3m pa is based on project expenditure e.g. Engage hearts and minds, per EECA Annual Report 18/19. However as noted, funding is considered variable to ensure the priority of expenditure is appropriate and any significant gaps identified in the Waste Infrastructure Stock take can be addressed as the priority.

6.4.9 Other

The Other investment envelope is intended to provide funding opportunities to other activities which are consistent with the intention of the Act, where a more effective investment is not available in the other investment envelopes.

Depending on factors such as the amount of Levy revenue, whether the full Levy revenue is allocated and the cost of the required infrastructure, there is the potential for funding to be available for projects outside of the allocation envelopes. Recent incidents have highlighted the risk the country faces with legacy landfills and the environmental impact when such landfills fail. However, as the waste has already been landfilled there may be debate whether remediation efforts can be funded under the WMA. The funds in the Other investment envelope can also "protect" committed infrastructure investment amounts in the event of a fall in Levy revenue. Where Levy revenue is consistent with projections the Other funds can be utilised for relevant identified projects or used to accelerate the implementation of waste system infrastructure. Where Levy revenue falls below projections the Other funds can be allocated to committed investments.

Legacy landfill remediation and contaminated soil remediation are good examples of "other" issues which could be funded via the Waste Levy and have the advantage of being able to utilise one-off injections of funding. Consideration should be given to allowing significant national waste related environmental issues to be funded by the Waste Levy, once priority initiatives have been funded. The potential issues which could be addressed under the other category depends on two factors, whether funding is available post allocation to the nominated investment envelopes and whether spending on other issues is permitted under the WMA. Such funding is considered variable with the quantum established through the medium-term investment plans.

MTIP Allocation

The inclusion of an allocation to the Other envelope (a total of $78m during the ten-year period to 2032) is intended to be **illustrative only**. In the period of this MTIP $9m has been allocated to Other investments. As noted above, in particular during the initial ten-year period it is feasible that infrastructure investment opportunities will exceed available funds, in which case the Other envelope may not be prioritised for investment during this period. This funding is considered variable with the quantum established through the medium-term investment plans.

6.4.10 Reserve

The Reserve investment envelope is intended to provide a buffer to the Ministry to help allow commitment to investments where the exact Levy revenue amount is uncertain.

The Reserve is a fiscally conservative mechanism which should allow the Ministry to commit to investments in current and future periods. The Reserve is built up at a rate of 5% over the period of the MTIP. The Reserve is utilised as required subsequently but replenished at a rate of 5% of Levy revenue to minimise the impact on investments as it is replenished.

We note that while not creating a reserve would increase the Ministry's risk in investment allocation this risk should be manageable if investment outflows and Levy revenue inflows are closely monitored.

Investment

The inclusion of an allocation to the Reserve envelope (a total of $25m at any time during the ten-year period to 2032) is intended to be **illustrative only**.

6.5 Comparison to Ministry Priorities

The Ministry consultation document (Reducing waste: a more efficient landfill levy) proposed the following priorities for investment of the increased Levy revenue. The Ministry priorities are consistent with our proposed approach of maintaining a mix and balance of areas for funding.

This approach reflects the conviction that all of the elements of the waste system need to be operating effectively for the waste system to be effective. Underinvestment in any of the core elements (as represented by the investment envelopes) will reduce the effectiveness of the overall system and may reduce the value New Zealand receives from investing the Waste Levy.

We have mapped the Ministry priorities to the proposed Investment Plan (Table 26).

Table 26 Mapping of Ministry Priorities to where they are addressed in the Investment Plan (MITP)

Ministry Priority Areas for Investment	Where addressed in Investment Plan
Initiatives that address an area where there is demand for a particular service, coupled with insufficient local provision.	The Long-Term Infrastructure Plan will be based on the NRR Infrastructure Stock take which will identify service/infrastructure gaps. The Medium-Term Investment Plans will prioritise investment based on national needs and waste streams. The Infrastructure Investment Envelope will reflect the priority of infrastructure in achieving Strategic objectives.
Initiatives that have the potential to lead to new methods of waste minimisation and drive innovation in the system.	The Research & Development and Innovation Investment Envelopes will fund both R&D and innovation to address this priority.
Creation of onshore waste/materials (re)processing capability to build resilience for external market changes and reduce reliance on overseas recyclers.	The Infrastructure Investment Envelope is expected to fund the development of onshore reprocessing and processing infrastructure to address this priority.
Monitoring and enforcement of the Levy, including measures to combat inappropriate forms of disposal (littering, fly tipping, illegal dumping).	The CME Investment Envelope is expected to fund compliance and enforcement activity to address this priority. We note we are recommending this activity is outsourced to EPA.
Data on waste quantities and composition, behaviour and economic incentives.	The Data Investment Envelope is expected to fund the collection, storage and analysis of waste data to address this priority.
Legacy and ongoing cases of non-compliant waste disposal methods that are not aligned with the objectives of the WMA.	The Other Investment Envelope is expected to fund projects, including legacy landfill remediation projects, to address this priority. We note the proposed allocations give this area lower priority.

6.6 Indicative Investment Envelope Modelling

The Indicative Investment Envelope modelling, Full Revenue Model (Table 27) provides an example of how potential waste Levy revenue of $2.16 billion could be allocated over the ten-year period from 2023 to 2032 inclusive. Our costing assumptions for this model do not attempt to cost individual projects and investments, but test whether it is feasible that total Levy revenue of this quantum can be effectively invested over the period.

Based on the following assumptions it appears sufficient market demand exists to support investment in waste minimisation activities of this quantum.

If the Ministry does not have confidence in the revenue projections (particularly in the initial stages as the system data quality and quantity are being improved) it is recommended the total amount committed to investment is a proportion of the projected revenue. The unallocated revenue should be accumulated, and a reserve created to give certainty to subsequent period allocations. Once a nominated reserve amount has been accumulated additional funds can be used to boost the funds available to the investment envelopes.

We note that, subject to Cabinet decisions, the revenue from an increased Levy is projected to flow from 1 July 2021, however the restrictions on the use of Levy funds created by the WMA are expected to remain in place until 1 July 2022, subject to the outcome of the current Levy consultation process and government willingness to revisit the WMA. For the year beginning 1 July 2021, 50% of any increased Levy revenue will be allocated to the TAs, based on the current population-based formula. We have factored this transition period into the following illustrative model.

We have presented below an indicative allocation model under two scenarios, firstly the full revenue calculated by NZIER and secondly the impact on the model if combined waste minimisation initiatives reduce waste volumes going to landfill by 2.5% per year (every year).

The models utilise the following assumptions:

- Levy increase starts from 1 July 2021, rather than 2020 assumed by NZIER. Revenue will flow as modelled by NZIER
- The current WMA remains in effect to 30 June 2022, including 50% hypothecation to TAs. During this time WMF administration costs include allocations to CME and improving data capabilities
- The WMA is updated with effect from 1 July 2022, including removal of the 50% hypothecation to TAs
- Unallocated or unspent revenue is able to be accumulated for later use and
- The Ministry requires a reserve of $25m to be accumulated.

We note the following models have assumed all Levy funds are available for the investment envelopes, subject to the assumptions above. This change would require amendment to the Act. If the Act is not amended, the Ministry would need to work closely with the TAs in an effort to coordinate investment, particularly in regard to infrastructure. Under such a model the Ministry and TAs would potentially need to coinvest in infrastructure, with an increased challenge in funding national infrastructure in preference to local or regional infrastructure.

If the Act Is not amended the impact on our model would be as follows:

- TA funding increased to 50% of the projected Levy revenue
- Infrastructure, R&D, Innovation, Education and Community Projects funding reduced proportionately and
- The Other category is removed, and the Reserve reduced or removed.

Without central direction it is reasonable to assume the timeline for addressing waste streams would increase.

6.6.1 Full Revenue Model

We have outlined below an indicative allocation model over the recommended investment envelopes based on the average of the funding models developed by NZIER and included in the consultation document.

Table 27 Output of indicative allocation model – Full Revenue (NZIER average)

Year ended 30 June	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Expected Revenue (Average)	**36,912**	**45,020**	**100,984**	**164,993**	**227,358**	**230,785**	**233,070**	**235,381**	**237,719**	**240,038**	**242,282**	**244,038**
Waste Management Fund	18,456	16,510	-	-	-	-	-	-	-	-	-	-
Infrastructure	-	-	30,000	90,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
CME - MfE	-	1,000	1,500	1,500	1,500	2,000	2,000	2,000	2,500	2,500	2,500	3,000
CME - EPA	-	3,000	6,000	6,000	6,000	7,000	7,000	7,000	8,000	8,000	8,000	9,000
Data	-	2,000	2,000	2,000	2,000	2,250	2,250	2,250	2,500	2,500	2,500	2,750
R&D	-	-	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Innovation	-	-	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
TA	18,456	22,510	22,510	22,510	22,510	25,000	25,000	25,000	30,000	30,000	30,000	35,000
Community Projects	-	-	15,925	16,733	15,980	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Education	-	-	3,000	3,000	3,000	5,000	5,000	5,000	5,500	5,500	5,500	6,000
Other	-	-	-	-	-	9,202	11,820	14,131	29,219	-	5,320	8,288
Reserve (5% of Levy Revenue)	-	-	5,049	8,250	11,368	333	-	-	- 20,000	11,538	8,462	-
Total	**36,912**	**45,020**	**100,984**	**164,993**	**227,358**	**230,785**	**233,070**	**235,381**	**237,719**	**240,038**	**242,282**	**244,038**
Unallocated	-	-	-	-	-	-	-	-	-	-	-	-
Total Reserve	-	-	5,049	13,299	24,667	25,000	25,000	25,000	5,000	16,538	25,000	25,000
Reallocated	-	-	-	-	-	-	-	-	20,000	-	-	-

For the first two years the status quo is largely maintained, with allocations to the current WMF and 50% hypothecation to TAs. However, in the year ended 30 June 2022 we assume a requirement for increased spend on administrative functions of CME activities and improving data capabilities.

As can be seen, the **Reserve is accrued** over the four years following updating of the WMA and utilised in subsequent years where the Levy revenue falls below the allocated total (2029). The reserve is rebuilt over subsequent years. We note this model assumes the "Other" category is committed and is not available to prevent the use of the reserve. Under a full revenue scenario, the reserve is quite fiscally conservative as revenue is increasing year on year.

Under this scenario **Infrastructure spend increases** over the first two years. This assumes a lead time required for infrastructure investments of 2-3 years for major infrastructure and at least a year for smaller infrastructure projects. Infrastructure remains consistent from 2025 at $150m pa to reflect the anticipated spend required to address the major infrastructure gaps and an on-going need to reinvest to account for aging plant and technological change.

CME is an early spend category which rises over time to reflect increasing costs. Similarly, initial data costs reflect an assumed systems, people and process implementation requirement, and then a BAU state with on-going cost increases.

R&D is assumed to be allocating funds to Callaghan Innovation and Scion Research's existing R&D funds with a mandate to identify and invest in waste minimisation focused projects. The innovation funding is assumed to be invested in GIFL in a similar manner to their current funding, but with an explicit waste focus. As discussed, we see value in development and innovation funding having a waste reduction focus.

We are proposing holding TA funding at 2022 levels (when we assume the 50% hypothecation is removed) to recognise their critical role in the waste system and to ensure current services and initiatives are able to continue. We note the proposed changes to the management of community project funding and the central infrastructure, CME and data spends should free up TA funding in these areas. The TA funding increases over time to reflect an expectation of a growing role in the waste system through the ownership and operation of waste infrastructure.

Community Projects is considered a flexible category for funding, partly because the proposed annual funding rounds are able to be adjusted to account for increased or decreased available revenue. While the overall level is below current WMF and TA contestable funding levels, we note that the establishing of separate Infrastructure, R&D and Education allocation envelopes should make more funding available for Community Projects than currently.

Education/Awareness funding gets an immediate boost in the first period and then increased in subsequent periods. This is to reflect our assumption of the need to raise awareness around (for example) Reduce messages and to increase education to support and promote waste system solutions as they are implemented.

The Other category is significant in this scenario, primarily driven by the increased revenue projected. This category gives some flexibility to the Ministry as the funds could be reallocated to the other allocation envelopes or utilised to address other issues such as legacy landfill remediation. The Ministry's determination of how to allocate these funds will depend upon their confidence with the Levy revenue projections and the size and actual cost of infrastructure gap identified through the Infrastructure Stock take.

The Reserve is a fiscally conservative approach to ensure that unexpected shortfalls in any period do not impact expenditure plans. The table illustrates $20m being required in 2029. This could be due to an unexpected fall in revenue or an unexpected increase in the costs of, say, a major infrastructure project. If the Ministry has confidence in the revenue projections, or if revenue can be "fixed" through additional Levy increases, the Reserve or Other category will not be required and the revenue reallocated.

Note: allocation numbers should be viewed as being illustrative only. We have allocated $1.3 billion for Infrastructure (with an additional $100 million allocated to Reserves and Other), until the Waste Infrastructure Stocktake and Gap Analysis is complete we are unable to determine whether this level of funding is sufficient to address the identified gap.

6.6.2 Falling Revenue Model

As stated above, the NZIER revenue projections have assumed Levy revenue increases over time driven by population growth. In their report NZIER state "*indirect effects, such as the impacts of levy-funded initiatives to support material recovery, are excluded from the analysis to concentrate on the effects of levy changes alone".* By 2026 if over $1 billion has been allocated, it is reasonable to assume this will have some impact on the volume of waste entering landfills.

In the following allocation model, we have assumed that waste volumes and therefore Levy revenue is falling by 2.5% per year, every year, with the following reduction in revenue from the Full Revenue projection:

Table 28 Reduction in Revenue compared to Full Revenue Scenario

YEAR per NZIER	YEAR per models (Year ending 30 June)	NZIER Projection	2.5% PA Reduction	Revenue Shortfall
2020	2022	45,020	45,020	-
2021	2023	100,985	98,460	2,525
2022	2024	164,993	156,743	8,250
2023	2025	227,358	210,306	17,052
2024	2026	230,786	207,707	23,079
2025	2027	233,070	203,936	29,134

YEAR per NZIER	YEAR per models (Year ending 30 June)	NZIER Projection	2.5% PA Reduction	Revenue Shortfall
2026	2028	235,381	200,074	35,307
2027	2029	237,719	196,118	41,601
2028	2030	240,039	192,031	48,008
2029	2031	242,283	187,769	54,514
2030	2032	244,039	183,029	610,010
Total		**2,201,672**	**1,881,195**	**320,477**

As can be seen, later year revenue is significantly impacted. While we acknowledge a straight-line reduction is unlikely ,and arresting the rate of increase would be a notable achievement, we believe a reduction in waste volumes is inevitable and will require on-going modelling by the Ministry to ensure the projected revenue for each medium-term Investment Plan is realistic and the Ministry is able to commit to the proposed funding.

The following allocation model assumes Levy revenue decreases as shown in Table 29.

Table 29 Output of indicative allocation model – Falling Revenue 2.5%

Year ended 30 June	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Expected Revenue (2.5% Reduction)	**36,912**	**45,020**	**98,460**	**156,743**	**210,306**	**207,707**	**203,936**	**200,074**	**196,118**	**192,031**	**187,769**	**183,029**
Waste Management Fund	18,456	16,510	-	-	-	-	-	-	-	-	-	-
Infrastructure	-	-	35,000	90,000	140,000	140,000	140,000	140,000	120,000	120,000	120,000	120,000
CME - MfE	-	1,000	1,500	1,500	1,500	2,000	2,000	2,000	2,500	2,500	2,500	3,000
CME - EPA	-	3,000	6,000	6,000	6,000	7,000	7,000	7,000	8,000	8,000	8,000	9,000
Data	-	2,000	2,000	2,000	2,000	2,250	2,250	2,250	2,500	2,500	2,500	2,750
R&D	-	-	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Innovation	-	-	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
TA	18,456	22,510	22,510	22,510	22,510	22,510	22,510	22,510	25,000	25,000	25,000	30,000
Community Projects	-	-	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Education	-	-	3,000	3,000	3,000	5,000	5,000	5,000	5,500	5,500	5,500	6,000
Other	-	-	-	-	-	-	-	-	3,534	3,531	-	-
Reserve (5% of Levy Revenue)	-	-	3,450	6,733	10,296	3,947	176	- 3,686	4,084	-	- 731	- 12,721
Total	**36,912**	**45,020**	**98,460**	**156,743**	**210,306**	**207,707**	**203,936**	**200,074**	**196,118**	**192,031**	**187,769**	**183,029**
Unallocated	-	-	-	-	-	-	-	-	-	-	-	-
Total Reserve	-	-	3,450	10,183	20,479	24,426	24,602	20,916	25,000	25,000	24,269	11,548
Reallocated	-	-	-	-	-	-	-	3,686	-	-	731	12,721

The most obvious difference is the **reduced funding available for the Other category**, a total of $7m reduced from $78m.

The **Reserve also takes longer to accumulate**, with the maximum allocation of 5% of Levy revenue not available in any of the years, with increased use of the Reserve in later years.

Other changes are:

- From 2025, **reduced amounts available for allocation to Infrastructure** investments
- **Innovation funding has been halved**, meaning a $50m fund with the GIFL at the end of the period and
- **TA funding** is held at current levels for the first two periods and **only increases as the infrastructure spend declines** in 2029.

We have assumed CME, Data, R&D and Education allocations are unchanged, and the Community Projects allocation is substantially unchanged.

The changes in allocation envelopes are illustrative only and there are a large number of alternative actions which could be taken. For example, if waste volumes are falling potentially the need for waste infrastructure might also be falling, allowing that allocation to be significantly scaled back over time.

7. Investment Processes

Different processes will be required for the different investment types. The Ministry should seek to use existing investment processes and expertise from across the public sector to avoid duplication and maximise efficiency. The investment process required by each of the investment types will be different due to the size and complexity of the potential investment, the instruments able to be utilised and the expertise required to assess the merits of competing ideas.

We have outlined below our recommendations of how the investment envelopes should be managed, some of the challenges the Ministry will face and discussion of other government agencies who are currently performing similar investment management and administration processes and who could assist the Ministry.

Investment approaches also need to recognize that Māori and Iwi contribute and play a major role in New Zealand's economy. Māori contribution to the New Zealand economy is multi-faceted and includes the primary sector, natural resources, small and medium enterprises and tourism and have a role in minimising waste.

The Crown–Māori Economic Development Strategy, He kai kei aku ringa, provides an organising framework to drive an all-of-government focus on achieving positive economic outcomes for Māori. "He kai kei aku ringa, literally, to provide the food you need with your own hands – or in today's world, to be responsible for the resources and capability you need to grow and develop"[53], is an intent, and as part of a wider framework, seems well aligned to the waste minimisation framework we propose. We note He kei aku ringa contains output and outcome structures, and an innovation investment fund[54], elements in common with existing MfE approaches, and what this document proposes.

7.1 Infrastructure Investments

As infrastructure investments are expected to be the largest and highest profile investments, they will carry the highest risk.

The current Ministry WMF investment processes are unlikely to be able to process the increased Levy funding and the resulting increase in investment application numbers, without significant investment in systems, processes and people. It currently takes the Ministry between 12 and 18 months to receive, assess, approve, contract and pay out investments. This delay is in part structural as all investments are processed internally, reviewed by an independent panel and then submitted to the Minister for the final decision. This process is followed for all investments regardless of size or complexity.

Consideration should therefore be given to outsourcing the infrastructure investment process to another party with greater experience, such as MBIE's Provincial Development Unit (PDU), Crown Infrastructure Partners (CIP), NZ Green Investment Finance (NZGIF), the Energy Efficiency and Conservation Authority (EECA), the NZ Superannuation Fund (NZSF) or a private funds manager.

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[53] "Strategy to 2040", Maori Economic Development Panel (2010), MBIE website

[54] The Māori Innovation Fund (MIF) is a $1 million a year fund. MBIE administers the fund and has joint responsibility for it with the Ministry of Māori Development, Te Puni Kokiri.

Table 30 Potential investment fund managers

Provider	Potential Benefits	Potential Challenges
PDU	Established public sector investor in infrastructure. Experience with range of investment types and durations. Established processes for managing high volume and high value transactions.	Provincial New Zealand focus. Current economic growth mandate. Potential longevity challenges (funded to June 2021).
CIP	Current water and roading infrastructure for housing mandate. Co-investment focus.	Current broadband/mobile coverage mandate. Processes developed for lower volumes and lower value transactions.
NZSF	Established investment analysis processes.	Seeking commercial opportunities. Processes not established for applications or RFP responses.
NZGIF	Environmental focus. Co-investment focus. Established governance processes for major investments.	Primarily seeking commercial opportunities (aligned to emissions reduction objective). Processes not established for applications or RFP responses.
EECA	Energy conservation focus Waste to energy investment expertise Electric Vehicle (EV) investment expertise	Primarily grant funding Only indirectly focused on waste
Private Funds Manager	Established investment analysis processes.	Seeking commercial opportunities only. Processes not established for applications or RFP responses.

The above analysis indicates that either of PDU, CIP, EECA or NZGIF could support the Ministry in administering infrastructure investments. All of the agencies would need an amended mandate and potentially processes and personnel to expand their operations to include waste infrastructure, however only PDU has established investment administration processes which are consistent with the Ministry's waste infrastructure needs. However, this would still allow the Ministry to work with other agencies such as NZGIF or EECA where circumstances allow it. For example, the Ministry could work with EECA to utilise their in-house expertise developed around waste to energy plants if such plants were considered a viable option for some waste streams. There is limited efficiency gain if the potential provider needs to establish a team and processes as the Ministry could grow their own team and processes as easily.

Where the Ministry has outsourced responsibility for the investment process, the Ministry will retain responsibility for setting the investment strategy, setting eligibility and investment criteria and monitoring the effectiveness of the investments. The Ministry will need to determine how large a role it will require in the decision-making process, although it is noted for larger investments The Ministry should have a role in creating a recommendation to the Minister or Cabinet.

We are proposing the establishment, or supplementing of, expert panels to support the investment assessment process for each of the allocation envelopes. The expert panels should draw from the expertise available from the broader waste sector including industry and TAs. The Ministry should consider being represented on each of the expert panels to ensure consistency

of the deliberations with the Waste Strategy and the maintenance of a New Zealand Waste System perspective. Where the Ministry has outsourced investment processes, it should have a role in identifying relevant expertise to support the outsourced providers assessment processes.

Across the public sector there are limited numbers of organisations making infrastructure investments, such as NZTA and MBIE (through the Provincial Growth Fund - PGF). NZTA has a focus on road and rail infrastructure and have a well-developed cost/benefit formula which priorities their investments which are effectively grant funding. The PGF has a much broader mandate and use a broader range of investment approaches. However, the Provincial Development Unit (part of MBIE established to administer the PGF) has an uncertain future, as the PGF was set up with a 3-year horizon as part of the Coalition agreement. As stated above, other agencies such as NZGIF, EECA or CIP could potentially develop the processes required for waste infrastructure investments, or this process could be in-housed to the Ministry.

Where the Ministry does outsource investment management processes it is important the Ministry sets the eligibility criteria, the investment criteria, the outcomes sought and has representation on, and influence over, the appointment of personnel to an independent advisory panel. The concept of independent advisory panels is well established and provides an opportunity for key stakeholders to be involved in determining what investments should be funded.

It is recommended the process for major infrastructure investments includes seeking input from the market on how identified infrastructure gaps could be filled, through an Expression of Interest/Request for Information (EOI/ROI) process before a contestable Request for Proposal process[55] is undertaken. Before any major infrastructure projects are considered, a Market Impact Analysis should be undertaken to ensure the investor understands the impact upon existing market participants.

The information gained through an EOI/ROI process will allow an RFP to be developed and issued. The type of investment needed will depend on the responses received from the RFP, but it is envisaged such investments will be longer term (to reflect the longer time frames required to design and build large infrastructure) and will utilise more complex instruments such as debt and equity.

A key decision required from the Ministry is whether, and to what extent, the Ministry is prepared to fund initial, or on-going, operations of the infrastructure developed. There might be World Trade Organisation (WTO) type considerations as on-going support might be viewed as anti-competitive. We understand the PDU has developed a consultative process with the Ministry for Foreign Affairs and Trade (MFAT) where their investments have the potential to trigger WTO concerns. We further understand that the PDU has utilised more neutral instruments, such as delayed repayment terms, to manage this concern.

A further consideration for the Ministry will be how to quantify and assess (against other investment criteria) the social good of waste infrastructure. Given current international prices for raw and processed waste streams there is a chance that prioritised waste infrastructure will not be commercially viable and the rationale for investment may rely heavily upon the social good the reprocessing of the waste stream creates. It is noted that a number of other factors could impact this consideration, such as international markets, container return schemes, product stewardship schemes and legislative changes impacting specific waste types (such as banning specific plastics types or imposing virgin material taxes).

The Ministry has determined they do not want to own infrastructure, therefore the investments will be supporting private sector, local government and potentially social enterprise organisations. It is expected the ownership of the asset will dictate the type of investment instrument utilised, as commercial ventures should be expected to repay financing (in the absence of significant

[55] Advanced procurement practice such as Early Contractor Involvement (ECI) and Competitive Dialogue, both common in NZ now for large infrastructure, are expected to be used.

public benefit). Where possible, the Ministry should grant fund publicly owned waste infrastructure and de-risk private co-investment to reflect the public good benefits inherent in waste minimisation projects.

Consideration will need to be given to co-funding arrangements with NZTA or TAs to fund critical supporting infrastructure for national or regional waste projects. For example, a second fibre plant would require used fibre to be collected, bulked and transported to the plant. The viability of the plant may be compromised without adequate supporting infrastructure.

7.2 Compliance, Monitoring and Enforcement

Compliance, monitoring and enforcement (CME) activities should be considered as part of the critical supporting infrastructure, however we believe these elements should be treated differently from other supporting infrastructure.

Compliance and enforcement activities will be critical to ensuring the increased Levy does not transfer waste from Class 1 landfills to Class 2-5 landfills and the increased Levy is being accurately and fully collected. We recommend consideration is given to working with another agency with greater regulatory enforcement experience, such as the Environmental Protection Agency. Any transfer of responsibility would require a matching transfer of funding for executing the responsibility. It is assumed such a transfer would be a permanent allocation from the Levy funds.

Elements of CME should remain with the Ministry, most notably responsibility for Levy collection and for monitoring TA spending of the Levy funds consistent with the Ministry's current responsibilities.

Expanded responsibilities for managing and monitoring compliance with landfill regulation, particularly in regard to illegal dumping could logically go to another agency with greater experience of regulatory compliance. Consideration should therefore be given to funding the Environmental Protection Agency (EPA) to increase their regulatory mandate to also cover compliance, monitoring and enforcement of the Waste Minimisation Act.

We note delegating regulatory responsibility to the EPA will require amendment to legislation. The EPA and Ministry CME funding would be a fixed allocation of Levy funds.

7.3 Data Collection and Analysis

Data Collection and Analysis (Data) activities should be considered as part of the critical supporting infrastructure, and intended to improve the quantity and quality of waste data available to the Ministry and the broader waste sector to inform central, regional and local decision making and to allow the effectiveness of interventions to be monitored and measured.

The Ministry needs to continue to collect system-wide data, maintain the infrastructure stock take and monitor the performance of the projects invested in. Understanding the effectiveness of investments will be critical in monitoring the achievement of strategy, shaping future investments as well as the Prioritisation Matrix. A key element of all funding contracts should be a reporting requirement back to the Ministry. The Ministry will also need to collect data and report on the effectiveness of the agencies the investment management has been outsourced to.

Discussions with sector organisations have indicated a dilemma. Sector organisations believe there is already significant reporting undertaken. As commercial operations they would have a natural reluctance to share some commercially sensitive information, as some TAs are seen as competitors[56].

[56] Some TAs operate landfills that in effect compete for the same waste as commercial operators

There is the potential for the Ministry to reduce this perceived competitive tension by collecting all required waste information directly from all sector participants and publishing consolidated information for the sector including TAs. The Ministry would need to ensure collection, consolidation and reporting processes are sufficiently efficient to allow the TAs to access the information they require on a timely basis. We understand WasteMINZ has developed the National Waste Data Framework which could be used as the basis for standardized reporting.

The CME activities will require access to timely, high quality data to be executed effectively. A shared data resource should allow multiple organisations to access and utilise the required data in a seamless manner. An automated reporting tool which allows direct input from participants and provides full access to the Ministry and any other CME agency should allow the required level of information sharing. We recommend the current reporting system (OWLS) is reviewed to determine whether it is capable of meeting the broader information needs of the Ministry and wider waste system.

There is a potential issue around how to fund the increased Data activity as the proposed Levy increase (projected to be implemented by 1 July 2021) will increase the flow of funds but there are limitations imposed by the WMA on how that funding can be utilised. In a following section we have outlined issues which the Ministry should consider if the WMA is reviewed.

7.4 Education and Awareness

The Education and Awareness investment envelope is intended to drive behaviour change particularly in the reduction of waste and to support the other investment steams.

All education and awareness activities need to be consistent with the Waste Strategy and the Investment Plan and should therefore be centrally managed and coordinated by the Ministry. We note there is potential for cross-government activities, such as education campaigns in schools, which would require Ministry to Ministry cooperation. As noted above, regional campaigns would require coordination with the relevant TAs.

The decision of who should operationalise education and awareness campaigns should be an efficiency and effectiveness question. Whichever agency is responsible for this work in central government, behavior change campaigns usually involve contract management of external companies to undertake audience research, creative development and advertising placement. Given the Ministry has the mandate for waste minimisation created through the WMA and the Waste Strategy, as well as, potentially, responsibility for implementing the national waste system, it makes sense for the Ministry to retain control over this key lever for influencing behaviour.

EECA has recently launched the Genless platform which is designed to deliver a long-term programme to change behaviours towards embracing a lifestyle which uses less energy and helps halt climate change. We understand the Ministry is currently investigating working with EECA around climate change education. As EECA has already made the initial investments in the Genless platform there may be efficiencies to be gained through utilising the same platform for waste minimisation education.

7.5 R&D and Innovation Investments

Funding innovation will not address New Zealand's current waste issues but are a method of helping to future proof the waste minimisation system.

New Zealand has a number of organisations, both public and private sector, dedicated to funding research, development and commercialisation of innovation. Public sector examples include MBIE's funding of Royal Society research grants, Callaghan Innovation (Callaghan), EECA, Scion Research and Green Investment Finance Limited (GIFL).

The challenge with investments in this space is the (in)ability to pick winners, or sufficient winners to justify the amounts invested across the portfolio. We do not believe these are skills the Ministry currently has and support the Ministry's intention to outsource this task to other organisations. The risk with funding research is the research might not produce an outcome which is relevant to waste minimisation. Counter to this, if research is not funded then potentially valuable, local solutions to waste issues might not emerge.

Development funding is generally considered to be lower risk than research funding as the technology/process has been established as viable and the funding is used to determine whether the technology or process can be commercialised. Development funding can be applied to both New Zealand developed and internationally developed technology and processes.

Callaghan Innovation and Scion Research are both involved in funding research and development, while GIFL and EECA are more focused on investing at the development stage. To this end the logical partners for the Ministry include GIFL, Callaghan Innovation, EECA and Scion Research.

It is noted the Ministry will have limited ability to direct the development and innovation activity. Even if the Ministry were to prioritise (say) fibre there is no guarantee they will find opportunities to invest in this sector. To invest in development and innovation the Ministry needs to accept the risks that their investments might not produce tangible results and the results generated may not match the Ministry's priorities.

Callaghan is focused on providing grants to New Zealand companies who have an innovation which they believe could be commercially viable. The also provide the supporting science to further develop the innovation as required. The Ministry would need to establish and fund a separate mandate for Callaghan. The nature of the Callaghan process means the Ministry can allocate a fixed value of funding (through the medium-term Investment Plan).

GIFL is focused on identifying environmentally friendly commercial deals they believe they can profit from. GIFL has been established with a fixed capital investment amount ($100m) which is intended to be maintained and grown through their investment activities. It is recommended a similar approach is taken for waste innovation, with a fixed amount of funding provided. This amount could be increased over time to create a permanent waste innovation investment fund.

EECA operates a number of contestable funds focused on increasing the use of electric vehicles (EV), low emissions technology demonstration as well as loan funding to state sector entities to facilitate the more rapid adoption of EVs. EECA use an expert panel to make recommendations to the EECA Board for funding decisions. These processes could be adapted to the waste system particularly around innovation or adoption of waste reduction activities and the development of waste to energy solutions which replace coal as an energy source. The Ministry could either provide fixed funding to EECA to support EV or waste to energy projects or work collaboratively with EECA to fund relevant projects as and when identified by EECA.

It is noted that innovation funding is seen as a key enabler of waste reduction activities.

As with Infrastructure investments, the Ministry will retain responsibility for setting the investment strategy, setting eligibility and investment criteria and monitoring the effectiveness of the investments.

7.6 Community Projects

Community grants are intended to allow the development and implementation of local solutions to be developed for specific local issues as well as raising awareness and engaging local communities in waste minimisation activities. However, community grants could be used for local, regional or national projects to share and implement effective solutions to common issues.

Historically, a proportion of grants made by the WMF have been for community projects. We have not seen analysis of the impact of grants to community organisations on total waste volumes compared to the impact of the larger projects funded.

The current WMF process is based on centrally assessing applications and making recommendations to the Minister for approval, a process which is time consuming for the Ministry and applicant. We understand the WMF is currently reviewing its processes with a view to increasing efficiency and effectiveness.

A challenge for any centrally administered scheme is understanding the effectiveness of the projects funded and identifying opportunities for effective projects to be shared across a wider region or nationally. We note that TAs play a limited role in funding community projects from the Waste Levy as only a few larger entities receive sufficient funds to make establishment of a grants scheme worthwhile.

The removal of infrastructure, R&D, innovation and education projects from the WMF's scope should allow WMF's processes to be simplified and should allow resource to be utilised in sharing effective initiatives nationally. The current WMF has an established governance structure. The change in focus from all potential projects to solely community projects will create an opportunity to streamline the processes employed, making it simpler for applicants and more straightforward for decision making.

We recommend community grants are limited to a maximum of $200,000, a minimum of $15,000 (to increase process efficiency) and are focused on community groups, NGOs and social enterprises. All applications would need to show the support of the relevant Local Authority and Iwi where relevant. Grants are for projects and feasibility studies.

Consideration should be given to establishing the minimum required information for applications, particularly applications for small grants (under $50k) with an increasing information requirement for larger grants. Consideration should also be given to waiving due diligence requirements where a TA is a party to the project or prepared to stand behind the project, effectively acting as the guarantor to the Ministry.

Reporting should also be in proportion to the expenditure involved, while remaining cognisant of the requirement to manage public funds appropriately. Consideration should be given to requiring the regional groups to prepare case studies of both successful and unsuccessful projects to allow good practice and lessons learnt to be shared.

7.7 Other & Reserve

Other investments are intended to provide funding to relevant opportunities outside of the established investment envelopes and the reserve is intended to protect the Ministry from fluctuations in revenue collected.

The other and reserve allocations represent a conservative approach to managing the Levy revenue against committed investments. As can be seen from the above investment envelope analysis, many investments will be medium to long-term and will require on-going Levy revenue for funding. The Reserve is proposed to be fixed at $25m and able to be used should

additional funding be needed to support an investment commitment or should Levy revenue be less than forecast in a given year.

The Other Investment allocation is aimed at supporting high priority funding outside of the established investment envelopes, for example Legacy Landfill Remediation. As the Other funds are built up, they can be utilised as one-off funding injections to relevant projects. If Levy revenue is less than forecast over a sustained period, the Other funds will not accrue as priority will be given to the established investment envelopes.

The management of the Other and Reserve funds will remain a Ministry responsibility, with funding allocations subject to the proposed decision hierarchy.

Appendix 1

Considerations for the Waste Minimisation Act

We understand the Ministry is considering a review of the Waste Minimisation Act 2008. In our work we have identified the following items which the Ministry should consider when reviewing the Act:

Under Section 30(c) (ii)

Consideration should be given to removing the requirement for the Minister to approve all Levy funded projects and establish a three-tier approval delegation:

- Up to $1,000,000 Chief Executive of the Ministry's decision (able to be delegated to other Ministry personnel or other agencies as appropriate)
- Between $1m and $10m Environment Ministers' decision
- Greater than $10m Cabinet Decision.

Under Section 30

Consideration should be given to broadening the purpose of Levy funds, for example developing and maintaining a National Infrastructure Plan, developing and implementing the Medium-Term Investment Plans and other activities needed to support the effective management of the increased Levy, such as CME and Data.

Under Section 31

consider removing the mandated Territorial Authority share of the Levy and replace with a requirement the Ministry allocate Levy funds in accordance with the Waste Strategy and Medium-Term Investment Plans.

Under Section 32

Consideration should be given to allowing Territorial Authorities to use Levy funds to pay for waste and recycling collection, storage and transportation to recycling or reprocessing facilities.

Under Section 38

Consideration should be given to ensuring alternative funding approaches (in addition to grant funding) can be utilised across the broader investment objectives proposed in the Medium Term Investment Plan.

Appendix 2

Current State Waste Stream summaries

We include current state summaries for six of the potentially higher priority waste streams (refer waste stream prioritisation matrix Table 8, pg. 35) where near-term investment is more likely.

We have not included glass as viable commercial options exist. We have not included hazardous or nappies as further work is required to identify appropriate treatments.

1. Putrescible

Volume / Recovery

2,900,361 tonnes of waste total pa[57], comprising:

1,175,667 tonnes recovered pa (40.5%)

Location	Domestic Kerbside	Residential	ICI	Landscape	C&D	Special	Rural	Total
Amount (tonnes)	64,685	80,000	899,516	130,000	0	0	1,466	1,175,667

1,724,694 tonnes sent to landfills pa (59.5%)

Location	Class 1 Landfill	Class 2	Class 3	Class 4	Farm Dump	Total
Amount (tonnes)	804,064	41,212	1,030	60,788	817,600	1,724,694

Type & Nature

Putrescibles are the items in a waste stream subject to decay. For residential streams, this is mainly food waste, and also greenwaste.

Organic waste represents a large proportion of the refuse collected at kerbside (49.6%).

Other large emitters are commercial (such as food production, wholesale and retail) and rural. Commercial wastes tend to be more putrescible than garden wastes with higher nitrogen content and higher odour potential[58].

Much of the problem is wasted food. Studies both globally[59] and locally[60] indicate around 40% of food is wasted.

[57] The New Zealand Waste Disposal Levy, Eunomia, May 2017
[58] "Review of the Targets in the New Zealand Waste Strategy", 2004, Ministry for the Environment
[59] PE Americas, 2011
[60] "Household food waste: the implications of consumer choice in food from purchase to disposal", 2016, C.A. Tucker & T. Farrelly, Local Environment, 21:6, 682-706

Long-term storage is not a viable option due to the nature of the stream: decay starts before collection. Greenwaste is more amenable to buffering delay in the supply chain than foodwaste from either commercial of household sources. “Best practice indicated that weekly collection of food waste provides the best diversion results.”[61]

How recovered

The large portion of the organic waste sent to landfill (“post-consumer”) is food, and study findings[62] that a large portion of the food that is wasted is due to the failure to adequately plan food purchases, suggests that education to prevent the initial generation of food waste has a significant part to play in waste minimisation.

Pre-consumer organic material is also an issue. We note that waste pre-consumer often represents a loss of yield to a commercial player such as a grower, distributor or retailer. Commercial operators have strong incentive to minimize this waste, as it represents either a charge for disposal but more importantly loss of sale revenue. It is interesting to note how on-truck collection data feeds, when deployed in an Australian state, rapidly penetrated the market and caused shift in behaviour[63]. This suggests that the technology (which has been deployed in NZ situations[64] but not for this purpose) could be a useful lever in future waste minimisation.

Given the nature of the stream (heavy) the right solution for each region will be different and site optimisation studies and detailed analysis will be required.

The two main commercial treatment approaches used in NZ (post source separation and size reduction) are windrow composting and anaerobic digestion (with or without EfW – Energy from Waste).

In areas without treatment, the organic material enters a landfill where it begins to rot. Some of these facilities have capture of the methane that is generated.

In places where there is management and treatment, approaches to dealing with organics centre around control and acceleration of normal biological processes. Methods usually involve mechanical (M) sorting and size reduction followed by some kind of biological (B) treatment.

The biological methods often involve accelerated or controlled composting (common for greenwaste management) and anaerobic digestion (AD) whereby microorganisms break down the biodegradable materials in the absence of oxygen. This approach can produce a high-quality compost, in addition to biogas. The gas is often combusted to produce energy to power the treatment plant (EfW). AD is widely used in NZ for wastewater treatment as the secondary step in a tertiary treatment facility. Some innovators have attempted to miniaturise the AD process to provide local solutions for householders.

AD is attractive from the viewpoint of effective treatment of the waste (control of methane and odour emission), but also the production of two valued outputs (energy in addition to compost) and the lowest carbon footprint for the treatment of segregated food waste[65]. “In comparison with landfilling, untreated waste composting / AD of putrescible wastes and recycling of paper produce the overall greatest reduction in greenhouse gases” [66.] Lifecycle comparison for various methods[67] of managing food waste to find the most environmentally and commercially sustainable options is important to explore in the various NZ contexts.

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[61] “Waste Management Options Review and Modelling”, 2017, Auckland Council
[62] This report will not include an exhaustive review of the studies. As a representative and local one, we do mention “Household food waste: the implications of consumer choice in food from purchase to disposal” (2015), C A Tucker and T Farrelly, Massey University, published in Local Environment (2016), Vol 21, No 6, 682-706
[63] Trimble, personal communication.
[64] Trimble, personal communication. We are aware that Taranaki used trucks with scales for the purpose of data collection for education campaigns, We are also given to understand that some of NZ’s large providers of waste management trucks have fitted (rear lift) scales for the purpose of understanding which customers are more or less profitable.
[65] “Waste Management Options Review and Modelling”, 2017, Auckland Council
[66] “Waste Management Options and Climate Change”, 2001, report to European Commission.
[67] Refer“Life Cycle Assessment of Systems for the Management and Disposal of Food Waste.” 2011, PE Americas; and “Literature overview: Impacts of Disposer and Food Waste Management”, 2015, InSinkErator

AD and MBT/composting can produce negative flux of greenhouse gas due to displacement of the fossil fuel or fertiliser that would otherwise be required[68].

Organic Treatment Destinations[69]

Process	Estimated Proportion by Inputs
Aerobic Composting	52%
Vermicomposting	17&
Rendering and stockfood	31%

Current state of NZ market

There are little material revenues from putrescibles – these materials are typically taken to organic treatment facilities[70]. NZ doesn't export any putrescibles[71]. However, firms can turn waste into revenue – Auckland food waste recycler Ecostock buys vegetable scraps, bread and packaged food from manufacturers, distributors and retailers, and reprocesses it before passing on the by-product ingredients for stock feed and bioenergy[72].

Indicative Charges for Disposal[73]

Disposal Costs (per tonne)	High	Low	Average
Organics – Green	$50	$30	$40
Organics – Putrescible	$160	$80	$120

In terms of household food waste, the only municipal collections currently operating (Christchurch and Timaru) co-collect food waste with garden waste and process this in in-vessel (Christchurch) or covered windrow (Timaru) aerobic composting systems[74].

There are kerbside collection firms for organic and greenwaste, and they also provide a place to drop off these materials. The drop off services are relatively inexpensive[75] as they turn the materials into compost with little cost.

Infrastructure

Auckland City Council announced in 2019[76] the letting of a 20-year contract to Ecogas for the reduction of the more than 100,000 tonnes of foodwaste currently sent to landfill. The press release claims a "reduction of 35kg per person". The rollout is planned from 2021.

T&G Global and Ecogas announced[77] "NZ's first large scale organic waste to energy plant" in 2019. Ecogas is a JV between Pioneer Energy and Ecostock. The aspiration for the facility is to accept more than 20,000 tonne per year of waste from "major local food manufacturers such as dairy factories, commercial bakeries, cool stores, milk sheds and fruit grading facilities". The initial full scale demonstration plant will be built with a $7m grant from the Provincial Growth Fund, on a 2 hectare site adjacent to T&G. T&G will provide 1,000 tonne of tomato vines as input and buy the renewable energy back to heat their greenhouses.

[68] "Waste Management Options and Climate Change", 2001, report to European Commission.
[69] "NZ Waste Disposal Levy Final Report", 2017, Eunomia, p111
[70] "NZ Waste Disposal Levy Final Report", 2017, Eunomia, p128
[71] "NZ Waste Disposal Levy Final Report", 2017, Eunomia, p111
[72] "EcoStock turning food waste into millions", NZ Herald, Nov 2017, https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11940805
[73] "NZ Waste Disposal Levy Final Report", 2017, Eunomia, p106
[74] "NZ Waste Disposal Levy Final Report", 2017, Eunomia, p112
[75] "Retail" BioRich website, http://www.biorich.co.nz/retail
[76] "Auckland Council announces world-class food scraps processing contract", 2019, Auckland Council website
[77] "First Large Scale Organic Waste to Energy to go ahead in NZ", 2019, WasteManagementWorld.com

WMF applications have included:

Project	Waste type	Cost
Implementation of solid and water waste minimisation and investigation of minimising energy consumption	Commercial green waste	$135,000
Kerbside Food Waste Collection	Household organic (food waste and green waste)	$336,000
Providing Commercial Composting Capabilities to Community Gardens	Household organic (food waste and green waste)	$275,000
Commercial Scale Composting	Multiple - Household and commercial organic (food)waste and green waste	$1,132,138
Compost expansion project	Other - Sweetcorn waste, grape mark, maize cobs	$1,556,900
Community Composting Initiative	Multiple - Household organic (food and green waste), Commercial green waste, Packaging (compostable), Paper and cardboard (household and commercial), Primary sector related organic waste	$184,890
Organic Processing: Composting Food waste	Household organics (food waste and green waste)	$1,005,777
[redacted]	Organic waste	$802,380
Food Waste Composting	Organic waste	$300,000

Collected cost estimation data

Wellington City Council has predicted that a kerbside food waste collection system could cost about $5 million annually[78] - this translates to $2,321,262.77 per 100,000 people p/a.

Christchurch City Council has spent $20 million on organic collect and processing for the financial year ending June 2018[79] - this translates to $4,944,375.77 per 100,000 people p/a.

Collection cost for kerbside is estimated to be $80 – 120 per tonne[80]

Capital cost for establishing a processing facility for 50,000 tonnes per annum could be $15-20m[81]

The total operating and capital cost for processing a mix of green and food waste ranges from $70-170 per tonne, with an average of $120[82].

Recovery cost $80-160 per tonne[83]

[78] "Food and green waste collection to be trialled in Wellington this year", 2019, Stuff NZ, https://www.stuff.co.nz/environment/112039198/food-and-green-waste-collection-to-be-trialled-in-wellington-this-year
[79] "Food and green waste collection to be trialed in Wellington this year", 2019, Stuff NZ, https://www.stuff.co.nz/environment/112039198/food-and-green-waste-collection-to-be-trialled-in-wellington-this-year
[80] "Costs of Recycling" Ministry for the Environment website
[81] "Costs of Recycling" Ministry for the Environment website
[82] "Costs of Recycling" Ministry for the Environment website
[83] "NZ Waste Disposal Levy Final Report", 2017, Eunomia

Auckland Council's recent modelling[84] (2017

Table 7-2
Indicative Organic Waste Collection Costs in Different Areas

Area Type	Total Collection Cost (per Tonne per Year)	
	Separate Vehicle	Co-Collection
Major urban area	c.NZ$250	c.NZ$390
Large urban area	c.NZ$370	c.NZ$435

Auckland Council's recent modelling[85] (2017)

Table 7-3
Indicative Organic Waste Collection and Treatment Costs

Collection / Treatment Method	Combined Collection & Treatment Cost per Tonne			
	Major Urban Area		Large Urban Area	
	Estimate	Range	Estimate	Range
Secondary Segregation (MBT treatment) - No separate collection	NZ$328	NZ$259-429	NZ$328	NZ$259-429
Source Segregation (AD treatment) - Separate collection vehicles - Co-collection vehicles	NZ$369 NZ$505	NZ$253-545 NZ$386-615	NZ$485 NZ$551	NZ$253-545 NZ$386-615

[84] "Waste Management Options Review and Modelling", 2017, Auckland Council
[85] "Waste Management Options Review and Modelling", 2017, Auckland Council

2. Plastics

Volume / Recovery

613,521 tonnes of waste total pa[86], comprising:

38,998 tonnes recovered pa (6.4%)

Location	Domestic Kerbside	Residential	ICI	Landscape	C&D	Special	Rural	Total
Amount (tonnes)	21,214	0	14,295	0	0	0	3,489	38,998

574,523 tonnes sent to landfills pa (93.6%)

Location	Class 1 Landfill	Class 2	Class 3	Class 4	Farm Dump	Total
Amount (tonnes)	361,947	0	0	0	212,576	574,523

Type & Nature

The Plastic Identification Code (PIC, an international standard) identifies / grades plastics into 7 different types:

NB the PIC does not equal recyclability, instead identifies the type of plastic.

Symbol	Type of plastic	Properties	Recycled in
1 PET	**PET** Polyethylene Terephthalate	Clear, tough, solvent resistant, barrier to gas and moisture, softens at 70°C	Pillow and sleeping bag filling, clothing, soft drink bottles, carpet
1 RPET	**RPET** Recycled Polyethylene Terephthalate (sub-classification within PET)	The recycling process produces consistent, pure quality of recycled plastic. Safe, clean and eco-friendly, it requires less energy to manufacture products made out of recycled plastic	PET Plastic Containers
2 HDPE	**HDPE** High Density Polyethylene	Hard to semi-flexible, resistant to chemicals and moisture, waxy surface, opaque, softens at 135°C, easily coloured, processed and formed	Recycling bins, compost bins, buckets, detergent containers, posts, fencing, pipes
3 PVC	**PVC** Un-Plasticised Polyvinyl Chloride PVC-U Plasticised Polyvinyl Chloride PVC-P	Strong, tough, can be clear, can be solvent welded, softens at 75°CFlexible, clear, elastic, can be solvent welded	Flooring, film and sheets, cables, speed bumps, packaging, binders, mud flaps and mats
4 LDPE	**LDPE** Low Density Polyethylene **LLDPE** Linear Low-Density Polyethylene	Soft, flexible, waxy surface, translucent, softens at 80°C, scratches easily	Rubbish bin liners, pallet sheets, slip sheets
5 PP	**PP** Polypropylene	Hard but still flexible, waxy surface, softens at 145°C, translucent, withstands solvents, versatile	Pegs, bins, pipes, pallet sheets, oil funnels, car battery cases, trays
6 PS	**PSPS** Polystyrene	Clear, glassy, rigid, brittle, opaque, semi-tough, softens at 95°C. Affected by fats and solvents	Coat hangers, coasters, white ware components, stationery trays and accessories

[86] The New Zealand Waste Disposal Levy, Eunomia, May 2017

Symbol	Type of plastic	Properties	Recycled in
	**EPS** Expanded Polystyrene	Foamed, light weight, energy absorbing, heat insulating	Car parts, concrete aggregate, plastic timber
	**OTHERS** Letters below indicate ISO code for plastic type including SAN (styrene, acrylonitrile), ABS (Acrylonitirite butadine styrene), PC (polycarbonate), Nylon, degradable plastic e.g. PLA	Includes all other resins, multi materials (e.g. laminates) and degradable plastics. Properties dependent on plastics or combination of plastics	Car parts, concrete aggregate, plastic timber

Plastics are commonly classified as being ‘thermoplastics’ or ‘thermoset’ materials. Many common plastics are thermoplastics. They soften when heated and can be melted and shaped repeatedly. In contrast, thermoset plastics undergo a chemical transformation that solidifies them. They are challenging to recycle because they cannot be melted and remoulded. However, they are generally more durable than thermoplastics.

Bakelite is an early example of a thermoset plastic; other examples include polyurethane (PUR) and epoxy resins.

https://www.royalsociety.org.nz/assets/Uploads/Plastics-in-the-Environment-evidence-summary.pdf

How recovered

Plastics represent approximately 12% of landfill waste as estimated by regional council surveys conducted between 2011 and 2017. In terms of recycling, plastics could be recovered through consumer recycling, which refers to the collection and recycling of plastic articles post being used by a consumer. There can be a variety of collection schemes including curb side collection, Community based Recycling or Consumer Drop Off Centres and Public Place Recycling Schemes.

https://www.plastics.org.nz/environment/recycling-disposal/consumer-recycling

https://www.royalsociety.org.nz/assets/Uploads/Plastics-in-the-Environment-evidence-summary.pdf

Current state of NZ market

The boom in global plastics production has outpaced that of almost every other material in history, owing to the massive growth of plastics used in everyday applications. In 2015, 407 million tonne of plastics were produced worldwide, and 302 million tonne of plastics were discarded as waste. If this growth in the plastics industry continues, global production could produce about 1,124 million tonnes of plastics annually by 2050.

While bioplastics contribute only a small fraction of the overall plastics industry, the global bioplastics industry is growing steadily, and is predicted to increase to about 2.6 million tonnes by 2023.

In 2017, New Zealand imported over 300 thousand tonnes of plastic resin to be used in manufacturing products. Plastics were also a key component in 49% (by value) of textile and textile article imports (including clothing), 85% of footwear imports, and 27% of fishing rods imports.29 In the same year, New Zealand exported 41.5 thousand tonne of plastics as waste.

https://www.royalsociety.org.nz/assets/Uploads/Plastics-in-the-Environment-evidence-summary.pdf

Infrastructure

Fickle markets for different plastics, the volumes required for recycling, and the cost of collecting and sorting are barriers that can make some plastics uneconomical to recycle. Clear polyethylene terephthalate (PET) and opaque or ‘natural’ (uncoloured) high density polyethylene (HDPE) have a high recycling value, making it more economical to collect and recycle than other plastics. Polyvinyl chloride (PVC), polystyrene (PS) and polyurethane (PUR) are particularly difficult to recycle. Plastics that do get recycled are typically made into lower value items in a process known as ‘down-cycling’. Ultimately, each time a piece of plastic is recycled, the quality of the plastic declines, until it is no longer useful as a source of raw material for new plastic products.

https://www.royalsociety.org.nz/assets/Uploads/Plastics-in-the-Environment-evidence-summary.pdf

WMF applications have included:

Project	Waste type	Cost
Waste Plastic Derived Binder Manufacturing Project	A commercially sustainable manufacturing facility and associated processing and transfer stations to convert all types of waste plastic into powder and water-based binders that can be used to create a myriad of composite products.	$71,210,033
Plastic Waste Pyrolisis Plant	Fractional distillation plant that proposes to completely recycle 5’000T of all types of waste plastic into various types of fuel products, with very little waste material - less than 10% of the original product.	$10,191,333
Waste Stream Plastics Recycling	A joint project with the Polypropylene container manufacturers to collect and recycle this product for reuse in industrial building products that will create a "circular economy" around this material.	$840,000

3. Rubble

Volume / Recovery

7,738,458 tonnes of waste total pa[87], comprising:

1,667,998 tonnes recovered pa (21.6%)

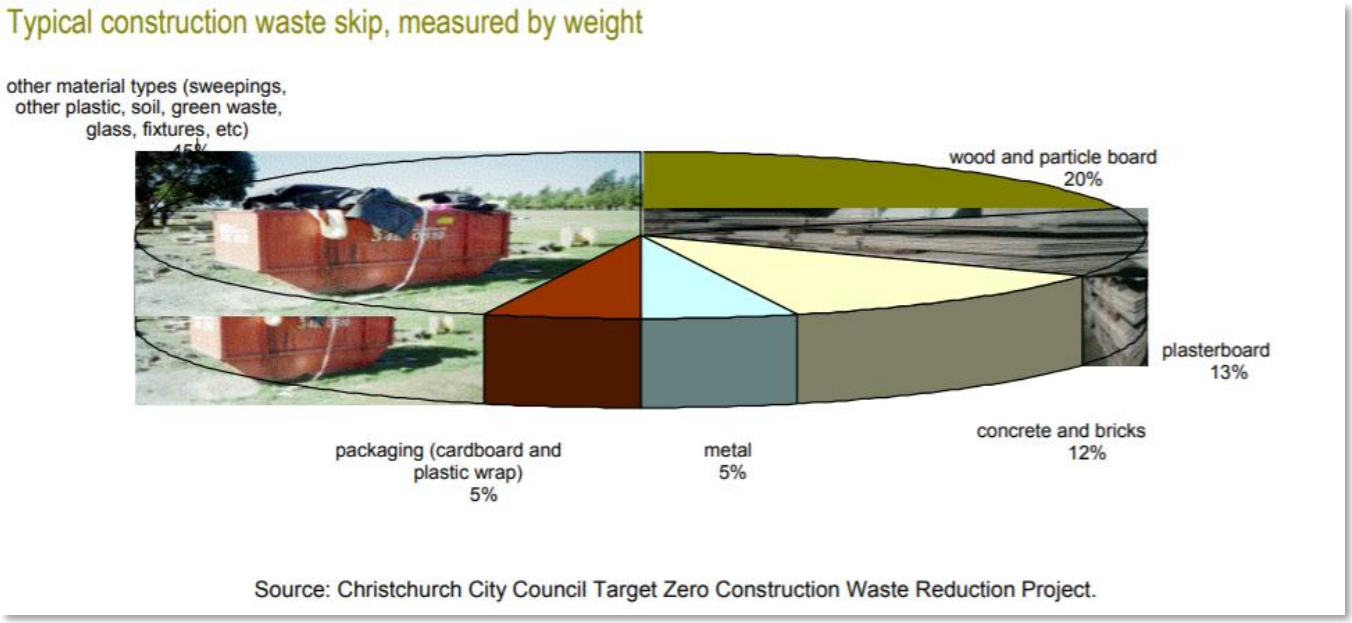
Location	Domestic Kerbside	Residential	ICI	Landscape	C&D	Special	Rural	Total
Amount (tonnes)	0	54,400	580,000	0	1,033,598	0	0	1,667,998

6,070,460 tonnes sent to landfills pa (78.4%)

Location	Class 1 Landfill	Class 2	Class 3	Class 4	Farm Dump	Total
Amount (tonnes)	345,807	2,289,861	57,247	3,377,545	0	6,070,460

Type & Nature

Rubble generally includes the waste or rough fragments of stone, brick, concrete, etc., especially as the debris from the demolition of buildings. It is estimated rubble comprises 12% of a typical construction waste skip as follows:



Source: Christchurch City Council Target Zero Construction Waste Reduction Project.

https://www.branz.co.nz/cms_show_download.php?id=5e8633f5234594b316612f186e49687aff5475dd

The main materials with current markets are:

- metals (ferrous and non-ferrous) sold for recycling - e.g. rebar, roofing, sandwich panel, drink cans, piping, wire, cladding, drums etc.
- concrete / rubble sold for crushing - e.g. ex slabs, pipes, excess material etc.
- untreated timber collected for recycling and reuse e.g. joinery, fittings, framing, boxing, off-cuts, pellets, framework etc.

[87] The New Zealand Waste Disposal Levy, Eunomia, May 2017

- paper and cardboard collected for recycling e.g. from packaging and infills (not black or synthetic building paper or house wrap).

https://www.branz.co.nz/cms_display.php?st=1&sn=105&pg=12520

How recovered

Construction waste, including rubble, is predominantly disposed of in cleanfills and landfills, however initiatives exist to encourage recycling. For example, REBRI (Resource Efficiency in the Building and Related Industries), which started in 1995 as a collaborative effort between the Auckland City Council and BRANZ, and whose purpose is to promote, advocate, and assist resource efficiency measures in the building and related industries.[88]

Rubble (in particular concrete) is recycled by using industrial crushing equipment with jaws and large impactors. After the rubble is broken up, it is usually run through a secondary impactor and is then screened to remove dirt and particles and to separate the large and small aggregate. Additional processes and equipment, such as water flotation, separators, and magnets, may also be used to remove specific elements from the crushed rubble. An alternative method is to pulverize the rubble, but this is not the always the best option, as it makes it harder to complete the separation process and may leave more contamination from smaller byproducts.[89]

Current state of NZ market

While options exist in both large urban and regional areas e.g. Green Vision Recycling[90] in Auckland, Jones Quarry[91] in Taranaki, etc. as noted above only approx. 20% of rubble is currently recovered. A commonly cited challenge is the ability to separate and store, on construction and demolition (C&D) sites, 'clean' material that recyclers require. As depicted above, it is simpler to discard all C&D wastes in a single skip. This is despite current charges to discard of mixed waste to class 1 landfills versus recyclers accepting rubble for free.

Infrastructure

When considering concrete recycling as an option, evaluation of the options available for crushing the concrete is required. The most practical solution can be a portable crusher that can be moved to different locations or projects. Often, it works best to set it up a portable crusher at a centralized location, near where the concrete is being demolished but where it will not hinder site traffic. Factors to consider when choosing processing equipment include:[92]

- Equipment should have a powerful electromagnet or water flotation or an air separator system that can pull steel from concrete.
- Separate hydraulic stands will allow for a faster setup.
- Control systems may be automatic, manual, or remote.
- Systems that have conveyors, jaws, and cones can provide complete processing of the concrete, from demolition to a usable material.

Based on advertised equipment prices, capital costs to process 25 to 50 tonne pa are $500k to $1m.

[88] https://www.branz.co.nz/cms_display.php?st=1&sn=111 accessed February 2020
[89] https://www.thebalancesmb.com/recycling-concrete-how-and-where-to-reuse-old-concrete-844944 accessed February 2020
[90] https://www.greenvisionrecycling.co.nz/ accessed February 2020
[91] https://www.jonesquarry.co.nz/services/concrete-recycling/ accessed February 2020
[92] https://www.thebalancesmb.com/recycling-concrete-how-and-where-to-reuse-old-concrete-844944 accessed February 2020

4. Paper

Volume / Recovery

786,592 tonnes of waste total pa[93], comprising:

435,000 tonnes recovered pa (55.3%)

Location	Domestic Kerbside	Residential	ICI	Landscape	C&D	Special	Rural	Total
Amount (tonnes)	148,497	0	283,219	0	0	0	3,284	435,000

351,592 tonnes sent to landfills pa (44.7%)

Location	Class 1 Landfill	Class 2	Class 3	Class 4	Farm Dump	Total
Amount (tonnes)	323,350	2,576	64	3,799	21,803	351,592

Type & Nature

There are three categories of paper that can be used as feedstocks for making recycled paper: mill broke, pre-consumer waste, and post-consumer waste. Mill broke is paper trimmings and other paper scrap from the manufacture of paper and is recycled in a paper mill. Pre-consumer waste is a material which left the paper mill but was discarded before it was ready for consumer use. Post-consumer waste is material discarded after consumer use, such as old corrugated containers (OCC), old magazines, and newspapers.

For post-consumer waste, products such as OCC are often preferred. Highly processed 'glossy' magazines can lose approx. 50% of their volume during the recycling process (removing glue, plastic and ink). Higher volumes of glue, plastic, ink etc. also increase the levels of waste from the recycling process, which are then required to be disposed. Based on our consultation with industry, while markets still exist for quality, clean OCC, wastepaper has little or no value.

How recovered

The process of wastepaper recycling most often involves mixing used/old paper with water and chemicals to break it down. It is then chopped up and heated, which breaks it down further into strands of cellulose, a type of organic plant material; this resulting mixture is called pulp, or slurry. It is strained through screens, which remove any glue or plastic (especially from plastic-coated paper) that may still be in the mixture then cleaned, de-inked (ink is removed), bleached, and mixed with water. Then it can be made into new recycled paper. Paper is able to be recycled approx. 4.8 times, albeit generally to lower grade uses each 'recycle', after which the pulp fibre will be unable to bind and will form part of the waste from the recycling process.

Any contaminants in the process, e.g. glass particles can damage the screens. For this reason, we were advised some recyclers will not accept feedstock from co-mingled sources as the risk of contamination, causing disruption to their process and requiring screen to be replaced, was considered too great.

Current state of NZ market

"New Zealand's recycling sector currently recovers around 485,000 tonnes of fibre-based material each year. Nearly half is processed and recycled in New Zealand. The rest is exported to markets overseas. Programme Director – Waste Solutions, Parul Sood says that the remainder – over 200,000 tonnes per year – could be at risk of being sent to local Kiwi landfills if global export markets plummet." Source, Looming paper recycling issues require an urgent onshore solution, Auckland Council, published 1 August 2019.

[93] The New Zealand Waste Disposal Levy, Eunomia, May 2017

Oji Fibre Solutions is the largest fiber recycler in NZ, collecting over 260,000 tonnes of paper products every year and recycles 220,000 tonnes through their paper mills[94]. Other NZ based recyclers process significantly lower volumes, e.g. Hawk Packaging processing approx. 3,400 tonnes pa[95].

Eunomia, in their National Resource Recovery Project - Situational Analysis Report dated September 2018 suggest finding a solution for fibre processing appears to be a high priority for several reasons:

- Fibre is more difficult to stockpile as it requires indoor storage
- It makes up a significant proportion of the recycling stream (35 – 40%)
- As a result of its high proportion in kerbside recycling it is one of the key materials in terms of recycling income
- Landfilling fibre would have a significant emissions impact at a local and national level; and
- Increasing capacity to recycle fibre locally or internationally requires significant capital investment and a lengthy lead-in time.

Eunomia also note the significant drop in commodity prices for fibre as follows:

Commodity	July 2018 price per tonne	July 2017 price per tonne
Mixed Fibre	$0-$20	$150 - $200
Cardboard	$80	$200 – $300

Infrastructure

WMF applications have included:

Project	Waste type	Cost
E-Receipt	Paper and carboard	$397,000
Materials Recovery and Reprocessing Facility	Multiple – Packaging – household and commercial, paper and cardboard	$3,000,000

Eunomia estimate to build a paper and card processing plant big enough to take the rest of NZ's fibre would be expected to cost in the region of $600m[96]. This does not include additional costs to clean up glass contaminated fibre. Note we are not suggesting a single fibre plant is the desired solution for the paper waste stream and further work and consultation will be required to determine the desired solution/s.

Alternatives may include smaller waste for energy (WfE) options e.g. for DHBs and schools, replacing existing coal burning plants, to dispose of low value wastepaper volumes.

[94] https://www.ojifs.com/about-fullcircle/ accessed February 2020
[95] National Resource Recovery Project - Situational Analysis Report, Eunomia, September 2018
[96] National Resource Recovery Project - Situational Analysis Report, Eunomia, September 2018

5. Timber

Volume / Recovery

1,434,421 tonnes of waste total pa[97], comprising:

163,200 tonnes recovered pa (11.4%)

Location	Domestic Kerbside	Residential	ICI	Landscape	C&D	Special	Rural	Total
Amount (tonnes)	0	8,160	0	0	142,421	0	12,619	163,200

1,271,221 tonnes sent to landfills pa (88.6%)

Location	Class 1 Landfill	Class 2	Class 3	Class 4	Farm Dump	Total
Amount (tonnes)	478,481	236,971	5,924	349,532	200,312	1,271,221

Type & Nature

Waste timber includes treated and untreated timber, hardwood, native timber, demolition, off-cuts, cladding, interior fittings and linings, engineered wood products (EWP – MDF, fibreboard, particle board, etc.), joinery, panels, lengths, pallets and packaging. Timber is a versatile material and can be reused, burnt for fuel or recycled into a variety of new products. However, treated timber (and EWP) can limit the options for recycling or fuel.[98]

How recovered

New Zealand currently doesn't export any recovered timber[99]. The average revenue from the sale of recovered timber in NZ is $100 per tonne.

Australian studies have found that carbon continues to be stored in wood for a period of time after it has been transported to landfills. Sawmills may have some limited approvals to burn small quantities of treated wood waste.[100]

Current state of NZ market

There are many firms across New Zealand which will pick up or accept timber to recycle. Often timber is turned into other wood products, or mulches for a range of commercial and household uses. Good quality timber can be repurposed into a multitude of uses.

As a guide, the following is in demand:

- Hardwood (lengths greater than 0.6 metres, architectural features, no borer or other damage, preferably nail-free).
- Native timbers (greater than 0.6 metres, architectural features, no borer or other damage, preferably nail-free).
- Lengths of untreated timber greater than 0.6 metres.
- Lengths of treated timber greater than 0.6 metres.
- Panels of EWP, trellis and other timber products greater than 0.5 square metres,

[97] The New Zealand Waste Disposal Levy, Eunomia, May 2017
[98] Resource Recovery – TIMBER – Collection and Transportation, March 2014, Rebri
[99] "NZ Waste Disposal Levy Final Report", 2017, Eunomia, p111
[100] Forestry: Residues – recycling and reuse, http://www.nzwood.co.nz/forestry-2/lc-forests-and-wood-waste-products-recycling-and-reuse-1/

Untreated softwood, native timber and hardwood timber can be chipped into:

- Landscaping mulch
- Boiler fuel
- EWP manufacture
- Timber composite materials and domestic fire pellets [101]

We understand there is potential for waste timber to be utilised as a fuel source for waste to energy plants, potentially after conversion to an more energy dense form such as a pellet. Treated timber is problematic as it produces toxic fumes when burnt, there are a number of technological solutions to this issue but it can add significant cost to such a project.

EECA has made a number of investments in the wood burning energy space as a replacement for coal powered generation. EECA is looking to support clusters where the users and suppliers are established together. We understand the current suppliers are utilising clean waste from sawmills and forestry as the fuel source rather than waste timber.

Infrastructure

In 2017, Marlborough District Council (MDC) contributed $450,000 in addition to $1m in infrastructure, plant and equipment costs for a plant which could turn treated and untreated timber into charcoal. The charcoal could be sold as a coal replacement or as carbon black, which is used to make products such as car tires. MDC was hoping to bring in "about $90,000 per year from the facility, reducing its annual contributions to the plant once it was up and running to only $14,700" [102].

We are aware that EECA has invested $10m to co-fund a number of waste to energy plants (for example 8 schools and a hospital in Southland) converting coal plants into woodchip fired plants. The Southland project is estimated to reduce the amount of carbon produced by 3,000 tonnes per annum[103]. EECA have also funded a number of plants to manufacture wood pellets and briquettes as fuel for converted plants. The largest investment was part funding of an $8m plant expansion in Taupo.

[101] Resource Recovery – TIMBER – Collection and Transportation, March 2014, Rebri
[102] Council buys buffer zone beside landfill, Pressreader website, 7 June 2017, https://www.pressreader.com/new-zealand/marlborough-express/20170607/281565175730039
[103] Government starts to take public sector off coal with eight schools and a hospital. Stuff. January 2020.

6. Metals

Volume / Recovery

Ferrous:

751,835 tonnes of waste total pa[104], comprising:

560,000 tonnes recovered pa (74.5%)

Location	Domestic Kerbside	Residential	ICI	Landscape	C&D	Special	Rural	Total
Amount (tonnes)	9,092	90,000	403,570	0	50,000	0	7,338	560,000

191,835 tonnes sent to landfills pa (25.5%)

Location	Class 1 Landfill	Class 2	Class 3	Class 4	Farm Dump	Total
Amount (tonnes)	137,702	2,576	64	3,799	47,693	191,835

Non-ferrous:

72,180 tonnes of waste total pa[105], comprising:

50,000 tonnes recovered pa (69.3%)

Location	Domestic Kerbside	Residential	ICI	Landscape	C&D	Special	Rural	Total
Amount (tonnes)	3,031	4,000	39,138	0	3,800	0	32	50,000

22,180 tonnes sent to landfills pa (30.7%)

Location	Class 1 Landfill	Class 2	Class 3	Class 4	Farm Dump	Total
Amount (tonnes)	22,180	0	0	0	0	22,180

Type & Nature

Metal waste is categorised as Ferrous (contains iron) and Non-Ferrous (does not contain iron). Ferrous metals include cast iron heavy steel, light grade steel and ferrous inorganic. Non-ferrous metals include aluminium, copper, brass, stainless steel, and lead.

The nature of metal waste is generally inert and heavy, depending on type (old appliances, cars, scrap metal offcuts, as well as electrical cabling, roofing sheets, etc.)

[104] The New Zealand Waste Disposal Levy, Eunomia, May 2017
[105] The New Zealand Waste Disposal Levy, Eunomia, May 2017

How recovered

Used oil, drums, pallets, ferrous and non-ferrous metals, paper, cardboard and many other items are collected by various recycling agents. Ferrous and non-ferrous metals are extracted from the remaining materials, which have separate recycling processes or disposal to landfills.

Recovery also happens within steelmaking processes, where manufacturers have processes in place to recover steel from slag, reprocessing, or offcut scraps.

Recovery also happens from metal scrapping, including cars and large appliances being shredded.

The recovery process consists of seven phases:

1. Collection
2. Sorting
3. Processing
4. Melting
5. Purification
6. Solidifying
7. Transportation of the Metal Bars

References:

https://www.nzsteel.co.nz/sustainability/redefining-waste/

https://www.thebalancesmb.com/an-introduction-to-metal-recycling-4057469

NZ-Waste-Disposal-Levy-Final-Report-Eunomia-30-May-2017

Current state of NZ market

Manufacturers, such as NZ Steel, have processes in place to recover and reuse metals. Recovery of steel includes all products, even building material, where recent research of commercial construction waste found that more than 90% of steel was recycled.

On the other hand, metal recyclers will accept almost anything metal, but their ability to buy it does depend to some extent on if they can find a buyer for the materials. The manufacture of new metal products can have significantly less environmental impact if recycled metals are used in the production process. Metal recyclers are experts in processing metals so they are able to be used in manufacturing.

Aluminium and steel are collected and recycled. The value of the collected materials is determined by the international prices of the raw materials as stated on the London Metal Exchange. The following prices for these materials are used, based on long run averages rather than current relatively high prices:

- $1700 /tonne for aluminium
- $120 /tonne for steel.

References:

https://www.nzsteel.co.nz/sustainability/redefining-waste/

https://www.nzamr.org.nz/What-We-Recycle/

https://www.mfe.govt.nz/publications/waste/recycling-cost-benefit-analysis/5-markets-and-value-materials

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Infrastructure

Creation of a Scrap Metal Recycling site involves the following aspects: sorting equipment which divides the infeed scrap into ferrous, non-ferrous and waste streams and a scrap shredding machine which enables improvements in efficiencies in handling, processing and transporting of scrap metal.

Engineering consultants are involved to perform:

- Geotechnical and environmental investigations
- Integration of site and plant layout logistics to establish the scrap metal processing facility with site infrastructure services and stormwater management compliance requirements
- Preparation of multiple resource consent applications
- Designed stormwater management systems
- Designed machine foundations, 3-storey plant room, discharge stack and utility buildings, site walls and pavement
- Prepared engineering specifications and engineer’s estimate
- Construction observation and certification.

7. Population data

We have utilised data on the NZ population from Statistics New Zealand as a method to allocate funding based on the logic that production of waste is proportional with population.

The groupings below are used to define the concept of urban (“initial metro”) and wider urban (“secondary extended metro”) leaving the remainder as rural. These then become the tranches defined in the section on putrescibles.

NZ Population (Statistics NZ)	2019		Initial Metro	Secondary Extended metro	
Far North District	68,500	1%			
Whangarei District	96,000	2%	2%		2%
Kaipara District	24,100	0%			
Auckland	1,642,800	33%	33%		33%
Thames-Coromandel District	31,500	1%			
Hauraki District	21,000	0%			
Waikato District	79,900	2%			
Matamata-Piako District	36,000	1%			
Hamilton City	169,500	3%	3%		
Waipa District	56,200	1%		341,600	7%
Otorohanga District	10,500	0%			
South Waikato District	25,100	1%			
Waitomo District	9,490	0%			
Taupo District	39,300	1%			
Western Bay of Plenty District	53,900	1%			
Tauranga City	144,700	3%	3%	273,700	6%
Rotorua District	75,100	2%	2%		
Whakatane District	37,100	1%			
Kawerau District	7,490	0%			
Opotiki District	9,720	0%			
Gisborne District	49,300	1%	1%		
Wairoa District	8,680	0%			
Hastings District	85,000	2%	2%		
Napier City	65,000	1%	1%	150,000	3%
Central Hawke's Bay District	14,850	0%			
New Plymouth District	84,400	2%	2%		
Stratford District	9,860	0%			
South Taranaki District	28,600	1%			
Ruapehu District	12,750	0%			
Whanganui District	47,300	1%		63,050	1%
Rangitikei District	15,750	0%			
Manawatu District	31,700	1%			
Palmerston North City	88,300	2%	2%	138,650	3%
Tararua District	18,650	0%			
Horowhenua District	35,000	1%			
Kapiti Coast District	56,000	1%			
Porirua City	59,100	1%	1%		
Upper Hutt City	46,000	1%	1%		

NZ Population (Statistics NZ)	2019		Initial Metro	Secondary Extended metro	
Lower Hutt City	108,700	2%	2%		
Wellington City	210,400	4%	4%	424,200	9%
Masterton District	26,800	1%			
Carterton District	9,690	0%			
South Wairarapa District	11,100	0%			
Tasman District	54,800	1%			
Nelson City	52,900	1%	1%		
Marlborough District	49,200	1%		102,100	2%
Kaikoura District	4,110	0%			
Buller District	9,840	0%			
Grey District	13,750	0%			
Westland District	8,960	0%			
Hurunui District	12,950	0%			
Waimakariri District	62,800	1%			
Christchurch City	385,500	8%	8%	513,900	10%
Selwyn District	65,600	1%			
Ashburton District	34,800	1%			
Timaru District	47,900	1%			
Mackenzie District	5,140	0%			
Waimate District	8,080	0%			
Chatham Islands Territory	710	0%			
Waitaki District	23,200	0%			
Central Otago District	23,100	0%			
Queenstown-Lakes District	41,700	1%	1%		
Dunedin City	131,700	3%	3%		
Clutha District	18,350	0%			
Southland District	32,100	1%			
Gore District	12,800	0%			
Invercargill City	56,200	1%	1%		
New Zealand	4,917,000	100%	73%		76%

Note: population in 2017 (December) the year of the Eunomia Report, was 4,805,400.

Appendix 3

Interviews Held

Name	Organisation
Sam Buckle – Deputy Secretary	Ministry for the Environment
Shaun Lewis – Director	Ministry for the Environment
Kathy Bass – Manager	Ministry for the Environment
Kevin Guerin – Chief Adviser	Ministry for the Environment
Becky Prebble – Chief Adviser	Ministry for the Environment
David Stephen – Programme Manager	Ministry for the Environment
Stephanie Hill – Senior Policy Analyst	Ministry for the Environment
Stephen Goodman – Manager	Ministry for the Environment
Matt Ide – NRR Project Lead	Ministry for the Environment
Roderick Boys, Senior Policy Analyst	Ministry for the Environment
Stuart McKay – Manager	Ministry for the Environment
Bhumika Bhatt-Wessel – Senior Investment Manager	Ministry for the Environment
Scott Priestley – Manager	Ministry for the Environment
Nigel Donovan – Senior Analyst	Ministry for the Environment
Sarah Helm – Principal Communications Adviser	Ministry for the Environment
Cathy Robinson – Director Investment Portfolio	Ministry of Primary Industries
David van der Zouwe - Director Investment Portfolio,	Ministry of Business Innovation and Employment
Donna Purdue – Chief Economist	Ministry of Business Innovation and Employment

Name	Organisation
Davin Hall, Principal Advisor	Treasury
Geraldine Treacher	Treasury
Anthony Powell	Treasury
Hannah Lobb	Treasury
Jessica Rowe	Treasury
Florence Reynolds	Treasury
Craig Weise	NZ Green Investment Fund
James Muir	Callaghan Innovation
Mathias Vest	Callaghan Innovation
Rowan Latham	Christchurch City Council
Helen Beaumont	Christchurch City Council
Ross Trotter	Christchurch City Council
Parul Sood	Auckland City Council
Emily Taylor-Hall	Wellington City Council
Arron Judson	Scion Research
Amanda Davies	Scion Research
Jeff Seadon	AUT
Vaughan Levitzke	Green Infrastructure South Australia
Jessica Thomas	Sustainability Victoria
Carl Muller	Sustainability Victoria
Janine Brinsdon	WasteMINZ
Various	Waste Management Industry Forum (WIF Forum)

Name	Organisation
Murray Parrish	Oji Fibre Solutions
Tom Nickels	Waste Management
Chris Aughton	EnviroNZ
Nick Baker	Visy Board NZ
Board	WasteMINZ
Robert Pigou	Provincial Development Unit (MBIE)
Marcos Pelenur	Energy Efficiency and Conservation Authority
Richard Briggs	Energy Efficiency and Conservation Authority
Dinesh Chand	Energy Efficiency and Conservation Authority