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New Zealand's National Recycling Rate: Options and Estimates

Report to the Ministry for the Environment

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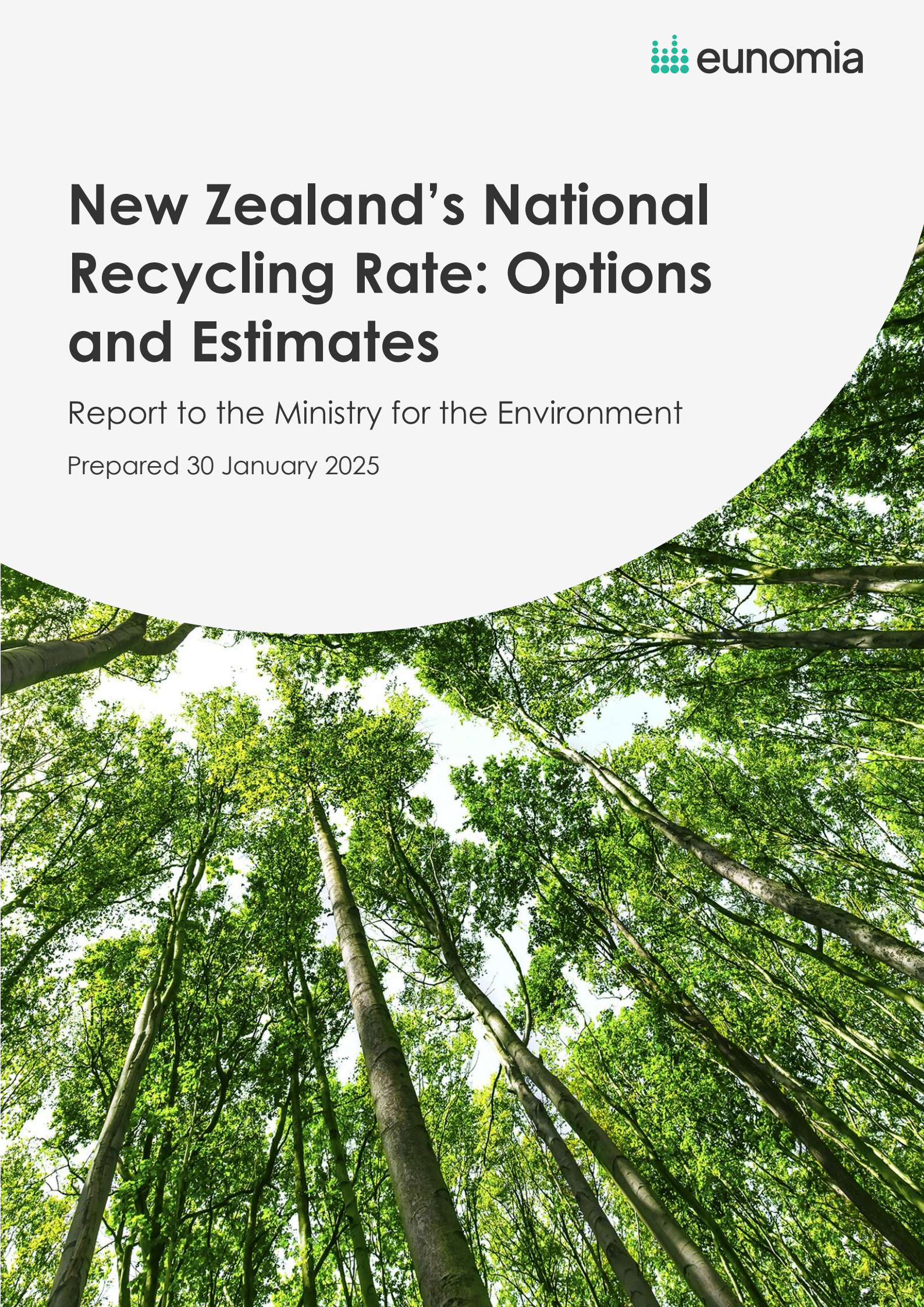

Report For

Ministry for the Environment

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Executive Summary

New Zealand's National Recycling Rate: Options and Estimates Executive Summary

Introduction

The purpose of this report is to provide information to the Ministry for the Environment (MfE) that will assist it in determining how to calculate national recycling rates.

Recycling rates measure the amount of waste that is recovered compared to the total amount of waste generated.[1] The value of recycling rates alongside per capita metrics and waste generation figures lie in their ability to allow policymakers and other interested parties to review progress in terms of waste reduction and diversion as well as to compare with other countries/localities to understand how well waste management is performing. Having a clear idea of waste management performance allows central and local government to identify gaps and opportunities for better waste outcomes.

Currently MfE hosts an online data viewer with municipal waste per capita and total municipal waste volume data and reports this amount to the Organisation for Economic Co-operation and Development (OECD).[2,3] However, MfE does not regularly produce or report a national recycling rate or rates.

International Review

The report begins with an international review of waste metrics in order to establish if there are any standardised international metrics or approaches, and to identify any useful lessons or practices that could be adopted or adapted for New Zealand. Typically, national waste reports include a recycling rate presented as a percentage, and a per capita metric presented as kilograms/person/annum for municipal waste. Although this appears to be straightforward there are many variables including waste streams, activity sources, and destination types that could be included or excluded from the definition of municipal waste and therefore the calculation of the recycling rate. It is also important to consider what information is available and what may need to be estimated.

Section 2.0 explores waste data regulations and metrics from Australia, South Pacific, European Union, United Kingdom, and United States as well as the OECD (which compiles annually reported data from 38 countries) and a Global Recycling League Table (which compares publicly available data from 48 countries). This section highlights the differences between municipal waste definitions and their subjective nature, and outlines metrics and approaches that could be useful for MfE's considerations. Key findings of the international review included:

- Reporting on 'Municipal Waste' or 'Municipal Solid Waste' is a fairly ubiquitous standard – all jurisdictions reviewed report on this as a minimum, although the definitions vary
- There are significant inherent difficulties with the use of the 'Municipal Waste' metric in terms of defining what material should and shouldn't be included.
- The focus of reporting on Municipal Waste risks overlooking non-municipal waste streams such as construction and demolition (C&D) waste and industrial waste, which may represent greater tonnages and with possibly greater potential for diversion or reduction.

[1] The term 'Recycling Rate' is not defined in this report. There is no standard international definition of this term, and it is defined differently in each country and for each metric. When the term is used in this report it is a generic term that covers any type of measure that accounts for the quantity of material diverted against the total amount generated.
[2] MfE data viewer available here: https://environment.govt.nz/facts-and-science/waste/waste-facilities-and-disposal/
Note: "municipal waste per capita" measures waste sent to Class 1 landfill only
[3] OECD data viewer available here: https://www.oecd.org/en/data/indicators/municipal-waste.html

- It appears that, despite other jurisdictions having more developed data and reporting systems in place, the data obtained through these systems is not complete or consistent, and the entities compiling the data still have to undertake significant data manipulation and adjustments in order to produce final figures.

While the international review identified a range of different approaches and highlighted key lessons, a key takeaway is that no ready-made international approach represents the full range of waste NZ produces. While metrics can be developed to enable better international comparisons, New Zealand's own waste landscape may be sufficiently different to require a bespoke approach to how the data is compiled and presented.

National Review

In section 3.0 the report reviews New Zealand's situation by identifying what datasets are available and what datasets could be called upon to generate recycling rate metrics. The datasets outlined include governmental, research, industry, and product stewardship sources.

A gap analysis of national data shows that a wide range of datasets are available, covering most disposed and recovered material streams. However, apart from waste disposal levy data, some territorial authority waste reporting data, and potentially data from product stewardship schemes, most data required for comprehensive recycling rate calculations is of low or medium quality. The biggest issue is with recovered material data on a time series basis. With the exception of some information available from export data (e.g. metals), and product stewardship (e.g. glass bottles), most recovered material data is only available from one-off studies. Identifying the source of this material for activity category reporting is also problematic and generally requires subjective judgements when reviewing the data.

Developing Waste Metrics for New Zealand

Sections 4.0 and 5.0 bring together learnings from the national and international sections to develop metrics that represent different aspects of recycling in and are potentially most useful to Aotearoa New Zealand as well as generating metrics comparable to Australia, EU, and the OECD.

The approach taken to developing a set of recycling rate metrics was to bring together as comprehensive a dataset as possible, which would allow almost any metric to be generated. Rather than be restricted by a lack of data or poor data quality, the approach instead uses the best available data and highlights issues with the data. This serves to provide a clear mechanism for identifying the most critical improvements required for waste data to derive more robust metrics.

A Recycling Rate Model was developed to calculate these metrics. The Recycling Rate Model has been supplied to MfE as an Excel workbook with a national dataset from various sources that can be updated as MfE gathers more up-to-date or accurate data. A Microsoft Power BI interface has also been provided to facilitate interrogation of data in the spreadsheet. The reference year for the model is the calendar year 2023.

Three metrics were developed with two variations on each of the metrics. All recycling rates are expressed as a percentage of all material with a known destination (i.e. all materials disposed of and recovered).

The metrics and their respective rates for Aotearoa New Zealand's data, as well as relevant references, are shown in the table below.

Table 1 Overview of Metrics and Corresponding References

Metric	Description	Recycling Rate New Zealand	Recycling Rate Reference	Waste Generated New Zealand	Waste Generated Reference
1a – Overall (Excl. Class 3-5)	This rate considers all material recycled and disposed of excluding inert material sent to class 3-5 facilities. It includes an estimate of rural waste and waste to industrial monofils.	28.6%	NA	3.336 tonnes/capita	NA
1b – Overall (Australia)	This rate is designed to align with the Australian national recycling rates reported by DCCEEW. It only includes material that is part of the formal waste management system, and so excludes rural waste, industrial monofil, and Class 5 disposal.	39.4%	63.0%	2.423 tonnes/capita	2.875 tonnes/capita

Metric	Description	Recycling Rate New Zealand	Recycling Rate Reference	Waste Generated New Zealand	Waste Generated Reference
2a – MSW (OECD)	This rate is intended to align with the OCED MSW definition. It includes household waste and some material from commercial sources.	37.6%	~30-50%[4]	0.403 tonnes/capita	0.542 tonnes/capita[5]
2b – MSW (EU)	This rate was developed to align with the EU definition of MSW (and Global Recycling League Table) which includes a wider range of commercial wastes than the OECD definition indicates.	41.6%	48%[6]	0.559 tonnes/capita	0.513 tonnes/capita
3a Kerbside (All)	This kerbside rate includes all household and commercial waste collected in residential kerbside collections.	27%	NA	0.253 tonnes/capita	NA

[4] The average recycling rate for OECD member states has not been published. For reference, Eunomia's Global Recycling League report indicates that most countries have recycling rates between 30 and 50%
[5] OECD data reported here for the 2021 reporting year: https://www.oecd.org/en/data/indicators/municipal-waste.html
[6] EU data reported here for the 2022 reporting year: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Municipal_waste_statistics

Metric	Description	Recycling Rate New Zealand	Recycling Rate Reference	Waste Generated New Zealand	Waste Generated Reference
3b Kerbside (Household only)	This kerbside rate excludes commercial waste in kerbside collections. There are no reliable datasets, so an estimate is provided based on the best available information.	27.6%	NA	0.229 tonnes/capita	NA

These new metrics suggest that New Zealand's recycling performance and waste generation is in the middle of the pack compared to other OECD countries. Similarly, the EU-compatible rate aligns with expectations around tonnes per capita for similar economies. The municipal waste per capita estimates (Rate 2a and 2b) are lower than previously reported in the Te Rautaki Para Waste Strategy (0.7 tonnes per capita) and the national recycling rate reported in Transforming Recycling (28%) is towards the lower end of the different recycling rate metrics calculated here.

Overall, the new metrics put forward in this report provide a starting point from which the measures can be further refined as data becomes available and as some of the finer points of the definitions are worked through and final determinations made.

Recommendations

A series of recommendations concerning metrics, data, additional data sources, and reporting are provided in section 6.0. Key recommendations to MfE include:

- The initial metrics that have been developed as part of this project should be further refined, including looking at what is included in each metric.
- Develop additional metrics based on the dataset that has been compiled. This could include per capita metrics that enable waste reduction and avoidance to be correctly accounted for.
- Key areas for improvement of data include farm fills and rural waste, Class 1 & 2 composition by Activity, paper (fibre) recovery, plastic recovery, organics recovery, textiles recovery, and C&D recovery.
- Options for additional data sources include undertaking regular recycling industry surveys, compiling industry data from industry organisations, product stewardship scheme data, and undertaking regular national composition analyses.
- Establish a comprehensive and consistent set of standards and guidance for reporting all data, building on the National Waste Data Framework and current waste disposal levy and Territorial Authority waste reporting.

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1.0 Introduction & Context

1.1 Introduction

The New Zealand Government does not regularly produce or report a national recycling rate that represents the proportion of waste that is recycled from the total waste that New Zealand produces. The absence of such a metric makes it difficult to assess and report on our progress on diverting waste from final disposal and compare this progress to other countries.

Government documents have cited low New Zealand recycling rates and high per capita levels of waste generation compared to other countries.[7] However, the numbers used for these comparisons do not represent like-for-like figures, and so they do not accurately account for New Zealand's comparative level of performance in terms of waste minimisation and recycling.

One aim of this study therefore was to identify, to the extent possible, like-for-like comparisons of Aotearoa New Zealand's recycling rate to international benchmarks for the 2023 calendar year.

The broader aim of the study however is to provide a suite of information and tools enabling policy-makers to decide if and how to report national recycling rates in the future, whether using one of the prepared metrics or other formulations. This information includes:

- Considerations on scope and alignment with international approaches
- An assessment of data sources
- A waste disposal and recovery data model with breakdowns by activity and material
- A Microsoft Power BI interface to facilitate data interrogation
- Recommendations for areas of improvement.

While a number of potential metrics are identified and calculated, the study does not put forward finalised recycling rates or metrics, but rather presents a range of options for policy-makers to consider as one-off or continuous measures as context requires, and suggests that further refinement of metrics be undertaken.

The metrics that are the focus of this work are national measures. Measures for reporting territorial authority (TA) or facility level data is outside of the present scope, although it is noted that national level and TA level measures should ideally align.

For clarity, this report is not intended to address the wider questions of how to gather and manage waste data. To this end, our frame of reference has been to work with existing waste data sources while noting where there is room for improvement in the sources needed to generate the types of metrics that are the focus of this study.

[7] For example, Ministry for the Environment. 2022. Transforming recycling: Consultation document. Wellington: Ministry for the Environment, p11 states that "In 2020, we sent 3.38 million tonnes of waste to class 1 municipal landfills. We estimate that nationally only 28 per cent of materials are recycled, and the other 72 per cent go to landfills. In contrast, Germany, Austria and Wales have the highest recycling rates in the world, with over 50 per cent of all waste recycled." Similarly in Ministry for the Environment. 2023. Te rautaki para | Waste strategy. Wellington: Ministry for the Environment, it is stated that "In 2021, each New Zealander is estimated to have sent nearly 700 kilograms of waste to municipal landfills. That makes us one of the highest generators of waste per person in the Organisation for Economic Co-operation and Development."

1.2 Report Structure

Section 2.0 International Review. This section contains a review of international data and practices. The purpose of the review is to identify how waste and recovery is measured in other jurisdictions to ascertain if there are useful measures, approaches or techniques that could be adopted in New Zealand. The international review covers key jurisdictions that are regarded as having good waste data and measures and/or that have relevance to New Zealand through close relations. The countries/regions covered are:

- Australia
- South Pacific
- European Union
- United Kingdom
- United States
- Organisation for Economic Co-operation and Development (OECD)

In addition, work on a Global Recycling League Table published by Eunomia and funded by the Can Manufacturers Institute, International Aluminium Institute, TOMRA and the Welsh Government is discussed.

Each jurisdiction reviewed is assessed in terms of the key recycling rate and waste metrics used, how the data is gathered and managed (including responsible agencies), supporting legislation, protection of commercial sensitivities and how effective the system is.

Section 3.0 New Zealand Situation Review. This provides a New Zealand situation review that identifies the available data sources and offers an assessment of quality and availability. The focus is on identifying what datasets could be called upon to generate recycling rate metrics. The datasets reviewed include governmental, research, industry, and product stewardship sources.

Section 4.0 Waste Metrics. This section contains discussion and assessment of the findings of the international and local reviews and develops an approach for generating recycling rates appropriate for Aotearoa New Zealand. Three metrics, each with a variation, are presented, giving a total of six potential rates.

Section 5.0 Recycling Rate Model. In order to calculate the initial set of metrics identified in this report a recycling rate model was developed. This section provides an overview of the recycling rate model (which is one of the deliverables for the project and is supplied alongside this report). The model develops the initial set of measures, put forward in the recommendations. It should be noted that the measures that have been developed are intended to be further refined over time as better data becomes available and the precise needs of government and other stakeholders become clearer.

Section 6.0 Recommendations. The final section puts forward a series of recommendations for taking forward the findings of this study including development of further metrics, improvements to waste data, suggestions for additional methods to gather data, and reporting of data.

1.3 Recovery and Recycling Data

One of the challenges in generating recycling and recovery rate data is determining what data to use, and how different data are defined. This section provides a brief introduction into some of the different dimensions and considerations. The variations in the data discussed here combine to create the variation in data quality and approaches discussed in this document.

Recycling versus Recovery. There are different types of recovery processes that are discussed in this report. These include:

- Reuse. Items that are not reprocessed but are used again without changing form (for example bottles being refilled). Most definitions of recovery only include reused materials if they have first entered a waste management facility.

- Recycling. Waste material that is processed into the same or a different material (for example bottles being crushed then turned back into new bottles). The term may refer to just 'dry' recycling (e.g. glass, paper, plastic) or both dry recycling and organic material recycling (i.e. 'wet' recycling).

- Composting (and Anaerobic Digestion). Converting food and/or garden waste into soil amendment. This is sometimes referred to as 'wet' recycling (as opposed to 'dry' recycling e.g. glass, paper, plastic).

- Downcycling. Waste material that is processed into a lower grade of material and used for different purposes than the input material – for example glass being crushed to use as sand or aggregate. This is generally considered a sub-category of recycling.

- Energy recovery. Waste material used to generate energy, including material sent to energy recovery facilities. Because energy is recovered, and the material does not go to landfill, this is sometimes included in recovery measures.

- Recovery. An overarching term generally applied to waste materials that are not disposed without recovering any value.

In general, recycling, downcycling, and recovery, are usually included in recycling rate calculations, with the other measures less commonly included.

When is material considered recycled or recovered? There are different points at which material may be considered to be recycled or recovered. These include:

- **When it is collected**. This is a common measure used by local authorities. However, this material includes contamination that households or businesses place in the collected material, and so not all of the collected material may actually be recycled or recovered.

- **When it has been sorted/sold to market.** This is once material has been collected and sorted and has had most of the contamination removed – to the point where it can be sold as a commodity. This is often considered as a more accurate measure of recycling or recovery. There is usually reasonable data on this material as it has to be accurately measured for the purposes of sale. However, there can still be some contamination remaining in the product, and so again, not all of the collected material may actually be recycled or recovered.

- **When it has been turned into recovered product.** Most material undergoes a final de-contamination phase (sometimes termed beneficiation) before it can be used in manufacturing a product. Counting material that is turned into product is regarded as the most accurate measure for recovery. However, because collected material may be sold into many different markets, transported around the world, and potentially mixed with other material before it is turned into product, it is not practical to measure recovery at this point. For materials such as organic waste there can also be mass or moisture loss in the process which means that outputs are not equal to inputs. This means that this measure is more difficult to use and generally estimates must be applied if it is to be used.

Availability and accuracy of data. There can be significant variation in the availability of data, depending on whether reporting is voluntary or mandatory, who is responsible for providing data, and

who is responsible for collating data. Commercial sensitivity and the costs of gathering and reporting data are also factors that must be considered.

Types of Activity. This is one of the biggest variations in the different types of recycling rates reported. Recycling rates are commonly reported according to whether they relate to household, 'municipal', commercial & industrial, and/or construction and demolition waste. Each of these terms can have different definitions, sub-categories, and activities included in different jurisdictions. The definition of 'municipal' is a particular source of variation (refer to section A.6.0 for further analysis of these differences).

Disposal. Last, but by no means least, the material that is accounted for in terms of disposal can have a profound impact on the recycling rate calculation. Key sources of this variation are whether material sent to facilities other than municipal (Class 1) disposal facilities is counted, and whether rural wastes, mining and other on-site disposal is included.

A further variation in how metrics may be calculated is to measure the quantities placed on market (POM) and the quantity recovered. The main issues with this approach are that different types of products and material may have differing lifespans before it reaches end of life, so material POM and recovery may relate to different time periods, and POM data is not always available by weight, so assumptions around average weights need to be applied to generate compatible data.

1.4 Glossary

Term	Acronym	Definition
Activity source/activity category		What type of activity was taking place when/where the waste material was generated. In New Zealand there are seven standard categories defined in regulation, which are described here: https://environment.govt.nz/assets/publications/Waste/Activity-source-reporting-fact-sheet.pdf
Average loss rates (ALR)		ALRs are used to account for tonnage losses of uniform, recyclable material prior to the final reprocessing, including contamination.
Bio-waste		Biodegradable waste including food waste, agricultural waste, and biosolids .
Calculation point		The calculation point is used by the EU standards to determine recycling tonnage. It is considered alongside the measurement point. It is discussed in section 2.4.1.2 with examples.
Construction and demolition	C&D	An activity source. Waste produced by construction and demolition activities.

Term	Acronym	Definition
Contamination		Material that is not accepted for recycling or reprocessing (e.g. plastic in garden material sent for composting). It is included in the term 'losses'.
Data granularity		The level of detail in data, the more granular the data the more information it has.
Data viewer		Online dashboards with interactive charts and tables, typically using the Microsoft Power BI platform.
Department of Climate Change, Energy, the Environment and Water	DCCEEW	Department of the Australian Government.
Duty of care		A legal obligation to adhere to a standard of reasonable care to avoid harm, used in UK countries for waste management standards.
Energy recovery		Waste material used to generate energy, including material sent to energy recovery facilities.
Environmental Protection Agency	EPA	An independent agency of the United States government.
Eunomia Global Recycling League		A report produced by Eunomia to compare the recycling rates of 48 countries.
European Commission	EC	The primary executive arm of the European Union.
European Union	EU	The supranational political and economic union of 27 European states.

Term	Acronym	Definition
Eurostat		The statistical office of the European Union.
Farm fills		Pits on farms for storing or disposing natural and non-natural rural waste.
Geographic source		Where the waste material was generated e.g. Auckland, New Zealand.
Greenhouse Gas Inventory	GHG	New Zealand's annual report of all human-induced emissions and removals of greenhouse gases.
Industrial, commercial, and institutional waste	C&I, ICI	An activity source. All waste that is generated at commercial, institutional, and industrial sites. C&I and ICI are used interchangeably, typically ICI is used in New Zealand.
Informal economy		For the purposes of this report, the informal economy refers resource recovery that occurs outside of the formal waste management system (e.g. home composting, passing on of used items etc.)
Landfill classifications		How a country or jurisdiction classifies landfills. The classification will specify what materials are allowed at the site. New Zealand's landfill classifications can be found here: https://www.legislation.govt.nz/regulation/public/2009/0144/latest/LMS491295.html
Landfill cover, capping		Material used to cover material at an operational landfill. This is often soil, green waste, or paper sludge.
Measurement point		The measurement point is used by the EU standards to determine recycling tonnage. It is considered alongside the calculation point. It is discussed in section 2.4.1.2 with examples.

Term	Acronym	Definition
Member states, member countries		States and countries that are members of a collective (i.e. OECD or EU members).
Metric		A measurement used for performance tracking and comparison.
Municipal solid waste	MSW	Typically defined as household waste collected by local jurisdictions, however municipal solid waste definitions vary from country to country and person to person. More detail can be found in section 2.0 International Review where each sub-section includes a definition of MSW.
National Waste Data Framework	NWDF	Protocol for waste management facility operators and territorial authorities for data collection and reporting.
Online Waste Levy System	OWLS	Reporting portal hosted by MfE for landfills and transfer stations.
Organics		Any material that comes from a plant or an animal, e.g. food scraps, garden waste, and wood.
Organisation for Economic Co-operation and Development	OECD	An intergovernmental organisation with 38 member countries.
PacWaste Plus		A programme to support the waste and pollution sector in the South Pacific.
Per capita		The average amount of something per person, typically per annum. For example, the amount of waste generated in New Zealand per capita in 2023.
Priority product		A product declared as a priority by the Minister as per section 9 of the Waste Minimisation Act 2008.

Term	Acronym	Definition
Product stewardship scheme		A scheme that focuses on the reduction of environmental harm from a product or achieves environmental benefits from the reduction, reuse, recycling, recovery, or treatment of the product. This may be accredited by the Minister for the Environment or be voluntary and may cover priority products or non-priority products.
Putrescible		Something that contains organic matter and is liable to decay.
Recovery		Recovery. An overarching term generally applied to waste materials that are not disposed without recovering any value.
Recovery rate, resource recovery rate		The amount of material recovered divided by the amount of waste material generated.
Recycling		When material is recycled from waste to a reusable material.
Recycling rate		The amount of material recycled divided by the amount of waste material generated.
Recycling rate model, model		The model produced by Eunomia that sits alongside this document with New Zealand's dataset and initial metrics.
Residual waste		Material that is destined for disposal including, for example, recyclable or compostable material that did not enter into recycling or composting facilities.
Return to productive use		Where material has been processed to the point that it is ready to be remanufactured (e.g. recycled plastic flakes).
Reuse		Where material has been collected and distributed to be used again, whether for its original function or something new.
Short tons/tons		A U.S. measure where 1 short ton is the equivalent of 907.18kg.

Term	Acronym	Definition
Solid Waste Analysis Protocol	SWAP	An audit of waste material to determine material composition by percentage and weight.
Territorial Authorities Waste Levy Expenditure System	TAWLES	Reporting portal hosted by MfE for territorial authorities to report expenditure of waste levy funding and other data.
Territorial authorities, local authorities	TA, LA	Authorities such as councils who oversee waste management and related reporting.
Washington Department of Ecology		The state of Washington's environmental regulatory agency.
Waste arisings, arisings		Waste generated.
Waste disposal levy		A levy imposed by government on waste disposed of at a disposal facility to raise revenue for promoting and achieving waste minimisation and increase the cost of waste disposal to recognise that disposal imposes costs on the environment, society, and the economy.
Waste hierarchy		The waste hierarchy is a tool used globally for explaining the different steps to reduce and manage waste. The most desirable steps are those at the top of the hierarchy; at the bottom are the techniques that are least desirable. There are different versions of the hierarchy. The version articulated in New Zealand's Waste Strategy has from most to least desirable: Avoid, Reduce, Reuse/repurpose, Recycle or compost, Recover and Destruction and Disposal.[8]

[8] https://environment.govt.nz/what-government-is-doing/areas-of-work/waste/aotearoa-new-zealand-waste-strategy/

2.0 International Review

2.1 International Review Introduction

The purpose of this international review is to establish if there are any standardised metrics or approaches in use internationally, and to identify any useful lessons or practices that could be adopted or adapted for New Zealand when considering how we calculate our recycling rates and recovery metrics. For the purposes of this research, the international review focuses on waste metrics for jurisdictions that New Zealand often compares itself to. We investigate and review practices in Australia, South Pacific, European Union, United Kingdom, United States, and the OECD, as well providing a review of the recently released Global Recycling League Table.

2.2 Australia

Australia operates with a federal government that can implement nationwide legislation, with states and self-governing territories who each have their own jurisdictions. Waste management and resource recovery is the responsibility of states and territories, where each jurisdiction has its own legislation, guidelines and regulatory frameworks. At a national level, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) leads the implementation and coordination of waste policy, with publications such as the 2018 National Waste Policy and subsequent 2019 Action Plan. The collection of waste data is conducted by each state and territory then collated at a national level by DCCEEW. The metrics that DCCEEW report on are explained in the following table.

2.2.1 Key Recycling Rate and Waste Metrics Used

DCCEEW identifies the following metrics as the primary performance indicators for waste management and materials recovery in the 'Australian standard for waste and resource recovery data and reporting' guidance.[9] Note that the definitions of recycling and recovery rates consider materials that may be generated and stored in one year, then released from storage for recycling (or energy recovery) in a different year. The implication of this definition is that previously published recycling or recovery rates may need to be subsequently revised when the fate of stored materials is resolved.

Table 2 Australian Waste Metrics

Indicator	Unit	Description
Waste generation per capita	kg per capita	The quantity of waste generated in the reference year *divided by* the jurisdictional population in December of that year. For data reporting purposes, waste generated is the sum of materials allocated to reuse, recycling, energy recovery, disposal, stockpiles and material littered or dumped into the open environment. Materials are only attributed to 'reuse' if first received by a recycling, energy recovery or disposal facility and subsequently reused.

[9] https://www.dcceew.gov.au/environment/protection/waste/publications/national-standard-waste-and-resource-recovery-data-and-reporting

Indicator	Unit	Description
Recycling rate	%	The quantity of waste attributed to the fate 'recycling' in the reference year that was generated in that year *divided by* the quantity of waste generated in the reference year. For data reporting purposes, recycling is the mass of material received by reprocessing facilities that is processed to the point of being suitable for manufacture or return to productive use.
Resource recovery rate	%	The quantity of waste attributed to the fates 'reuse', 'recycling', and 'energy recovery' in the reference year that was generated in that year *divided by* the quantity of waste generated in the reference year.[10,11]
Return to productive use	tonnes	The quantity of secondary materials (i.e. materials that have been processed to the point of being remanufactured e.g. RPET flakes) that have entered a remanufacturing operation, an energy from waste facility, or were directly used in the reference year.[12]
Local recycling rate	%	The quantity of waste attributed to the fate 'recycling' in the reference year that was not exported and was generated in that year *divided by* the quantity of waste generated in the reference year.
Local recovery rate	%	The quantity of waste attributed to the fates 'reuse', 'recycling', and 'energy recovery' in the reference year that was not exported and was generated in that year *divided by* the quantity of waste generated in the reference year.

[10] DCCEEW define energy recovery as "processes through which wastes are collected, sorted and processed to recover energy in usable form, for example process heat, steam or in electricity generation. For data reporting purposes, the quantity of waste allocated to the fate 'energy recovery': excludes residuals from energy from waste facilities that are recycled or sent to landfill or otherwise disposed of; may include (and does include in national reporting) landfill waste that produces methane gas used for energy recovery estimated based on standard formulas used in greenhouse gas reporting; is reported as wet weight."
[11] DCCEEW define recovery as "activities through which wastes are collected, sorted, processed (including through composting), and/or converted into raw materials for use in a production system. For data reporting purposes, the quantity of waste allocated to the fate 'resource recovery' is the sum of the quantities allocated to waste reuse, recycling and energy recovery."
[12] DCCEEW define secondary materials as "a term applied to recovered materials that have been processed to the point of being suitable for remanufacturing or other return to productive use."

Indicator	Unit	Description
Secondary material utilisation rate	%	The quantity of a secondary material consumed in Australia in the reference year *divided by* the total quantity of the material consumed in the reference year. It is not systematically measured; in some instances, it is modelled through materials flows analyses.

2.2.1.1 Metrics Published in Annual Reports

In its annual National Waste Report, the DCCEEW reports two key metrics:[13]

- **Waste resource recovery rate:** the proportion of waste that is processed for recycling, reuse, or used for energy recovery
- **Waste recycling rate:** the proportion of waste that is processed for recycling

For both metrics, the denominator of the metric is the "total waste generated that has a known fate". This data is measured at a state level, and then aggregated by DCCEW. Across all the data collected by the local authorities and DCCEEW, the only waste stream for which the fate is unknown is "hazardous waste sent for treatment", so this is not included in the "total waste" figure. Other exclusions from the total waste generated measure include:

- liquid non-hazardous wastes
- soil used for landfill cover or capping that came from the same site
- soil-based waste from mining and mineral processing
- pre-consumer waste that is recycled on-site as part of a manufacturing process
- wastes from agriculture, forestry, and fishing
- waste used for producing energy on the same site where more than 50% of the waste was generated.

With regard to landfill waste, DCCEEW's definition of "disposal" includes all residual waste sent to landfill, and any waste material used for landfill cover or capping. Other, non-waste material used for landfill cover or capping is not included in the definition, nor is soil used for landfill construction.

Table 3 Waste and Landfill classifications across Australia

This table (from Box 1. 'Review of the Application of Landfill Standards (2010)) outlines the waste and landfill classifications of different jurisdictions in Australia and shows that they are unique in each, making it difficult to align with landfill classifications in New Zealand.[14]

Jurisdiction	Waste Classifications[15]	Landfill Classifications

[13] https://www.dcceew.gov.au/environment/protection/waste/national-waste-reports/2022
[14] https://www.dcceew.gov.au/sites/default/files/documents/landfill-standards.pdf
[15] "Wastes" refers to solid wastes other than clinical and related wastes.

New South Wales	Four classifications: General (non-putrescible) General (putrescible) Restricted[16] Hazardous	Three major categories of landfill, with sub-classes in two categories: • General solid waste (non-putrescible) • General solid waste (putrescible) • Hazardous – for any waste designated as hazardous.
Victoria	Three major categories of landfill, with sub-classes in two categories: General solid waste (non-putrescible) General solid waste (putrescible) Hazardous – for any waste designated as hazardous.	Three classifications based on acceptable waste types: • Type 1 – Prescribed Industrial waste (PIW) containment facility • Type 2 – Putrescible, inert, fill, and Category C PIW • Type 3 – inert, fill.
Queensland	Two classifications: General Regulated[17]	Three categories: • Putrescible waste • Non-putrescible waste • Inert waste.
Western Australia	Seven classifications: Clean fill Inert Type 1 Inert Type 2 Inert Type 3 Contaminated solid waste Special Type 1 Special Type	Five classes of landfill based on acceptable waste types and design inclusions: • Class I – unlined – fill, Inert Type 1, Contaminated solid waste[18], Inert Type 2, Inert Type 3, Special Type 1. • Class II – unlined – fill, Inert Type 1, Putrescible, Contaminated solid waste3, Inert Type 23, Inert Type 33, Special Type 13, Special Type 23.

[16] Restricted solid wastes in NSW are specifically gazetted – none have been nominated at the time of publication.
[17] "Regulated Waste" in Queensland covers oils, tyres, clinical waste, asbestos, batteries, abattoir effluent and lead.
[18] Requires special approval conditions

		• Class III – lined and may have leachate collection – fill, Inert Type 1, Putrescible, Contaminated solid waste3, Inert Type 23, Inert Type 33, Special Type 1, Special Type 2. • Class IV – double lined with leachate collection – contaminated soils and sludges. • Class V – the Mount Walton East intractable waste disposal facility.
South Australia	Four classifications: Inert C&I (General) – excludes listed wastes C&D (Inert) – excludes foreign materials[19] Municipal Solid Waste.	Landfill sites are classified according to the amount of waste received per annum, and the potential to generate leachate. The classes ranging from <1,000 to >200,000 tonnes/year.
Tasmania	Four classifications: Solid inert Potentially contaminated Putrescible Controlled.	Level 2 landfills receive >100 tonnes/year and require management systems as set out in legislation. There are three categories of landfill: • Category A – solid inert • Category B – putrescible • Category C – secure.
Northern Territory	Classifications under development.	General A, B, C based on size. Classifications under development

In 2019, DCCEEW amended the Landfill Waste Classification and Waste Definitions (1996) along with their efforts to provide data to support better decisions. The classifications I-V have common names inert, putrescible, secure, and intractable where permitted waste types are quite similar across Class I-IV and highly specified in Class V.

[19] "Foreign materials" – in the SA context includes green waste, plastics, electrical wiring, timber, paper, insulation, tins, packaging and other waste associated with construction or demolition of a building or other infrastructure. Foreign material must not be Municipal Solid Waste, Liquid, Listed, Hazardous or Radioactive Waste.

Table 4 Australian Landfill Classes and Permitted Waste Types

Material	Class I Inert	Class II Putrescible	Class III Putrescible	Class IV Secure	Class V Intractable
Clean Fill	✓	✓	✓	✓	
Uncontaminated fill	✓	✓	✓	✓	
Neutralised acid sulfate soil	✓ Where authorised	✓	✓	✓	
Putrescible wastes[20]		✓	✓		
Contaminated solid wastes	✓ Where meeting Class I criteria	✓ Where meeting Class II criteria	✓ Where meeting Class II or III criteria	✓ Where meeting Class II, III or IV criteria	
Inert Waste Type 1 (Soils, rocks, building and demolition waste, asphalt, sand)	✓	✓	✓	✓	
Inert Waste Type 2 (Tyres)	✓ Where authorised	✓ Where authorised	✓ Where authorised	✓ Where authorised	
Inert Waste Type 3 (Material from secondary waste treatment plants)	✓ Where authorised				
Special Wastes Type 1 (Asbestos)	✓ Where authorised	✓ Where authorised	✓ Where authorised	✓ Where authorised	
Special Wastes Type 2 (Biomedical)		✓ Where authorised	✓ Where authorised	✓ Where authorised	
Special Wastes Type 3 (PFAS)	✓ Where authorised	✓ Where authorised	✓ Where authorised	✓ Where authorised	
Intractable and other wastes (Radioactive or significantly contaminated wastes)					✓

[20] Putrescible waste includes any component that is likely to become putrid i.e. organics materials that will biodegrade in a landfill environment. This includes municipal waste, food waste; biosolids; sewage treatment grits and screenings; animal manure and carcasses; paper, cardboard, plastic and wood waste from offices or packaging; pesticide, biocide, herbicide or fungicide containers; materials from automotive workshops that may contain oil; nappies; agricultural or horticultural vegetative waste from all sources; non-chemical waste from manufacturing and services.

New Zealand Class I landfills seem most similar to the Australian Class II, III, & IV which accept the broadest range of materials, including putrescible wastes, but differ only in the types of 'contaminated solid wastes' they accept.

Waste data is gathered by each jurisdiction before being collated by DCCEEW, each of which have differing requirements as to which facilities must report data. However, it seems that all classes of landfills are typically required to report data – in some cases there is a de minimis threshold, such as in Western Australia where landfills must report data only if they receive more than 20,000 tonnes of waste per year.[21]

DCCEEW do not consider waste imported to Australia as waste generated, although waste import and export tonnages are reported separately to waste generation.[22] In local circumstances they attribute waste to the state or territory where it was generated where possible, although for international waste, import tonnages are not included in waste generation reporting. The exclusion of international imports appears to be to avoid any double counting, however, it may leave a significant amount of waste unaccounted for. For example, Australia imported over 1,000,000 tonnes of recyclable waste in 2020-21, including around 16,000 tonnes of glass waste and 57,000 tonnes of metal waste from New Zealand. This could then be captured in the value of the amount of material recycled, but not in the amount generated, thus potentially inflating the recycling rate.

The waste streams covered in these metrics includes all types of waste that enters municipal or commercial waste services only. Waste is categorised as Commercial & Industrial (C&I), Construction & Demolition (C&D), or Municipal Solid Waste (MSW). Together these three waste streams are used for the waste metrics where soil (contaminated soil is classified as hazardous), rural waste, and biosolids are only counted if they enter the formal waste management system as mentioned above. The waste classification definitions below refer to the Australia and New Zealand Standard Industrial Classification (ANZSIC).[23] The definitions of the categories used in Australian reporting are as follows:[24]

Commercial and industrial (C&I). Waste that is produced by institutions and businesses, including offices, schools, restaurants, retail and wholesale businesses, and industries such as manufacturing. Also includes waste from primary and secondary production, such as mining and minerals processing. Encompasses waste from all ANZSIC codes except industry classifications from Division E (construction) and Group 753 (Local government administration).

Construction and demolition (C&D). Waste produced by demolition and building activities, including road and rail construction and maintenance and excavation of land associated with construction activities. Consistent with ANZSIC industry classifications from Division E (construction). This category excludes contaminated soil.

Municipal solid waste (MSW). Notably the Australian definition of MSW differs from the OECD definition. The Australian definition is as follows:

- Waste produced by households or collected by, or on behalf of, a municipal council. Includes waste from:
    - street bins
    - street sweeping
    - litter and dumping clean ups
    - aquatic litter traps

[21] https://www.wa.gov.au/service/building-utilities-and-essential-services/waste-management/annual-waste-data-reporting
[22] https://www.dcceew.gov.au/sites/default/files/documents/standard-wrr-data-and-reporting-final-issued-v2.pdf
[23] https://www.abs.gov.au/statistics/classifications/australian-and-new-zealand-standard-industrial-classification-anzsic/latest-release
[24] australian-standard-wrr-data-reporting-second-edition.pdf (dcceew.gov.au)

    - municipal parks and gardens
    - street tree prunings
    - council facility operations (consistent with ANZSIC Group 753 (Local government administration) and transfer stations (other than waste readily identifiable as arising from commercial operations)
- Excludes waste:
    - collected by, or on behalf of, a municipal council from businesses
    - from road works undertaken by, or on behalf of, a municipal council.

The main difference between this and the OECD and EU definitions of MSW is that it specifically excludes waste collected by, or on behalf of, a municipal council from businesses, and also commercial waste 'similar to household waste'.

For data reporting purposes the definition of recycling is "all material received by a reprocessing facility that is processed to the point of being suitable for remanufacturing or return to use". The data required by DCCEEW to be reported includes the weight of the loads of waste both entering and leaving each facility. If the metric is calculated using the weight of waste exiting the facility, in theory this should mean that any contamination at the point of collection should not be captured in this value, although in reality some contamination may remain in the bales exiting the reprocessing facilities.

Alongside the core waste materials, the reporting also covers ash (fly ash from coal-fired power stations, and bottom ash from both coal-fired power stations and thermal waste processing). Australia reports energy recovery as a separate fate than disposal; New Zealand does not currently have any energy from municipal waste facilities, so this is not currently relevant. Consideration of how this is accounted for this will be required if New Zealand does begin operating energy recovery facilities.

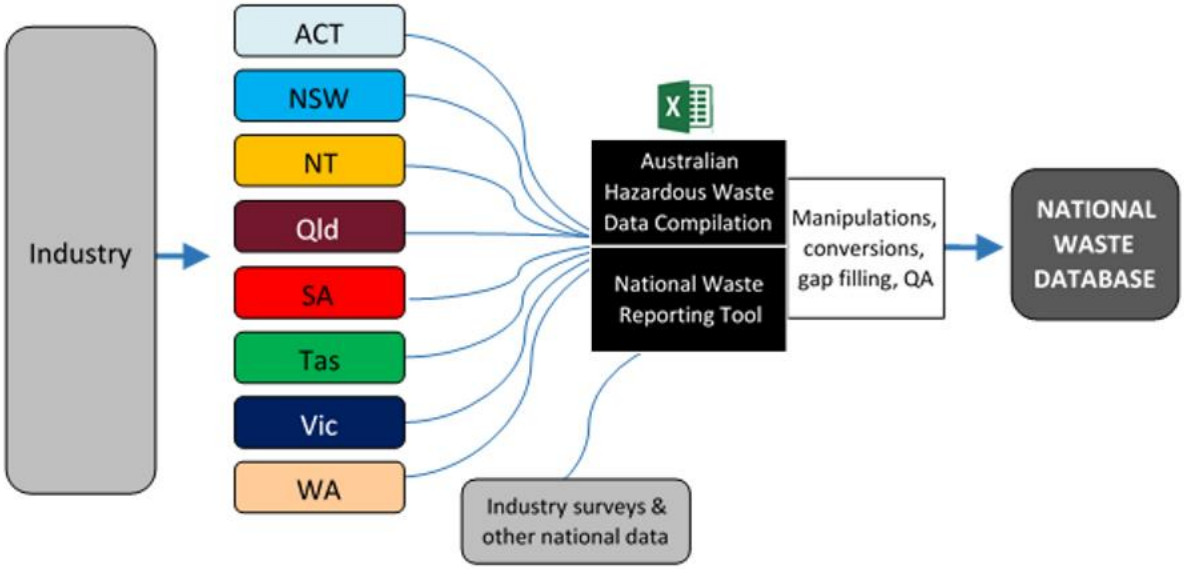
Long-term storage is also reported on as another fate for waste. If materials are released from storage in a later year than when they were generated as waste, the recycling or recovery rates from the initial year of the generation of the waste should be updated to account for the now known fate. In New Zealand, any long-term storage beyond 6 months is considered disposal under the Waste Minimisation Act Section 26(3).

2.2.2 How the Data is Gathered and Managed

2.2.2.1 Agencies responsible

Data is collated and published by DCCEEW, a central government agency, although the data is initially gathered and published by each state. DCCEEW recommends states and territories establish mandatory data reporting for Waste and Resource Recovery (WRR) facilities that receive waste above a threshold quantity (which can be defined by the state/territory), as well as voluntary reporting for facilities receiving waste quantities under the threshold. Data is collected biennially by a survey/reporting tool. Ideally data should be measured as weight of the waste obtained through weighbridges, which DCCEEW recommends states and territories should encourage or mandate the use of, however it is acceptable to estimate the weight if a reliable site-specific waste density is known. Otherwise, the data can be reported in terms of volume. The data management flow is shown in the diagram below:[25]

[25] Diagram source: Vinoshan Shankar (DCCEEW)



The waste must then be classified by both the source stream and the waste category.

Table 5 Australian Waste Source Streams and Characteristics

Source Stream	Characteristics
MSW	• 95% or more of the materials originate from households (excluding commercial construction or demolition of a dwelling); or • 95% or more of the materials originate from the operations of a municipal council or its contractors, excluding road works; or • Contains mostly materials of uncertain origin delivered by a private citizen; or • Container deposit system returns
C&I	• 95% or more of the materials originate from the operations of businesses, institutions or governments (other than a municipal council); or • Contains mostly materials of uncertain origin that are not building and demolition wastes and are delivered by a commercial operation

C&D	• 95% or more of the materials originate from a commercial construction or demolition operation, including:
	  o construction or demolition of a dwelling
	  o road works, including those undertaken for or on behalf of a municipal council
	• Contains mostly building and demolition waste of uncertain origin; or
	• Disaster waste that cannot be readily partitioned by source stream

Although central government published a National Waste Classification System in the 1990s as part of the Australian Waste Database project, most states historically had not aligned to this for their own waste

data reporting.[26] Australia's 2019 National Waste Policy Action Plan set out the goal to implement alignment and harmonised waste data reporting by 2022. It is an ongoing exercise for DCCEEW with jurisdictions to harmonise data, where DCCEEW has taken steps including updating standards for hazardous and non-hazardous wastes with regular review.[27,28] In the meantime some of the data is manipulated by DCCEEW in order to unify the various sources for the purpose of presentation in the National Waste Report. The main issues given the decentralised nature of waste data systems across Australia include incomplete data coverage and disparate data, legal restrictions on reporting, and capturing interstate flows. Adjustments may include re-categorisation, applying some assumed material composition, and adjusting for cross-border transportation.[29]

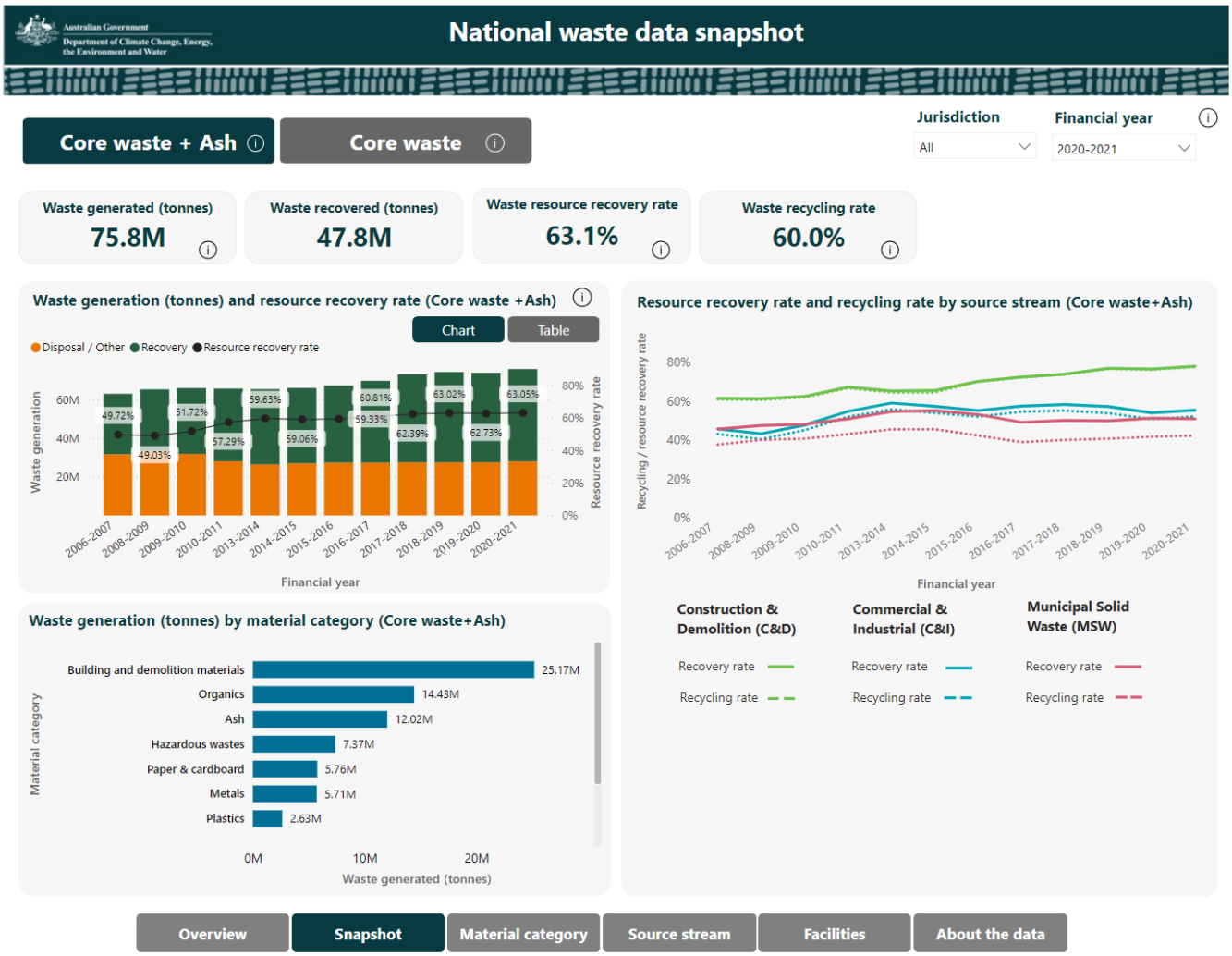
For example, where quantity data is reported in terms of volume, it must then be converted to a weight. A standard list of typical density values is used by DCEEW for this conversion in Appendix E of the 'Australian standard for waste and resource recovery data and reporting' guidance, although it is also recommended that those reporting data use their own density values where these can be cited, and if they differ significantly from the standard list.

2.2.2.2 IT systems and reporting mechanisms

DCCEEW has created various data viewers that present a range of information from the use of the Recycling Modernisation Fund, to display the organics kerbside collection services available.[30] One of the available data viewers is the Waste and Resource Recovery Data Hub, (shown in the screenshot below), which allows users to view both current and historic national waste data presented by material stream and fate.[31]

[26] Hyder Consulting for the Department of Sustainability, Environment, Water, Population and Communities, 2011 https://www.agriculture.gov.au/sites/default/files/documents/waste-classifications-comparisons.pdf
[27] Hazardous waste standards (2022): https://www.dcceew.gov.au/environment/protection/publications/australian-hazardous-waste-data-reporting-standard-2022
[28] Non-hazardous waste standards (2024): https://www.dcceew.gov.au/environment/protection/waste/publications/national-standard-waste-resource-recovery-data-reporting-second-edition
[29] https://www.dcceew.gov.au/sites/default/files/documents/standard-wrr-data-and-reporting-final-issued-v2.pdf
[30] https://www.dcceew.gov.au/environment/protection/waste/how-we-manage-waste/data-hub/data-insights
[31] https://www.dcceew.gov.au/environment/protection/waste/how-we-manage-waste/data-hub/data-insights/national-data-viewer

Figure 1 Example of DCCEEW 'National Waste Data Snapshot' Data Viewer



Note that the page is able to be filtered by "Core waste + Ash" and "Core waste". Core waste is all waste generated excluding ash given ash has such a large volume it can skew the overall figures. Ash is a byproduct from coal fired power plants.

A number of states also operate online systems to enable the reporting of monthly waste data. The Queensland Waste Data system (QWDS) is an online portal that allows waste operators to report all required data.[32] Data that is reported monthly and/or annually through this system is then available in an aggregated format through an online platform.[33] The New South Wales (NSW) Environment Protection Authority (EPA) also utilises an online portal to facilitate monthly waste data collection although this does not offer the public the ability to explore the data, as the Western Australia system does.[34,35]

[32] https://www.qld.gov.au/environment/circular-economy-waste-reduction/data-reports/qwds

[33] https://app.powerbi.com/view?r=eyJrIjoiM2I3MmVkMGEtMmZiNi00Y2Q3LWJkMTQtYjcwNjQ3NzRiZTZmIiwidCI6ImQxNmRlNTMwLTk0ZTctNDE1OC1iN2UyLTZlZTIyMGFmNjI4ZCJ9

[34] https://www.epa.nsw.gov.au/your-environment/waste/waste-facilities/waste-reporting/waste-and-resource-reporting-portal

[35] Domestic waste and recycling dashboard | Waste Authority WA

The types of information reported by the different portals varies. For example, the QWDS portal is fairly comprehensive and enables the user to explore the data by source (MSW, C&I and C&D), material, and fate. Examples of the portal are shown in the screenshots below:

Figure 2 Example of QWDS 'Headline Waste' Data Viewer

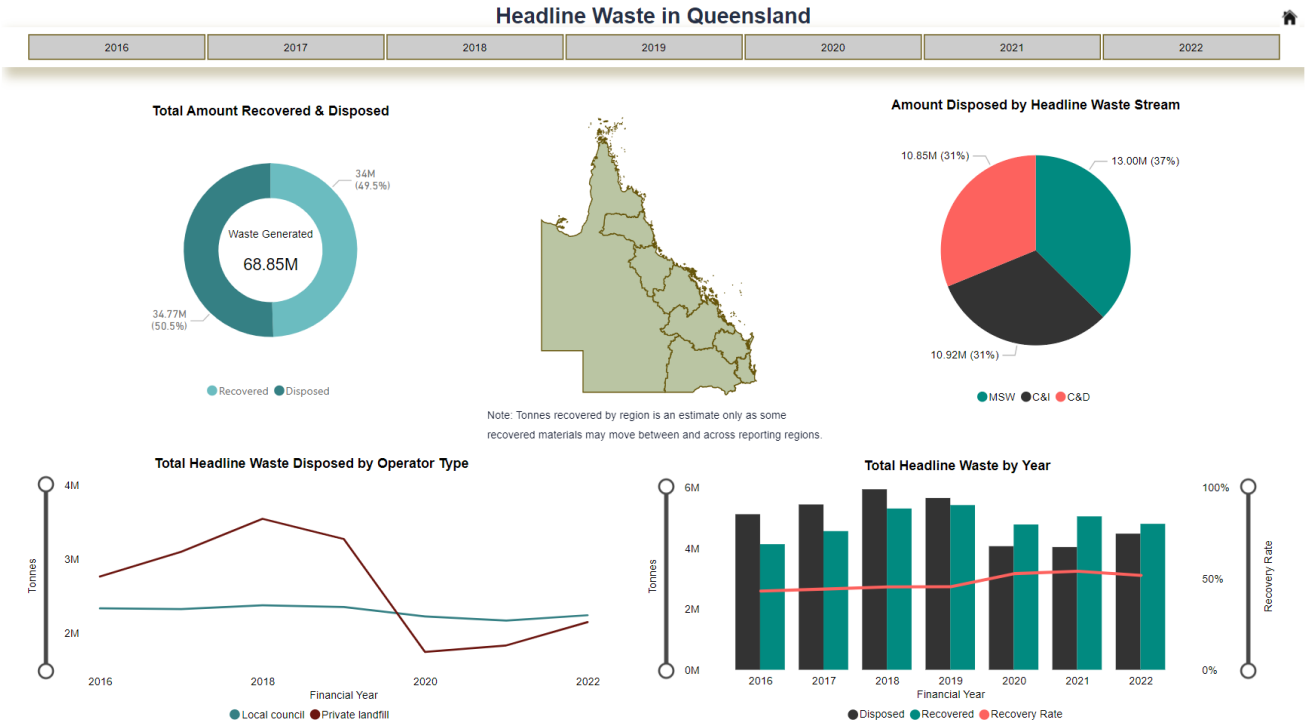
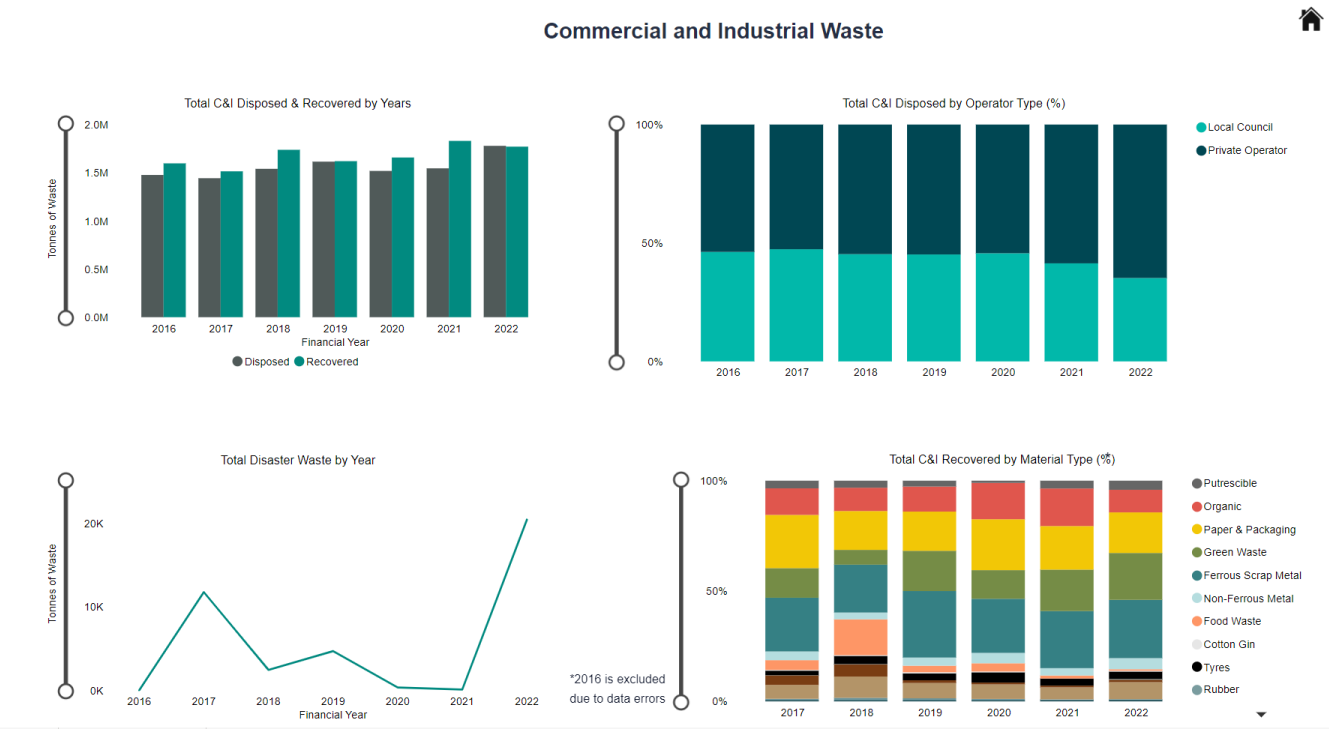


Figure 3 Example of QWDS 'Commercial and Industrial Waste' Data Viewer



Meanwhile, the Western Australia Waste Authority's Recycling dashboard displays data in a similar format, but to a lower degree of granularity and detail. Notably the WA system focuses solely on household waste.

Figure 4 Example of WA 'Waste Data Summary' Data Viewer

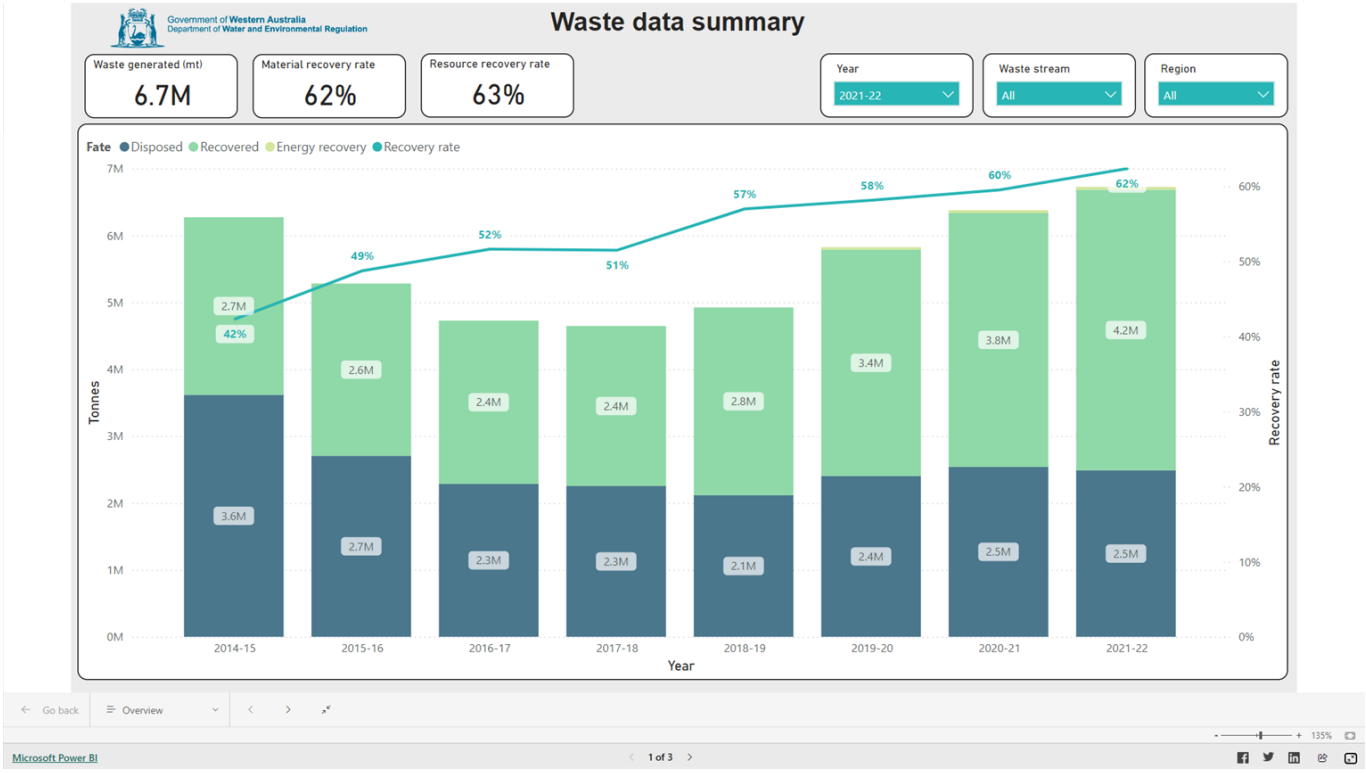
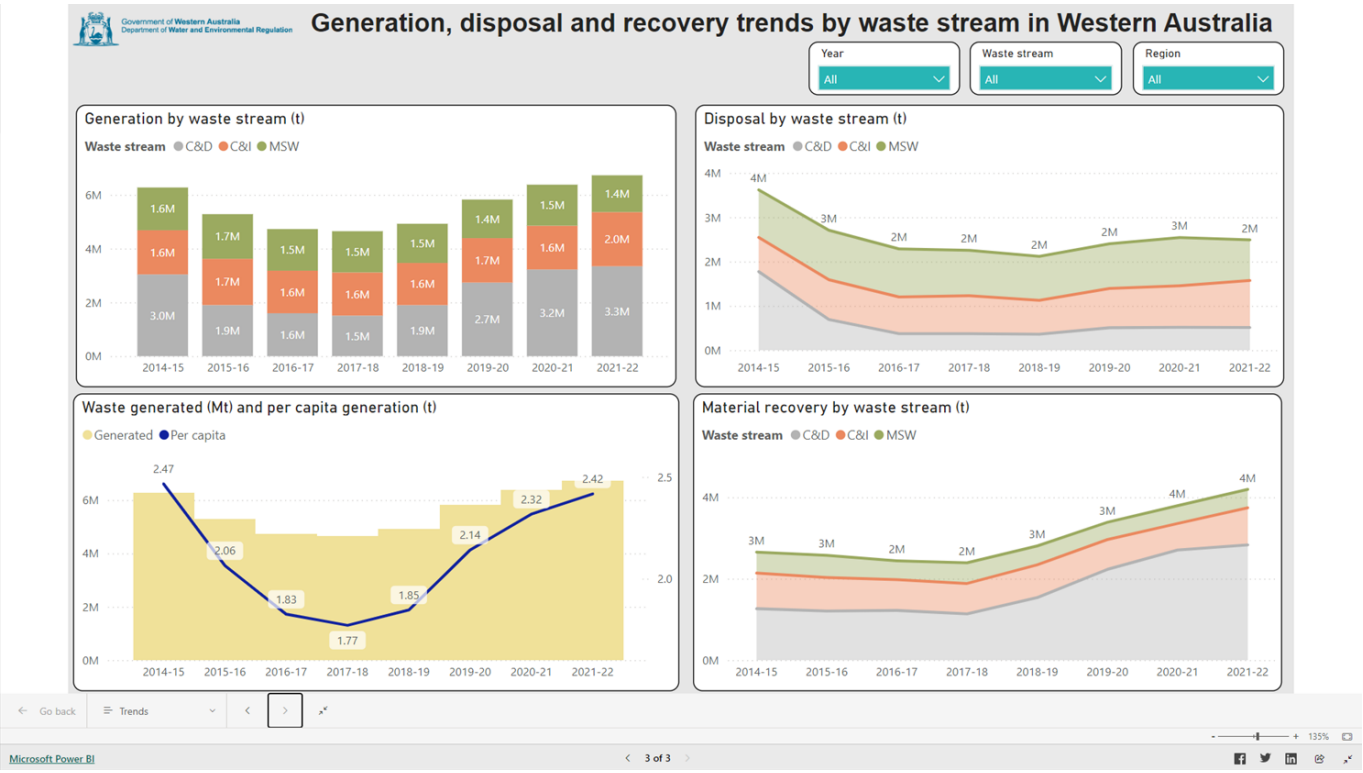


Figure 5 Example of WA 'Generation, Disposal, and Recovery Trends by Waste Stream in Western Australia' Data Viewer



Other jurisdictions do not offer online tools for the reporting and publishing of data; South Australian metropolitan and regional councils collect monthly data on residual waste (landfill), recyclables, and organics collected from the kerbside. The data is collated and presented to the public in an annual report. Some councils report their data as an aggregation of all Municipal Solid Waste (MSW), not just that which is kerbside collected, and so some elements of the data are adjusted for consistency across councils and the state. The methodology does not outline whether contamination is counted as residual waste or included in organics and recyclables. The state reports three metrics outlined below.

Figure 6 Metrics reported by the South Australia state

$$\text{3-Bin Recovery Rate} = \frac{\text{organics + recyclables}}{\text{organics + recyclables + residual}} \times 100\%$$

$$\text{Organics Recovery Rate} = \frac{\text{organics}}{\text{organics + residual}} \times 100\%$$

$$\text{Recyclables Recovery Rate} = \frac{\text{recyclables}}{\text{recyclables + residual}} \times 100\%$$

All waste material streams in metropolitan Adelaide and many regional councils in South Australia are weighed on weighbridges, giving a high accuracy to the data.

2.2.2.3 Supporting legislation/regulation

Legislation enforcing the reporting of waste data is decentralised, with each state managing its own jurisdiction. The legislative measures are outlined in the table below.

Table 6 Australian Jurisdictions and Associated Waste Legislation

State	Legislation	Description
Australian Capital Territory	Waste Management and Resource Recovery Act 2016 [36]	There appears to be no mandate for facilities to report data other than the national requirement to report on interstate transportation of hazardous waste.
New South Wales	Protection of the Environment Operations Act 1997[37]	Any waste facilities that are liable to the waste levy must report waste data on a monthly basis, reporting all waste received and waste sent for recycling.
Northern Territory	National Environment Protection Measure 1998	There appears to be no mandate for facilities to report data other than the national requirement to report on interstate transportation of hazardous waste.
Queensland	Waste Reduction and Recycling Regulation 2023 [38]	Any entity that receives, sorts, recycles, treats or disposes of over 1,000 tonnes of waste annually is subject to requirements on reporting.
South Australia	Environment Protection Regulations 2023[39]	Any waste facility that receives at least 20,000 tonnes of waste per year must provide data monthly on the mass of all solid waste, and volume of all liquid waste.
Tasmania	Waste and Resource Recovery Act 2022 [40]	Both Landfill and Resource Recovery Facilities must report data on a monthly basis.
Victoria	Circular Economy (Waste Reduction and Recycling) Act 2021[41]	Councils, waste storage facilities, and material recovery facilities are required to provide data to the state.

[36] ACT Government Legislation Register, *Waste Management and Resource Recovery Act 2016*, https://www.legislation.act.gov.au/a/2016-51
[37] NSW Government, Protection of the Environment Operations Act 1997, https://legislation.nsw.gov.au/view/html/inforce/current/act-1997-156
[38] Queensland Government, *Waste Reduction and Recycling Regulation 2023*, https://www.legislation.qld.gov.au/view/html/inforce/current/sl-2023-0127
[39] Government of South Australia, Environment Protection Regulations 2023, https://www.legislation.sa.gov.au/lz?path=/c/r/environment_protection_regulations_2023
[40] Tasmanian Government, Waste and Resource Recovery Act 2022, https://www.legislation.tas.gov.au/view/whole/html/asmade/act-2022-006
[41] Victorian Legislation, https://www.legislation.vic.gov.au/as-made/acts/circular-economy-waste-reduction-and-recycling-act-2021

State	Legislation	Description

Western Australia	Waste Avoidance and Resource Recovery Regulations 2008 [42]	The regulation requires several bodies to annually report data on the quantities of waste they have handled. This requirement is imposed upon:
		• All local governments who provide waste services[43]
		  ○ Total weight of waste collected
		  ○ Total weight of waste to landfill
		  ○ Total weight of waste recovered (by material)
		• Recyclers / reprocessing facilities who produce over 1,000 tonnes of reprocessed / recycled / recovered material[44]
		  ○ Total weight of waste received (by source sector)
		  ○ Total weight or volume of waste recycled or recovered
		  ○ Total weight or volume or percentage of processing losses
		  ○ Estimated weight of stockpiled waste
		• Landfills who receive over 20,000 tonnes of waste[45]
		  ○ Total weight of waste received (by source sector)
		  ○ Total weight of waste removed from the site, and its destination
		  ○ Total weight of waste disposed to landfill
		  ○ Total weight of stockpiled waste, both processed and unprocessed.

DCCEEW provides guidance on reporting waste data – the "Australian standard for waste and resource recovery data and reporting" (originally published by the Department of Agriculture, Water and the Environment), with a goal of achieving harmonisation across all states and alignment to this standard.[46]

[42] Government of Western Australia Department of Justice Parliamentary Counsel's Office, *Waste Avoidance and Resource Recovery Regulations 2008*, https://www.legislation.wa.gov.au/legislation/statutes.nsf/main_mrtitle_3568_homepage.html
[43] https://www.wa.gov.au/system/files/2023-06/ceon-warr-regulations-18d-liable-local-government.pdf
[44] https://www.wa.gov.au/system/files/2023-06/ceon-warr-regulations-18d-liable-recyclers.pdf
[45] https://www.wa.gov.au/system/files/2023-06/ceon-warr-regulations-18d-liable-non-metropolitan-landfills.pdf
[46] https://www.dcceew.gov.au/sites/default/files/documents/standard-wrr-data-and-reporting-final-issued-v2.pdf

2.2.3 Assessment of Metrics

Given the decentralised nature of waste data systems across Australia, DCCEW are making efforts towards harmonisation through regular review of their various standards. There are seven metrics which provide a national picture of waste management across Australia, and the data portals mentioned in the section above allow for further interrogation of the data. There is one per capita metric (waste generation), one metric in tonnes (return to productive use), and five rate-based metrics (recycling (national and local), resource recovery (national and local), and secondary material utilisation rates).

The metrics are relatively standard, although the presentation of national and local rates for recycling and recovery rates are novel. It would be beneficial to present other metrics in the same way as the ability to compare waste generation and other metrics may encourage jurisdictions to improve their waste management if performance is lower than others.

The per capita metric enables comparison between countries if what is included in the calculation is the same. For example, there are several considerations to make in terms of comparing MSW data for Australia and New Zealand. Australia only accounts for waste that enters the formal waste management system. While there is no official dataset used, New Zealand's waste figures have included contaminated soil and rural waste in total waste generation, whereas Australia classifies contaminated soil as hazardous and when rural waste ("pre-farm gate waste") stays on-farm or in farm fills, this is not included. Similarly, industrial monofils or any waste managed on-site are not included in reported figures. Another difference in waste management in Australia is that they have substantial volumes of ash produced by coal fired power plants, a waste stream that is much more limited in New Zealand (with Huntly the only power plant that has some of its generation capacity coal fired). Australian waste data is reported with the ability to include or exclude ash, enabling for a better comparison to waste in New Zealand (and other countries).

National waste data (that can be filtered by jurisdiction) is available to the public through data viewers which increase transparency and accountability of the jurisdictions in terms of waste management and associated targets in the 2019 National Waste Policy Action Plan. There are also data viewers for Queensland, New South Wales, and Western Australia with varying levels of ability for the user to interact with the data. While these data viewers help to hold local authorities and national governments to account, the public aspect of the data allows any interested party (individual, commercial, etc.) to interrogate waste data and understand their influence in waste management.

2.3 South Pacific

PacWastePlus is a multi-year programme funded by the European Union (EU) and implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP) with the aim of improving waste management across the Pacific nations. Its four key focus areas are:[47]

- **Improved data collection:** Improved data collection, information sharing, and education awareness
- **Policy & Regulation:** Development and implementation of policies and regulatory frameworks
- **Best Practices:** Enhanced private sector engagement and infrastructure development
- **Human Capacity:** Enhanced human capacity.

One element of PacWastePlus' work is assisting countries in managing their recyclable waste. In August 2023, the programme published the results of national waste audits it had undertaken for 14 countries, having recently developed a framework for waste data collection, monitoring and reporting.[48] This

[47] https://pacwasteplus.org/about-us/
[48] https://pacwasteplus.org/wp-content/uploads/2023/07/Regional-Waste-DCMR-Framework.pdf

framework sets out a series of recommended KPIs that will allow for consistent and comparable data collection across the region. As part of this, it recommends, as a priority, a national recovery rate should be calculated annually, with monthly data collection identified as best practice. Its definition of recovery is any activity that diverts waste management from landfill, including:

- Dry recycling
- Organics recovery
- Energy recovery.

This does not include any informal waste recovery activities, such as small-scale organics recovery or recycling.

The programme aimed to begin measuring each KPI in the waste audits conducted, however the current level of data availability led to a very limited capacity to measure metrics such as the recovery rate. In addition, several countries currently have a very limited capacity to recover waste, and as such the framework recommends that this KPI only be reported once the total amount of waste recovered reaches 5% of the total weight disposed.

2.3.1 Key Recycling Rate and Waste Metrics Used

2.3.1.1 Metric 1

As part of the PacWastePlus project, waste audits have been conducted for island nations across the Pacific region. Only a smaller number of these identify data that enables recovery rates to be calculated. In the 2023 National Waste Audit for Tonga, a recovery rate of 8.57% was calculated. This reflects an estimate 1,590 tonnes of waste being "recovered", of 18,553 tonnes disposed of. Two private sector companies carry out recycling in Tonga, collecting metals (aluminium, iron, steel, copper, brass and lead), e-waste, PVC, and some white goods. None of these materials are processed domestically but are exported for recycling. Records are not kept of the weight of recyclables collected, so the values used to calculate the national recovery rate stem from estimates made during interviews with the private waste companies. The value of the total weight of weight disposed of is estimated by the waste facilities that were identified during the national audit. Again, data is not recorded but rather estimates made when prompted by the audit process.

2.3.2 Assessment of Metrics

As outlined above, PacWastePlus has identified the need for countries in the South Pacific to calculate and report national recovery rates once the recovery is above 5%. There are many challenges including lack of data gathering for recycling and recovery as well as the need to export this material for these countries to reach and report a 5% recovery rate.

2.4 European Union

Municipal waste recycling rate reporting in Europe is driven by the Waste Framework Directive (WFD). The WFD is the leading piece of European Union (EU) legislation seeking to protect the environment and human health from the adverse impacts of waste. There have been several iterations of the directive;

1991 (91/156/EEC)[49], 2006 (91/689/EEC)[50], 2008 (2006/12/EC)[51], and 2018 (Directive (EU) 2018/851).[52] The most notable versions are from 2008 and 2018 as they outline specific calculation rules that are examined further in this section.

The reporting obligation of member states to the European Commission (EC, the executive arm of the EU) is based on the implementing decisions described in the introduction for European Council Directives 2008/98/EC (WFD) which was amended most recently by Directive (EU) 2018/851).[53,54] Member states are required to report their progress against the targets outlined in Article 11(2) of Directive 2008/98/EC to the EC, discussed further in Section 2.4.1.5.[55]

Member states are required to ensure compliance with the targets by calculating the weight of waste streams generated and those prepared for reuse, recycling, or subjected to other material recovery within a single calendar year. Municipal waste data is hosted publicly by Eurostat, the statistical office of the EU, who gather data through the EC. Eurostat has collected municipal waste generation and treatment data in the EU since 1995, collected in a joint questionnaire with the OECD.

2.4.1 Key Recycling Rate and Waste Metrics Used

2.4.1.1 Metrics to 2024 (Old Calculation Rules)

The 2008 version of the directive introduced a legally binding target for member states to meet a municipal waste recycling rate of at least 50% by weight by 2020. Definitions under this iteration are as follows:

- **Municipal Waste:** *"mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture"* and *"mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households".*

- **Recycling:** *"any recovery operation by which waste materials are reprocessed into products, materials, or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations".*

- **Preparing for reuse:** *"checking, cleaning, or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing".*

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[49] Official Journal of the European Communities (1991) Council Directive of 18March 1991 amending Directive 75/442/EEC on waste. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31991L0156&from=ES
[50] Official Journal of the European Union (2006) Directive 2006/12/EC of the European Parliament and Council of 5 April 2006 on waste. Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0009:0021:en:PDF
[51] EUR-LEX (2008) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Text with EEA relevance). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098
[52] Official Journal of the European Union (2018) Directive (EU) 2018/851 of the European Parliament and Council of 30 May 2018 amending Directive 2008/98/EC on waste. Available at: https://eur-lex.europa.eu/eli/dir/2018/851/oj
[53] EUR-LEX (2008) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Text with EEA relevance). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098
[54] EUR-LEX (2018) Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (Text with EEA relevance). Available at: https://eur-lex.europa.eu/eli/dir/2018/851/oj
[55] EUR-LEX (2008) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Text with EEA relevance). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098

Some considerations in terms of how the municipal waste definition would affect a national recycling rate for New Zealand are the inclusion of bio-waste and bulky waste. Bio-waste includes green waste collected from the private sector which would influence the national recycling rate significantly. Although bulky waste, like Auckland's inorganic collection for example, wouldn't influence the rate significantly it is unclear whether bulky waste would include one-off collections for households from services like Junk Run or skip bin collections. It is also worth considering the recycling definition which excludes the vast majority of timber diverted in New Zealand as it is used for fuel.

The old calculation rules allow member states to choose from four calculation methods outlined below.[56] Along with the data submission, member states must provide a quality report detailing the methods and sources of data used to calculate the amounts of waste generated and recycled, explaining how these figures correspond to the waste data to be reported.

Calculation Method One: Preparation for reuse and recycling of paper, metal, plastic and glass household waste

$$\frac{Amount\ recycled\ of\ paper;\ metal;\ plastic\ and\ glass\ household\ waste}{Total\ amount\ generated\ of\ paper;\ metal;\ plastic\ and\ glass\ household\ waste}$$

Under this metric, member states utilise national data for reporting. Data from other waste reporting obligations may be used and adapted to suit national conditions. This grants member states flexibility in utilising and leveraging existing waste management data (such as that collected to demonstrate compliance with the Landfill Directive)[57] to fulfil the reporting requirements. The policy recognises that MS have different waste management systems and allows the data to be tailored to reflect national circumstances and methodologies. In essence this reduces the administrative burden on member states with limited datasets.

This method targets key commonly recyclable waste materials from households only, facilitating clear and focused measurement. Its limited scope simplifies implementation and monitoring, ensuring consistency. However, by excluding other recyclable materials, it may underestimate overall recycling rates and provide a distorted view of overall performance. It also does not encompass all municipal waste as per the definition above.

Calculation Method Two: Preparation for reuse and recycling of paper, metal, plastic, glass household waste and other single types of household waste or similar waste

$$\frac{\begin{array}{c}Recycled\ amount\ of\ paper;\ metal;\ plastic;\ glass\ waste\ and\ other\ single\\ waste\ streams\ from\ households\ or\ similar\ waste\end{array}}{\begin{array}{c}Total\ amount\ generated\ of\ paper;\ metal;\ plastic;\ glass\ waste\ and\ other\ single\\ waste\ streams\ from\ households\ or\ similar\ waste\end{array}}$$

Under this metric, member states use national data and may adapt data from other waste reporting obligations to fit national conditions, more information on what this means is provided in the description of the previous calculation method. If home-composting is included the calculation method for these amounts must be explained in the quality report, clarifying how these amounts correspond to the data on household waste and other economic activities reported.

This metric offers broader coverage, resulting in a more comprehensive recycling rate. This flexibility allows for a fuller picture of recycling activities. However, it is more complex to implement and monitor,

[56] European Union (2011) Commission Decision of 18 November 2011 establishing rules and calculation methods for verifying compliance with the targets set in Article 11(2) of Directive 2008/98/EC of the European Parliament and of the Council. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011D0753
[57] EUR-LEX (1999) Landfill of waste. Available at: https://eur-lex.europa.eu/EN/legal-content/summary/landfill-of-waste.html

requiring detailed data collection and sorting processes, which can be challenging for member states with less developed waste management systems and data gathering processes.

Calculation Method Three: Preparation for reuse and recycling of household waste

$$\frac{Recycled\ amount\ of\ household\ waste}{Total\ amount\ of\ household\ waste\ excluding\ certain\ waste\ categories}$$

Under this metric, member states use national data to report the recycled amount of household waste. Waste codes 08.1 (discarded vehicles) and 11-13 (sludges and mineral wastes) are excluded from the calculation.[58]

The benefits of this metric lie in its inclusion of all household waste, providing a more complete assessment of recycling rates and a broader perspective on household waste and recycling efforts. However, the wide range of materials increases the complexity of data collection and reporting, making it more resource-intensive to monitor and verify compliance.

Calculation Method Four: Preparation for reuse and recycling of municipal waste

$$\frac{Municipal\ waste\ recycled}{Municipal\ waste\ generated}$$

Under this metric, member states rely on the statistical data on municipal waste reported annually to the EC/Eurostat. Member states reporting under this metric have the same amounts under the new calculation rules from 2025, applying to municipal waste under a stricter definition and a new higher recycling target, as outlined below.

This metric encompasses all municipal waste, offering the most holistic measure of recycling performance and aligning with broader waste management goals and policies, thereby ensuring consistency in reporting and compliance. However, its implementation is highly complex due to the extensive range of waste types included, necessitating rigorous data collection and accurate tracking of all municipal waste streams, which can be challenging for some municipalities and member states.

In the New Zealand context, municipal waste makes up 20-40% of waste sent to Class 1 landfills and is typically the only waste stream that local government plays a management role for. Although municipal waste metrics are commonly used they have limitations for use in practical purposes.

2.4.1.2 Metrics from 2025 (New Calculation Rules)

As part of the 2018 WFD update, significant amendments were made to the methodology for calculating, reporting, and verifying municipal waste recycling. These changes were made to harmonise methods across EU member states, ensuring consistent and transparent data for accurate comparisons. These changes supported the new recycling rate targets (55% recycling rate by 2025, 60% by 2030 and 65% by 2035), promoting a circular economy by improving the quality and effectiveness of recycling efforts. The new rules also enhance compliance monitoring and enforcement by the EC, while ensuring data accuracy and reliability to inform effective waste management policies. These revisions do not become mandatory until reporting is due for the reference year 2024 in time for the application of higher recycling targets in 2025. As a result, the previous rules around calculations against the 2020 recycling targets are still in force.

The 2018 version with a set of new stricter definitions:

[58] These codes can be found in the European waste catalogue: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:253:0002:0041:EN:PDF

- **Municipal waste:** *"mixed waste and separately collected waste from households including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture"* and *"mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households"*

This definition excludes waste from production, agriculture, forestry, fishing, septic tanks and sewage network and treatment, including sewage sludge, end-of-life vehicles, and construction and demolition waste.

Under the new rules, member states can determine the quantity of recycled waste either at the calculation or the measurement point. Under the old rules the calculation point was different for each method, which led to discrepancies in reporting and the negation of any significant losses at the reprocessing stage prior to the final recycling activity and overestimated recycling activities.

- **Calculation point:** *"the point where municipal waste materials enter the recycling operation whereby waste is reprocessed into products, materials or substances that are not waste or the point where waste materials cease to be waste, as a result of a preparatory operation before being reprocessed".*

The calculation point can be thought of as the figure that has been calculated as the amount of material that will become new products where factors or adjustments (like losses) have been taken into account. For example, if 100kg of glass has been sorted at a materials recovery facility (MRF) and is ready to be reprocessed, and the reprocessing facility has reported an average contamination rate of 10%, the calculation point would be 90kg.

- **Measurement point:** *"the point where the mass of waste materials is measured with a view to determining the amount of waste at the calculation point".*

The measurement point can be thought of as the figure that measures the amount of material that will be sent to a reprocessing facility. For example, if 100kg of glass has been sorted at a materials recovery facility (MRF) and is ready to be reprocessed, the measurement point would be 100kg.

The difference between the two reporting points is that the measurement point is the gross amount of material whereas the calculation point uses the measurement point with applied factors and adjustments like average loss rates (ALR).

ALRs are used to account for any subsequent losses prior to the final reprocessing. Member states have the option to utilise ALRs when quantifying the amount of municipal waste recycled. This provision allows for the use of ALRs in cases where obtaining reliable data is challenging, such as in waste shipment and export contexts. However, ALRs should only be applied when no other dependable data on the weight of waste at the calculation point are available. If ALRs are employed, a comprehensive explanation of the calculation approach must be provided in the quality report, including details on applicable waste streams, sorting plant types, methodological approaches, and technical specifications. The Commission's Delegated Decision on ALRs has not been implemented yet; forthcoming versions are expected to offer more details on the published legal act.

2.4.1.3 How the Data is Gathered and Managed

2.4.1.4 Agencies responsible

The OECD is an intergovernmental organisation with 38 member countries, founded in 1961 to stimulate economic progress and world trade.[59] Established in 1953, Eurostat is the statistical office of the EU, whose

[59] OECD (2024) Who are we. Available at: https://www.oecd.org/about/

main purpose is to provide the EU with data comparisons between member states and regions.[60] The European Commission supports the delivery of municipal waste statistics within the Eurostat and the OECD Joint Questionnaire (JQ), which is composed of four tables. Table 1 'Municipal waste statistics', Table 2 ' Material breakdown' (this became mandatory from the reference year 2020, Table 3 'Recycling Rate' (this can only be used up to reference year 2025), and Table 4 'Landfill Rate'. Member states must complete the tables as well as their corresponding quality report before submission. The OECD first established the data collection in 1980, with Eurostat joining the exercise in 1988. Data is gathered in the questionnaire from OECD member countries, including EU member states and other nations.

2.4.1.5 IT systems/reporting mechanisms

The standard tool installed by the National Statistical Institutes for the transmission of statistical data, is the eDAMIS system, which creates a secure environment for the transmission of data. It records all data submissions and acknowledges the data delivery. Member states completed Table 3 under the old calculation rules and Table 2 under the new rules for the reporting of their municipal waste recycling rates.

Figure 7 EU Format for Data Reporting Under 'Old Rules'

Table 3 - Recycling rate for measuring compliance with the policy target according to point (a) of Article 11(2) of Directive 2008/98/EC, according to the format set out in Annex IV of the Commission Implementing Decisions 2019/1004 - to be filled in only by the Member States wanting to prove compliance with the old targets until 2025 using the old rules						
Country:						
Reference year:	**2020**					
Calculation method[1]		*<= Select the calculation method here*				
	Municipal waste generated [2]	**Standard footnotes**	**Explanatory footnote**	**Preparing for re-use and recycling**[2]	**Standard footnotes**	**Explanatory footnote**
	GEN			RCY_PRP_REU		
Tonnes						

Figure 8 EU Format for Data Reporting Under 'New Rules'

Table 2 - material breakdown according to Implementing Decision 2019/1004/EC Annex V																				
Country:																				
Reference year:		**2020**																		
Codes	**Municipal waste**	**List of Waste codes (LoW) (for generated amounts only)**	**Municipal waste generated (tonnes)**[1]	**Standard footnotes**	**Explanatory footnote**	**Separate collection**[8] **(tonnes)**	**Standard footnotes**	**Explanatory footnote**	**Preparing for reuse (tonnes)**	**Standard footnotes**	**Explanatory footnote**	**Recycling (tonnes)**	**Standard footnotes**	**Explanatory footnote**	**Energy recovery (tonnes)**[2]	**Standard footnotes**	**Explanatory footnote**	**Other recovery (tonnes)**[3]	**Standard footnotes**	**Explanatory footnote**
			GEN			COL_SEP			PRP_REU			RCY			RCV_E			RCV_OTH		
TOTAL	**Total**																			
W063_122_MUN	**Metals**	20 01 40, 15 01 04, 15 01 11*																		
W063_122_MUN_INC	**Metals seperated after incineration of waste**[4]	20 01 40, 15 01 04, 15 01 11*																		
W071_MUN	**Glass**	20 01 02, 15 01 07																		
W074_MUN	**Plastic**	20 01 39, 15 01 02																		
W072_MUN	**Paper and cardboard**	20 01 01, 15 01 01																		
W091_092_MUN	**Bio-waste**	20 01 08, 20 01 25, 20 02 01																		
W091_092_MUN_S	**Bio-waste seperated and recycled at source**[6]	20 01 08, 20 01 25, 20 02 01																		
W075_MUN	**Wood**	20 01 37*, 20 01 38, 15 01 03																		
W076_MUN	**Textiles**	20 01 10, 20 01 11, 15 01 09																		
W082_84_MUN	**Electrical and electronic equipment**	20 01 21*, 20 01 23*, 20 01 35*, 20 01 36																		
W0841_MUN	**Batteries**	20 01 33*, 20 01 34																		
W1011_MUN	**Bulky waste**[6]	20 03 07																		
W1011_1021_MUN	**Mixed waste**	20 03 01, 15 01 06																		
MUN_OTH	**Other**	See below[7]																		

Notes:

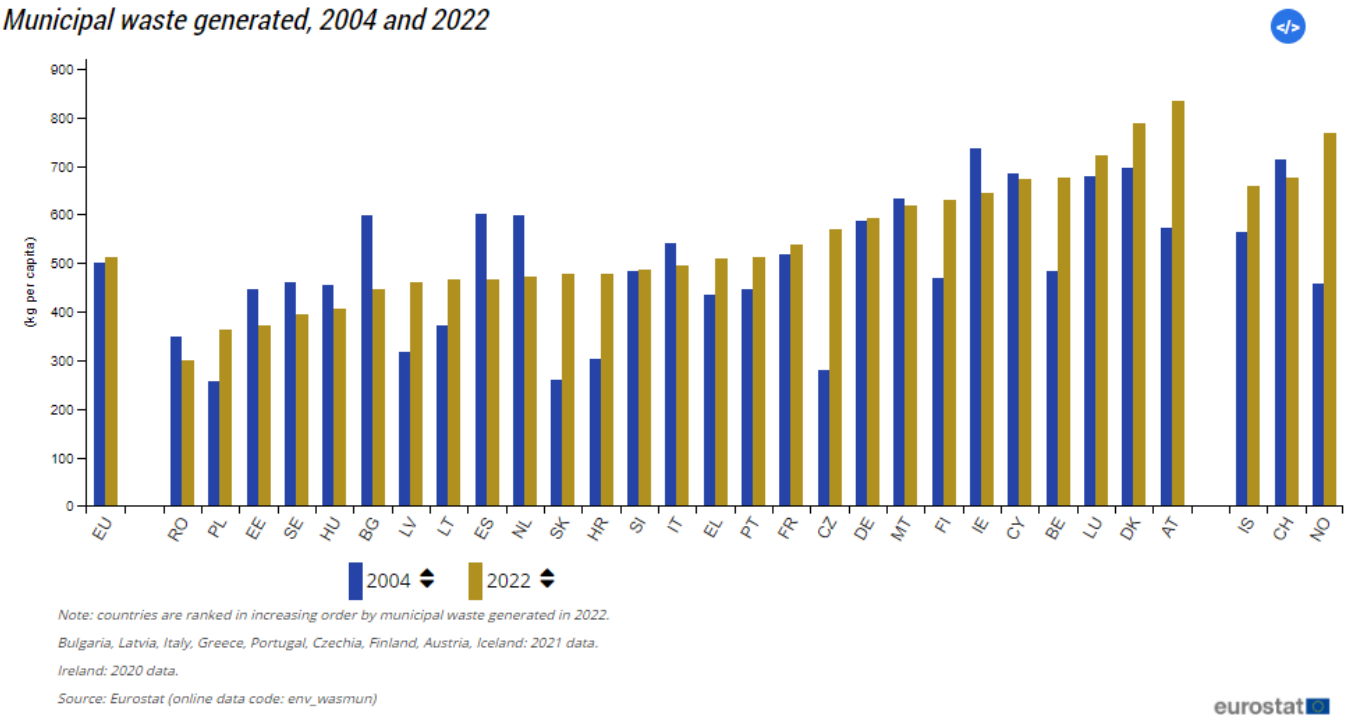
Cell shading:

White: Data provision is required.
Light blue: provision of data is voluntary.
Light orange: Footnotes (only to be filled-in when relevant)
Black: Reporting is not applicable.

[60] Eurostat (2009) Eurostat – The statistical office of the European Union. Available at: https://unstats.un.org/unsd/wsd/docs/Eurostat_wsd_history.pdf

Figure 9 Example of Eurostat MSW Per Capita Data Viewer

The data is shared on the Eurostat website and has some basic charts and tables.[61,62] The information is for 2004 and 2022 only and is the MSW generated in kg per capita.



2.4.2 Assessment of Metrics

This section has outlined the 'old' and 'new' calculation rules and metrics that will be used from 2025 as per the WFD legislation by the EU. The WFD outlines a harmonised methodology, which ensures consistency and comparability across member states. This standardisation is crucial for accurately assessing and comparing the performance of different countries. The framework is comprehensive, encompassing all types of municipal waste, and includes clear definitions and guidelines to reduce ambiguities. Additionally, stricter definitions and guidelines on what constitutes recycling and how it should be measured have been provided. This clarity helps reduce uncertainties and ensures member states follow a uniform approach. The new rules emphasise the measurement of actual recycling (the sum at the calculation or measurement point), rather than collection (as was the case in the old methods), ensuring that the recycling rates reflect the amount of waste actually processed and converted into new materials. It has been noted that the terms 'calculation point' and 'measurement point' are not commonly used in New Zealand and would need to be clarified to people generating and collecting data (definitions and examples are provided previously in section 2.4.1.2).

Although there have been great efforts to harmonise data, given that the EU has 27 member countries, it is still likely that there will be discrepancies. In particular the definition for MSW isn't exhaustive and has room for interpretation regarding materials that are typical of C&D or C&I arise from households (e.g. wood, rubble, soil) or when materials typical of MSW arise in large quantities from non-household sources. It is also important to note that 22 EU members are also OECD members, and the OECD has a different definition of MSW which leads to more confusion about which definition these members should use.

[61] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Municipal_waste_statistics#Municipal_waste_generation
[62] Country codes can be found here: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Country_codes

The data collected by Eurostat is used for metrics of household waste and municipal waste, although only municipal waste per capita is presented on the Eurostat online data viewer and it is relatively basic. The data viewer shares a chart comparing EU member countries and has the MSW per capita metric for 2004 and 2022, a table with (inconsistent) MSW per capita data between 1995 and 2022, and a chart showing municipal waste in the EU by treatment over time. Data from the EU is also shown on the OECD Data Explorer (more detail on OECD in the upcoming section 2.7) which provides metrics including per capita rates and is more interactive. Per capita rates are important as they provide figures that can be compared with various countries and give better insight into what the reported numbers actually represent in terms of waste management.

The new calculation rules offer reporters to choose at what point data should be collected (the calculation or measurement points) which should not differ greatly, depending on the associated losses. At this point in time New Zealand reporting does not consider the calculation and measurement points; data is typically only captured when material has been delivered to a transfer station, MRF, or landfill, or sent from a MRF for reprocessing (although new TA waste reporting will require estimates of contamination in recycling collections). Another consideration for New Zealand to keep in mind if wanting to compare MSW metrics to EU countries is that the EU's definition of MSW excludes C&D.

By setting ambitious recycling targets, the EU encourages member states to enhance their waste management systems and adopt practices that support a circular economy, contributing to resource efficiency and sustainability. It is important to acknowledge the waste hierarchy here as the upper tiers (prevent, reduce, reuse) are not accounted for in recycling rates so they don't offer a holistic insight into sustainability or circularity. Taking this on board, it would be more meaningful to see decreasing per capita rates for recycling and disposal, as an increase in the ratio (recycling rate) is not necessarily attributable to resource efficiency.

Nevertheless, despite its strengths, there are notable weaknesses in the methodology. One significant issue is the variability in national implementation, which can affect data accuracy and comparability due to differences in local practices, infrastructure, and interpretation of guidelines. Collecting accurate data on waste generation and recycling is challenging, with potential discrepancies arising from informal recycling activities, mixed waste streams, and varying levels of monitoring and enforcement. Furthermore, the focus on weight-based reporting may accentuate the influence of heavier materials, which may or may not correlate with waste reduction priorities. For instance, plastic is lightweight (so constitute a relatively small part of overall waste tonnage) but can breakdown and cause disproportionate harm and pollution in the sea and waterways. There is also a risk that member states might manipulate their recycling statistics to meet targets, involving practices like exporting waste for recycling without ensuring it is properly processed or counting waste recovery processes that do not meet the strict recycling criteria. Moreover, the methodology does not adequately differentiate between high-quality recycling and downcycling (where materials are recycled into lower-quality products), which can give an overly positive impression of the recycling rates without reflecting the actual value retained in the materials. The detailed reporting and monitoring requirements can impose significant administrative burden on member states, particularly those with limited resources, leading to inconsistencies in compliance.

The EU measures focus on municipal waste meaning it does not cover all waste streams. The risk is that what is measured is what is managed. Attention and resource could be diverted away from areas where significant performance improvements are possible but won't add to the recycling rate statistics to areas where the gains may be more marginal, but they are included in the statistics. Similarly, recycling targets encourage member states to increase the quantity of materials recycled, neglecting the upper tiers of the waste hierarchy.

2.5 United Kingdom

2.5.1 How the Data is Gathered and Managed

2.5.1.1 Overview

In the UK, municipal waste policy is a devolved matter meaning that England, Scotland, Wales, and Northern Ireland are responsible for their own municipal waste management and reporting.[63] There are therefore four different recycling rates calculated across the different nations as well as UK-wide reporting for municipal waste. There are several consistencies in these approaches, and all local authorities (LAs) across the UK are required to report information on waste type and quantity collected using a web-based system called WasteDataFlow that was implemented in 2004.[64] The data collected on this platform is used to inform national and UK waste statistics, including reporting to the OECD.

The metrics on WasteDataFlow will be discussed in more detail in the further sections. Given that the data provided by LAs is varied, the metrics do not have per capita contexts, and there is no visibility of waste managed by the private sector, the amalgamated data has issues. How countries within the UK define municipal waste is included in Table 7.

There are different recycling rate targets across the UK, and different strategies and metrics to measure progress against these targets which has led to some inconsistency when trying to compare performance between individual nations.[65,66,67,68] For example, there are differences in what is included in the calculation of waste arisings, or in what counts as recycled so it is not always possible to compare figures on a like-for-like basis. This also means that there are significant differences in how recycling rates and quantities are calculated across countries within the UK. In order to calculate the UK's overall recycling rate (the Waste from Households (WfH) figure described below) each question in the WasteDataFlow system is coded with its relevance to the WfH figure so that only the relevant data is included in the calculation.

2.5.1.2 Agencies responsible

LAs have a statutory duty to manage and report on household waste in their areas, including providing services for the collection and deposit of this waste in their area. If requested, local authorities also have the responsibility to arrange for commercial waste collection from business premises or non-domestic properties in their area. In practice LAs contract out their services to private operators, and so these commercial collections are subcontracted to commercial operators who collect material for council business customers alongside their other commercial routes. Some councils engage in bulk purchasing on behalf of small business which enables efficiencies and a lower rate to be offered to businesses.

LAs can fulfil their statutory duty through kerbside collection, bulky waste collection, bring banks (termed drop-off facilities in NZ) or household waste recycling centres (HWRCs). They are also responsible for dealing with litter in public spaces, including, highways and roads.[69] In practice LAs commonly collect small commercial waste quantities, while industrial waste is collected by private operators.

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[63] Defra (2012). Local Authority Waste statistics - Recycling measures. Accessed at: https://assets.publishing.service.gov.uk/media/641acd558fa8f547cab4480d/Recycling_Explainer.pdf
[64] WasteDataFlow (2024). Accessed at: https://www.wastedataflow.org/
[65] https://www.gov.uk/government/statistics/estimates-of-residual-waste-excluding-major-mineral-wastes-and-municipal-residual-waste-in-england/estimates-of-residual-waste-excluding-major-mineral-wastes-and-municipal-residual-waste-in-england
[66] https://www.daera-ni.gov.uk/articles/waste-management-strategy
[67] https://www.gov.scot/policies/managing-waste/
[68] https://www.gov.wales/new-waste-and-recycling-stats-published-today
[69] Litter and refuse: council responsibilities to keep land clear - GOV.UK

All other waste, including commercial waste not collected by LAs, is collected and managed by private companies who are not required to report data on waste type and quantity through WasteDataFlow. This means that any waste collected by private companies (like commercial waste or private skips for household waste) are estimated.[70] It is important for both public and private sector waste data to be collected to provide the full picture of waste management especially when used for benchmarking and comparisons with other countries. The UK is planning to introduce mandatory digital waste tracking in 2025 as a mechanism to fill the current data gaps on private waste collections and to enable tracking of waste movements in real time.[71] Given we don't know the extent of private market share in the UK it removes the ability to compare MSW metrics. In New Zealand, the Ministry for the Environment (MfE) collects disposal data from landfills, which must be registered and provide data whether they are public or private. MfE is starting to collect data on collection services and recovery facilities that are publicly owned or operated however fully private services or recovery facilities are not actively monitored.

Once the data is collected from LAs, the Department of Environment Food and Rural Affairs (Defra) with assistance from the Environment Agency conduct data quality assurance checks before publishing the data quarterly and annually on behalf of the UK Government. These quality assurance checks look for consistency in the data and help Defra identify any potential outliers or reporting errors.

2.5.1.3 IT systems/reporting mechanisms

LAs are required to report quarterly (only annually in Scotland) on their data on waste type and quantity collected across the UK. They do this by uploading their waste collection and disposal tonnage data to the WasteDataFlow system. This produces the data source used to produce the various recycling rates and waste statistics for the UK.

The WasteDataFlow system is a web-based system introduced in 2004 to the UK, to replace the old, often repetitive system of municipal waste management questionnaires used to report municipal waste data by LAs to the UK Government.[72] WasteDataFlow acts as the data collection system for the current Defra Municipal Waste Management Survey in England and similar surveys in Wales, Northern Ireland and Scotland. This system can be seen as an example of good practice as it aims to promote accurate and regular data collection, transparency of LA activities, and it acts as an evidence base to inform waste policy and targets. There is guidance for LAs and a help desk available.

The data collected covers kerbside recycling, residual waste collections, HWRCs and sometimes other collection routes like bulky waste collection. The portal aims to capture waste quantities at all stages including processing, sorting and treatment as well as accounting for the removal of contamination. Each of the four UK countries produces national statistics from the WasteDataFlow data and uses this to measure performance against their separate recycling targets. LAs in the four countries input the same core information into the system however the questionnaires differ slightly between the countries and the waste categories reported by each country are outlined below.[73]

The data is published quarterly and annually (only annually in Scotland) by the relevant departments, Defra, StatsWales, Department of Agriculture, Environment and Rural affairs (DAERA), and the Scottish Environment Protection Agency (SEPA). The published data is freely available, and the raw data can be accessed freely after registering for an account on WasteDataFlow. The data can be accessed in the form of both summarised reports and as raw data, broken down by local authority for each quarter period, but is only made available once verified by Defra, for example, the dataset that was published in January 2024 contains data for the year April 2022- March 2023. The deadline for submitting the data for

[70] https://www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste
[71] Defra (2023) Mandatory Digital Waste Tracking Policy Paper. Available at: https://www.gov.uk/government/publications/digital-waste-tracking-service/mandatory-digital-waste-tracking
[72] WasteDataFlow (2024). Accessed at: https://www.wastedataflow.org/
[73] Defra (2023). National Statistics on Local Authority Collected Waste in England - Methodological Summary. Available at: https://assets.publishing.service.gov.uk/media/65b91d904ec51d000dc9f19d/Methodology_summary_202223_rev.pdf

each quarter is three months after the end of the quarter. It has been reported that there are often issues with late data submissions which has delayed the publication of the statistics.[74]

The data from WasteDataFlow is publicly available. Therefore, there are some commercial sensitivities it has to consider. For all four UK countries, the data is available at a local authority level. This means that individual companies are not named and therefore the data cannot be interrogated at a company level.

2.5.1.4 Supporting legislation/regulation

There are a number of policy instruments that provide regulations on waste management across the UK. The EU Waste Framework Directive (2008/98/EC) provides the overarching policy and legislative framework for UK waste management, including common waste definitions.

There are different duty of care regulations relating to waste across the UK that apply to importers, producers, carriers, storage facilities, treatment facilities, disposal facilities, dealers and brokers of certain waste. The waste duty of care regulations are as follows:

- **The Waste Duty of Care - Code of Practice** (England and Wales)[75]
- **Waste Management Duty of Care - Code of Practice** (Northern Ireland) [76]
- **Duty of Care – A Code of Practice** (Scotland)[77]

The duties of care also apply if the waste activities are authorised or registered in one country but dealt with in another, for example if the waste originates from an LA in Scotland but is dealt with in England. The WasteDataFlow guidance sets out clear guidelines and rules for LAs across the UK for what data they should report on, and how they do it.[78] The data is used to measure progress against targets from various waste strategies which are summarised in Table 6.

Table 7 Summary of Recycling Targets Across the UK

Country	Waste Strategy	Recycling targets
England	Resources and Waste Strategy[79]	By 2025, at least 55% of municipal waste must be recycled, with the target increasing to 65% by 2035.

[74] Defra (2023). National Statistics on Local Authority Collected Waste in England - Methodological Summary. Available at: https://assets.publishing.service.gov.uk/media/65b91d904ec51d000dc9f19d/Methodology_summary_202223_rev.pdf
[75] Defra (2016). Waste duty of care: code of practice. Accessed at: https://www.gov.uk/government/publications/waste-duty-of-care-code-of-practice
[76] Daera (2016). Waste Management The Duty of Care – A Code of Practice. Accessed at: https://www.daera-ni.gov.uk/publications/waste-management-duty-care-code-practice
[77] Natural Scotland (2012). Duty of Care – A Code of Practice. Accessed at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2012/10/duty-care-code-practice/documents/00404095-pdf/00404095-pdf/govscot%3Adocument/00404095.pdf
[78] WasteDataFlow (2024). WasteDataFlow Guidance. Available at: https://www.wastedataflow.org/htm/datasets.aspx
[79] Defra (2024). Resources and Waste Strategy: Monitoring Progress. Available at: https://assets.publishing.service.gov.uk/media/663a23391c82a7597d4f31fc/Monitoring_Progress_4th_edition_May_2024.pdf.

Country	Waste Strategy	Recycling targets
Scotland	Scotland's Zero Waste Plan[80]	Minimum of 60% recycling of household waste by 2020 (which was 42% (i.e. not reached) in 2020 due to Covid impacts), and a minimum of 70% of recycling of all waste by 2025.[81]
Wales	Beyond Recycling[82]	To recycle a minimum of 64% of municipal waste by 2025.
Northern Ireland	Northern Ireland Waste Management Strategy[83]	To recycle 50% of household waste by 2020 (which was reached at 50.0% but lower than the previous financial year). New strategy in development.[84]

2.5.2 Key Recycling Rate and Waste Metrics Used

There are three main metrics used to calculate municipal waste recycling across the UK in national statistics/publications:

1. **Waste from households (WfH)**
2. **Household waste**
3. **Local authority collected municipal waste**

The measures are described separately below. There are significant differences in the calculations of these measures between the four UK nations, which are highlighted in Table 7. For example, metals recovered from incinerator bottom ash count towards the recycling targets in Wales, but not other nations - this is in line with the EU methodology which also allows metals from IBA to count towards recycling targets.

Across the UK, and in all three metrics described in this section, the recycling rate is calculated as the tonnage of material recycled, as a percentage of the total tonnage of relevant material collected.

[80] Natural Scotland (2010). Scotland's Zero Waste Plan. Available at: https://falkirk.gov.uk/services/bins-rubbish-recycling/trade-waste/docs/Zero%20Waste%20Plan%20(Scotland).pdf?v=201906271131
[81] Scottish Government (2022). Delivering Scotland's circular economy - route map to 2025 and beyond: technical annex. Available at: https://www.gov.scot/publications/technical-annex-delivering-scotlands-circular-economy-route-map-2025-beyond/pages/2/
[82] Welsh Government (2021). Beyond Recycling. Available at: https://www.gov.wales/sites/default/files/publications/2021-03/beyond-recycling-strategy-document.pdf
[83] DAERA (2020). Waste management strategy. Available at: https://www.daera-ni.gov.uk/articles/waste-management-strategy#:~:text=The%202013%20Strategy%20moved%20the,their%20use%20on%20the%20environment.
[84] https://www.daera-ni.gov.uk/news/northern-ireland-local-authority-collected-municipal-waste-management-statistics-released-24

Material is considered 'recycled' at the point at which it is accepted by a processing facility, i.e. the tonnage of waste sent for/prepared for reuse, recycling, and composting (inc. anaerobic digestion). The data reported by LAs breaks down the quantities of waste by material (e.g. glass, plastic, etc.) and excludes rejected material from collection or sorting of the waste, as well as any material sent for incineration or landfill. The rejected material can be anything rejected at the sorting or re-processing stage where it is either contaminated with food residue or if it is non-target material. The tonnage calculated as 'recycled' also includes materials diverted to recycling from the residual stream.

For all three metrics described further below, the recycling rate is calculated as tonnage of waste sent for reuse, recycling and composting, as a proportion of the total tonnage of waste collected within scope as shown in the calculation below. The sections below show how the tonnage of material recycled can vary across UK countries.

$$Recycling\ rate\ (\%) = \frac{Tonnage\ of\ material\ recycled}{Tonnage\ of\ material\ collected} * 100$$

Table 8 Comparison of Waste Metrics Reported Across the UK[85]

Collection types made by local authorities and specified materials	All UK countries (a) 'Waste from households'	Wales (b) national 'Household waste'	Wales (b) national 'Local authority municipal waste'	England (c) 'Household waste'	England (c) 'Local authority collected waste'	Northern Ireland (d) 'Household waste'	Northern Ireland (d) 'Local Authority Collected Municipal Waste'	Scotland National (e) 'Household waste'
Residual & recycling collected waste – from kerbside, HWRC, bulky, bring banks & other household sources.	✓	✓	✓	✓	✓	✓	✓	✓
Parks & grounds	×	✓	✓	✓	✓	✓	✓	×
Street Cleaning which may inc gully emptying wastes	×	✓	✓	✓	✓	✓	✓	×
Street Bins	×	✓	✓	✓	✓	✓	✓	×
Separately collected healthcare waste	×	✓	✓	✓	✓	✓	✓	×
Commercial collections	×	×	✓	×	✓	×	✓	×
Beach cleansing	×	×	✓	×	✓	×	✓	×
Clearance of fly-tipped materials	×	×	✓	×	✓	×	✓	×
Other 'non-household' waste categories in WasteDataFlow	×	×	✓	×	✓	×	✓	×
Asbestos waste	×	✓	✓	×	×	✓	✓	×
Soil	×	✓	✓	✓	✓	×	✓	✓
Rubble & plasterboard	×	×	✓	×	✓	×	✓	✓
Ash recovered after incineration	×	✓	✓	×	×	×	×	×
Metal recovered after incineration	✓	✓	✓	×	×	×	×	×

2.5.2.1 Metric 1: Waste from households (WfH)

This measure is the UK's interpretation of the European Commission's definition of household waste, which is waste generated by households. It is the most consistent measure used across the UK nations and is therefore used most often as the measure to accurately compare household waste statistics between England, Scotland, Wales and Northern Ireland. This rate includes rubbish and recycling collected from kerbside, HWRCs, bulky waste collections, bring banks (drop-off facilities) and other household sources but excludes all other waste types like street bins and commercial collections.

[85] Defra (2012). Local Authority Waste statistics - Recycling measures. Accessed at: https://assets.publishing.service.gov.uk/media/641acd558fa8f547cab4480d/Recycling_Explainer.pdf

2.5.2.2 Metric 2: Household waste

This metric incorporates the WfH metric described above but includes some additional waste types and differs between UK nations. For Wales, England and Northern Ireland it also includes waste collected from parks, street cleaning, street bins, and other sources, while in Scotland only residual and recycling waste collected from households is considered, as per Metric 1 above. This metric is used to track progress against each UK nation's respective recycling targets. For all four UK countries, commercial collections, beach cleansing and fly-tipped materials are excluded from this measure.

2.5.2.3 Metric 3: Local authority collected waste

This metric is referred to as 'local authority collected waste' in England, and 'local authority collected municipal waste' in Northern Ireland and Wales. This measure includes most waste types across Wales, England and Northern Ireland but there are some differences. Scotland does not report on this metric. In England, Wales and Northern Ireland, this measure includes non-household waste. In England, asbestos, incinerator ash and incinerator metal are excluded. In Northern Ireland only the incinerator ash and incinerator metal are excluded, and in Wales all waste types are included.

2.5.3 Assessment of Metrics

The use of the national reporting system WasteDataFlow enhances transparency in the process of reporting waste data throughout the waste management system across the UK. The platform attempts to calculate not only what is collected but how much is lost throughout the sorting processes to create more accurate data, which is similar to the EU measurement and calculation points. There is clear guidance available on how to use the platform and the data is publicly available meaning it is well used by reporters and those interested in interacting with waste data. There are currently inconsistencies between data collection and reporting by the devolved nations making direct comparisons difficult and inaccurate. If the data was more consistent it would also be beneficial to add a per capita metric to better compare performance between LAs and identify challenges and opportunities for waste management.

The data does not consider private sector waste which means that the data is not comprehensive. Although the UK is planning to implement mandatory digital waste tracking to reduce data gaps from the private sector. Currently, any waste data for private collections is collected through surveys, however the most recent survey for Wales was 2018 and for the rest of the UK was 2013. This shows how outdated this data is, and how necessary it is to introduce the electronic waste tracking system and have businesses reporting waste data online. It is also a known challenge for UK LAs to report on business/non-household waste data, which would be necessary to get a more complete picture of the overall municipal waste recycling rate.[86]

Waste reporting is carried out annually but there are limited sanctions on misreporting to WasteDataFlow, and no stringent quality assurance measures in place to detect these. The figures are checked against the previous year to ensure there are no large or unexplained divergences in the overall trend, but otherwise there is room for misreporting. The data accuracy is limited by the data management, technical capacity, and varied interpretations of the LAs and waste operators, which the guidance does some way towards mitigating, but there may still be errors.

Data is publicly available from WasteDataFlow where users need to provide an email address and password to access it. Instructions on how to use the data portal is sent by email and reports can be run and downloaded in .xls format. It is difficult to navigate and has no interactive data viewers.

[86] Municipal waste is defined as both household waste and waste which is similar in composition and nature (including both household waste and a significant proportion of waste generated by businesses and not collected by Local Authorities).

In England and Wales, the Environmental Permitting Regulations require sampling of mixed waste at material facilities from each supplier.[87] The frequency and size of the sample depends on the material type and is based on how many tonnes are received but the reporting frequency is quarterly. This will produce data on the quantities of non-target material and the relative purity of the output at these facilities. The updated regulations will come into force from October 2024 to include more materials facilities. The data collected through this sampling would be useful data to combine with the information from LAs, to compare with the figures for waste lost during the process. This would be an example of best practice; however, currently there is limited reporting from these regulations.

As with the EU and OECD reporting the focus on municipal waste potentially relegates the importance of non-municipal waste streams. It is also clear that there are issues in terms of the consistency of data and what is included in the metrics used. Finally, as with the EU focusing on recycling risks neglecting the upper tiers of the waste hierarchy.

[87] UK Government (2023). The Environmental Permitting (England and Wales) (Amendment) Regulations 2023. Available at: https://www.gov.uk/guidance/materials-facilities-waste-sampling-and-reporting-from-october-2024

2.6 United States

2.6.1 Environmental Protection Agency Facts and Figures – Industry Based Reporting

There is no official national recycling rate for municipal solid waste (MSW) published for the US that is publicly available, although the United States Environmental Protection Agency (EPA) has publicly available data on municipal solid waste (MSW) generation and disposal within the US from 1960-2018 through 'Facts and Figures' reports.[88,89,90] The last year that is included in the OECD reporting from the US is also 2018 which is thought to be due to the OECD report relying on data from 'Facts and Figures' reports.[91] It is understood that the EPA is focusing on revamping their methodology and making the process of data collection and reporting automated, hence why reports ceased from 2020 onward.

The metric that the EPA uses shows the overall recycling rate of MSW below:

$$Recycling\ rate\ (\%) = \frac{Tonnage\ of\ material\ recycled}{Tonnage\ of\ material\ generated} * 100$$

'Tonnage of material recycled' refers to the tonnage of material sent to a processing facility. For plastics, this would mean a plastic recycler, whereas for paper this would refer to a paper mill. For materials collected in commingled bins, this would refer to the step after sorting and selling the material in commodity form. The tonnage recycled does not account for moisture and dirt residues in bales.

'Tonnage of material generated' refers to the tonnage of material, which is discarded each year, and is either collected for recycling or for residual collection. It therefore relates closer to arisings rather than only sales. This terminology can be inconsistently applied throughout the figures however as the methodology for calculating the generation of different materials varies depending on the material.

2.6.1.1 How the Data is Gathered and Measured

The EPA does not measure the data which is published in its 'Facts and Figures' reporting. There is no survey or reporting program which gets submitted to the EPA to be published. Instead, the EPA performs a data compilation and modelling exercise, with the help of a third-party contractor, to estimate tonnages recycled and generated by material categories. In most cases, the EPA relies on annual reports and data published by trade organizations such as the US Glass Packaging Institute or the US Aluminium Association. The EPA then processes and standardises this data to aggregate across material categories and produce an overall MSW recycling rate.

The source type varies by material category, but a summary is shown in the table below:

[88] What a Waste Global Database | Data Catalog (worldbank.org)
[89] National Overview: Facts and Figures on Materials, Wastes and Recycling | US EPA
[90] 2018_ff_fact_sheet_dec_2020_fnl_508.pdf (epa.gov)
[91] Municipal waste, Generation and Treatment (oecd.org)

Table 9 US Methodology by Material Category

Material Category	Source Type	Method Explanation
Paper and Paperboard	Industry statistics from annual report	The source is the American Forest & Paper Association, which reports annual tonnages of pre and post-consumer paper sold and recycled. The EPA adjusts for the pre-consumer material.
Glass Containers and Packaging	Industry statistics from annual report and state reports	The Glass Packaging Institute publishes shipment data on glass sales as well as provides data on the tonnage being input to glass container recycling. The EPA then compares this to state data for verification.
Steel Containers and Packaging	Industry statistics from annual reports	The EPA uses an annual report by the American Iron and Steel Institute (AISI) for steel can sales. It then uses published recovery rates from the Steel Recycling Institute and applies them to the sales data to estimate US short tons recovered.
Aluminium Containers and Packaging	Industry statistics from annual reports	The EPA uses annual reports on shipment data published by the Aluminium Association for generation of aluminium cans. The EPA also uses Aluminum Association published figures on recovery.
Plastic	Industry statistics from annual reports	Plastic production data is taken form the American Chemistry Council annual reports. The EPA choose which categories within this report fall under MSW and assign likely resins to the product category. For recovery data, the EPA uses published data by the ACC as well as the National Association for PET Container Resources (NAPCOR).
Wood Packaging	Industry statistics and market research	The EPA uses new pallet production data from the National Wooden Pallet and Container Association for generation data. For recovery, the EPA uses

Material Category	Source Type	Method Explanation
		market research information from the Fredonia Group.
Food Waste	Modelled	Food waste is modelled based on studies which sample food generation at the household and commercial level. The EPA then estimates total residential generation by applying an average generation per person metric and scaling it to the US population. For commercial generation, the EPA uses average commercial generation and multiplies them by "appropriate demographic and economic statistics" to estimate commercial generation.
Yard Trimmings	Modelling and State Data	Generation of yard trimmings is modelled using a standard "pounds per person" generation factor and multiplying it by the US population. Recovery data is estimated by compiling the tonnage of material reported as composted by state agencies.

In all cases above, there is no standard reporting requirements. The EPA relies on organisations to measure and verify their own data, which the EPA then uses. For most industries sales are used to estimate the amount of waste generated.

2.6.1.2 Supporting Legislation

There is no supporting legislation for the EPA's Facts and Figures reporting. The agency receives funding each year from the US congress. The EPA can then decide to use the funds to contract services to calculate the Facts and Figures.[92] It is therefore a discretionary choice by the EPA to produce the generation and recycling data, rather than a mandatory statute. As mentioned in the previous section, the Facts and Figures have not been updated since the release of 2018 data which was published in December of 2020.[93]

2.6.1.3 Protection of Commercial Sensitivities

All data published within the report are aggregated to the national level and converted to US short tons (tons), where one ton is the equivalent of 907.18kg. Because the data compiled for the report is sourced from publicly available data by trade associations, the data has already been aggregated and published in a way which is not seen as commercially sensitive by the trade organisations.

[92] EPA Funding Instruments and Authorities | US EPA
[93] 2018_ff_fact_sheet_dec_2020_fnl_508.pdf (epa.gov)

2.6.2 Washington Department of Ecology – Facility Based Reporting

An example of another metric used is an approach taken by a state government: The Washington Department of Ecology. The state government requires facilities handling solid waste such as landfills, transfer stations, material recovery facilities, and separate drop off-sites (or "depots") to report on their annual tonnages at a mixed detailed material category level. Each year facilities will submit their annual tonnages handled to the department, which will then standardise, clean, verify and remove any double counting of the data to produce its Solid Waste and Recycling Data.[94] Data is presented in per capita and recovery rate metrics where progress can be seen over time. Within the solid waste generation and recovery data is a statewide recovery rate for solid waste. However, this metric includes non-MSW material listed below, but excludes industrial waste (i.e. waste produced by industry/manufacturing processes).

- C&D waste
- Household Hazardous Waste and
- Appliances

The equation for the metric is given as:

$$Recovery\ rate\ (\%) = \frac{Tonnage\ of\ material\ recovered}{Tonnage\ of\ material\ generated} * 100$$

Where recovery relates to the amount of material which is sent for recycling after being collected and sorted. The department does not use the term "recycling", as recycling is not a defined term for the state, but "recovery", which includes beneficial uses of material, is defined.[95] Material generated is the tonnage of material recovered and disposed combined.

2.6.2.1 How the Data is Gathered and Measured

Data is gathered through annual reports submitted by facilities that handle solid waste. This includes both incoming and outgoing tonnages. Facilities who want to handle solid waste are required to obtain a permit from the local county health department. These facilities will keep track of their inflows and outflows of material, including the destination of the material. These annual reports are then compiled by the Department of Ecology. The department manually removes double counting when separate facilities both handle the same waste, confirms tonnages with the facilities, and aggregates all the information to the state level.

Facilities do not use standard reporting software or IT systems, and instead must set out in their permitting process how they are going to record waste volumes. This can be a physical form or a computer printout. Facilities which report into the system include:

1) Transfer stations
2) Material recovery facilities (MRFs)
3) Landfills

[94] Solid waste & recycling data - Washington State Department of Ecology
[95] Private communications with Washington Department of Ecology

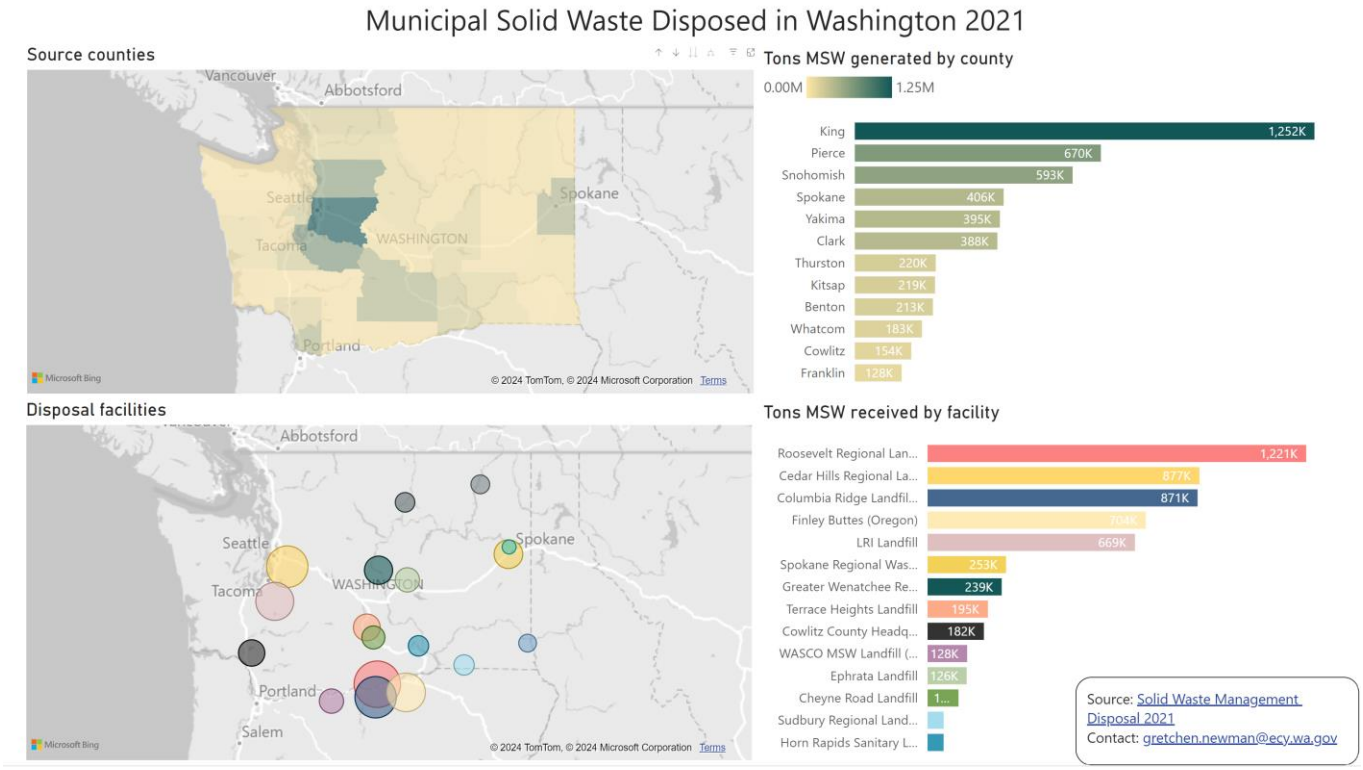
4) Scrap metal recyclers

5) Large scale retailers (e.g. Walmart)

The system does not generally include the actual recyclers who receive the outgoing material (e.g., paper mills, plastic recyclers). The point of measurement is at the commodity level, prior to material being input to the actual recycling system. The data reported will therefore include some bale contamination.

The data viewer on the Department of Ecology website is shown below where there is information on tons of MSW generated by county and tons received by waste facilities in 2021. It does not allow a lot of interaction for example, tons can't be split by waste stream and it only gives the ton measure rather than a rate or per capita metric.[96]

Figure 10 Example of Washington Department of Ecology 'Municipal Solid Waste Disposed in Washington 2021' Data Viewer



2.6.2.2 Supporting Legislation

The legislation requiring data reporting by recycling, composting, land application and anaerobic digestion facilities is WAC 173-350-210.[97] This bill states that in order to obtain a permit to handle solid waste, facilities must show in their application how they will "maintain operating records on the amounts (weight or volume) and the types of waste received or removed from the facility". Annual reports are required to be within the Facility's operating record. The legislation also states that the facility must "prepare and submit an annual report to the jurisdictional health department and the department [of Ecology] by April 1st". This annual report is required to show the following information:

[96] https://ecology.wa.gov/research-data/data-resources/solid-waste-recycling-data
[97] WAC 173-350-210.pdf (SECURED)

1) Name and address of the recycling or material recovery operation

2) Calendar year covered by the report

3) Annual quantities and types of waste received, recovered or recycled, and disposed, in tons

4) Destination of material and;

5) Any additional information required by the jurisdictional health department.

Facilities are therefore required to report on the tonnages disposed and recovered in their processes, and from these data the state can estimate its recovery rate.

2.6.2.3 Protection of Commercial Sensitivities

Data is aggregated to the state level for material specific tonnages, and there is no mention of how much tonnage comes from each facility in the published data. There is also no reporting publicly on the final destination of this material, so the recyclers are not included in the data.

2.6.3 Comparison of EPA and Washington State Metrics and Variables

Each of the metrics discussed have advantages and disadvantages. One of the metrics is primarily industry dependent, while the other requires a comprehensive primary data collection methodology. A summary table comparing each of the metrics discussed is shown below.

Figure 11 Comparison of EPA and Washington State Metrics and Variables

Variable	EPA Facts and Figures	Washington State Facility Based Reporting
Geographic Scope	National	Washington State
Frequency	Annual and voluntary – last published in 2020	Annual (skipped 2019 and 2020)
Data Collection	Compilation of public industry reports, some modelling	Primary data collection of waste facility reports
Granularity	Recycling and disposal tonnage by material	Recycling by material, disposal grouped for all MSW
Legislative Support	None	State statute requiring facilities to report annually

Variable	EPA Facts and Figures	Washington State Facility Based Reporting
Point of Measurement – Generation	Primarily sales data for packaging, waste generation for organics	Waste generation for all materials
Point of Measurement – Recycling	Material sent to reclaimer	Material sent to reclaimer
Contamination	Does not account for residue, moisture	Does not account for residue, moisture

The first difference between the two metrics is in the geographic scope. The EPA Facts and Figures data is meant to represent a national picture of waste and recycling in the United States. The Washington State data is meant to give a snapshot of the activity within Washington state only. This difference then relates to the data collection methodology of each metric, as the Washington state primary data collection is more intensive, however because it is only for one state it is not unwieldy. The Facts and Figures data, by contrast, represents all of the US. Conducting the same type of data collection as Washington may not be feasible at the national level for the US. Washington State publishes an interactive Power BI dashboard where the public can visualise data by tonnes of waste received by disposal facilities, and waste generated by the 39 counties within the state.[98] This enables counties to compare data with other counties, although it would be beneficial to consider population and presenting as a per capita metric to have a fairer comparison.

The data collection in Washington is also legislatively mandated, while it is not for the EPA Facts and Figures. Relying on the voluntary publication of industry annual reports may help explain why there have not been updated Facts and Figures since a data year of 2018. The Washington data is generally submitted annually; however, it should be noted that the program skipped 2019 and 2020, and its most recent year of data is 2021.

In terms of accuracy in measurement, neither data source accounts for moisture or residue (contamination) within the commodities that are reported. There is therefore some potential overcounting in the recycling rate of material in both metrics as losses are not accounted for. Furthermore, the disposal in Washington is estimated from reported landfill tonnages, which may or may not account for moisture. The EPA facts and figures by contrast more often subtracts recycling from overall sales to arrive at a disposal number, meaning overestimation of disposal is less likely to be due to moisture content.

2.6.4 Assessment of Metrics

In the US waste data is collected and reported on at the national level (EPA) as well as on a local level (for example, the Washington State). The national EPA is presented via the EPA website 'National Overview: Facts and Figures on Materials, Wastes and Recycling' up until 2018. It focuses on municipal waste generated by treatment method (recycling, composting, combustion, landfill) by material (in tons), as well as MSW generation per capita (in lbs) between 1960 and 2018. The Washington State 'Solid

[98] https://ecology.wa.gov/research-data/data-resources/solid-waste-recycling-data

Waste & Recycling Data' webpage on the other hand is more up to date and interactive. The Washington State data is able to be filtered by county enabling jurisdictions to compare waste management in their area.

On a national level the biggest downfall is not being required to report itself and not requiring waste reporting by its states and various levels of governments, relying on data compilation and modelling to estimate tonnages, resulting in unreliable data. It is also discouraging that the EPA has not reported for over three years through the EPA or the OECD, although it is understood that efforts are being made to harmonise and automate reporting.

Each publication of data has benefits and limitations. For example, the EPA 'Facts and Figures' datasets has per capita metrics while the Washington State data viewer presents data by county and facility. If there was the ability to have per capita metrics as well as localised data it would be best for comparison and the ability to identify challenges and opportunities in waste management at the relevant governmental level.

2.7 OECD Reporting

The Organisation for Economic Co-operation and Development (OECD) is an international organisation founded in 1961 and has 38 member countries including New Zealand.[99,100] The OECD has a knowledge hub that steers evidence-based standards and solutions for economic, social, and environmental policies. The OECD collects data annually and reports on five waste-related indicators outlined below. Every 10 years or so, the OECD publish Environmental Performance Reviews for member countries with independent assessments of the progress toward environmental policy goals.[101]

2.7.1 Key Recycling Rate and Waste Metrics Used

The OECD collects datasets for municipal waste, e-waste, waste by selected sectors, waste of selected waste streams, food waste and hazardous waste and present them on the data viewer 'OECD Data Explorer'.[102,103] Associated waste metrics for four of the datasets are listed below:

- **Municipal waste: generation and treatment** (kg per capita, thousand tonnes) [can be found here]
- **Electrical and electronic equipment (e-waste or WEEE)** (kg per capita, thousand tonnes) [can be found here] NZ not charted
- **Generation, recovery and recycling of selected waste streams** (thousand tonnes, kg per 1000 USD, kg per capita) [can be found here] NZ not charted
- **Waste by sector: generation, recovery and recycling** (thousand tonnes, kg per 1000 USD, kg per capita) [can be found here] NZ not charted

From the data available it appears that New Zealand only reports on municipal waste and not the remaining recycling and recovery datasets, meaning a New Zealand recycling and recovery rates can't

[99] https://www.oecd.org/about/document/ratification-oecd-convention.htm
[100] Given the large crossover of countries who report to both the EU and the OECD there is more information in the appendix section A.5.0
[101] https://www.oecd.org/en/publications/oecd-environmental-performance-reviews-new-zealand-2017_9789264268203-en.html
[102] Note: the food waste dataset has either not been taken over to the newest data viewer, Data Explorer, yet, or it may not be included.
[103] https://data-explorer.oecd.org/

be calculated from this data. The indicators and corresponding indicators are discussed in the following sections.

Municipal Waste Metrics

One key waste metric is the indicator 'municipal waste per capita' and it presents data from more countries than the other datasets.[104] The OECD defines municipal waste below:

"Municipal waste is defined as waste collected and treated by or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, as well as yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste if managed as household waste. The definition ***excludes waste from municipal sewage networks and treatment, as well as waste from construction and demolition activities."***

One issue with the metric is that countries use different definitions of municipal waste, whether due to a misunderstanding or due to a lack of accessible data that fits the definition. For example, the data that New Zealand has provided to the OECD does not fit with the OECD definition of municipal waste. The data provided is the waste disposed at Class 1 landfills which take biosolids, construction and demolition, and other industrial wastes. The data provided to the OECD by MfE does not include any recovered material, whether material diverted from disposal facilities or material collected for the purposes of recycling.

The metric is calculated for each country by dividing the kilograms of municipal waste over a twelve-month period by the population:

$$\frac{Municipal\ waste\ (kg)}{Population}$$

The most recent data point (2022) shows New Zealand's municipal waste per capita as 703kg, the OECD total as 531kg, and the average as 518kg. This means New Zealand's municipal waste per capita is 36% greater than the whole OECD dataset for 2022, emphasising the need for New Zealand to provide data that is comparable with other countries according to the OECD definition of "municipal waste".

The second municipal waste-related metric that the OECD uses is 'thousand tonnes' that uses municipal waste to draw the metric from. It is calculated for each country by dividing the tonnes of municipal waste over a twelve-month period by 1000:

$$\frac{Municipal\ waste\ (tonnes)}{1000}$$

The data collected from New Zealand was at the same points in time as the first metric. The most recent data point (2018) shows New Zealand's thousand tonnes is 3,705 and the average across 46 countries is 15431. This means New Zealand's thousand tonnes is 4.2 times lower than the average in the dataset, showing that the metric is not comparable between countries without considering the country's size or population.

Municipal waste per capita accounts for population, allowing values from different countries to be compared, regardless of population size. If all countries (including NZ) were able to provide data according to the OECD definition of municipal waste it would technically provide a consistent measure for comparison. The comparison would allow countries to identify benchmarks and address waste management improvements that need to be made.

[104] Waste - Municipal waste - OECD Data

Municipal waste in thousand tonnes does not account for population, meaning comparison of countries isn't as relevant as the municipal waste per capita metric.

E-waste Metrics

The OECD also uses per capita and thousand tonnes metrics for e-waste generated, recycled, and reused. E-waste has been recognised to be a global problem due to overconsumption and lack of recovery. Apart from New Zealand, all countries in the OECD have a national e-waste scheme, although only 12 member countries have data that is populated on the OECD Data Explorer.[105] The metrics are calculated as above but with e-waste in place of municipal waste. Data is presented by country and year, and breaks down waste generated, products on the market, and waste collected by e-waste type:

- Temperature exchange equipment
- Screens and monitors
- Lamps
- Large equipment
- Small equipment
- Small IT and telecommunication equipment.

E-waste is a priority product under the WMA and given the considerations of the stages of the material (generation, in-use, end-of-life) means that it is a somewhat holistic approach although it would be useful to have an associated recovery or disposal rate.

Comparing e-waste generation, recycling, and reuse could enable countries to identify benchmarks, but it only addresses one waste stream and there is limited data with data only visible for 12 member countries. Like municipal waste, e-waste is presented in per capita and thousand tonnes metrics. The benefits of per capita metrics are aforementioned.

Generation, Recovery and Recycling of Selected Waste Streams Metrics

Another indicator used by the OECD is the generation, recovery and recycling of selected waste streams with the unit thousand tonnes per annum. On the OECD Data Explorer there is data from 34 member countries, excluding New Zealand. The selected waste streams are important from the points of view of the environment and national waste management strategies, the selected waste streams are:

- Aluminium
- Ferrous metals
- Other non-ferrous metals
- All metals
- Glass
- Plastics

[105] https://www.stuff.co.nz/national/the-detail/119542951/the-detail-new-zealands-ewaste-problem

- Paper, paperboard, and paper products
- Organics
- Solid hazardous waste
- Masonry materials
- Fly ash
- Packaging (sorted by total packaging, paper and paperboard, glass, plastic, and metals).

The generation, recovery, and recycling of selected streams is presented in thousand tonnes only which does not allow for quality comparisons between countries with different populations.

Priority products between countries may not align with the selected streams so this data may be less relevant on a global scale, although it could be useful to monitor progress made by introductions of product stewardship schemes and identify products that require product stewardship schemes.

Generation of Waste by Sector Data

This indicator is also presented in thousand tonnes per annum by country and year, with 19 sectors as categories. On the OECD Data Explorer there is data from 27 member countries, excluding New Zealand. The sectors follow the major divisions of the UN's International Standard Industrial Classification (ISIC) revision 4.[106] The sectors include:

- Agriculture, forestry and fishing
- Mining and quarrying
- Manufacturing (food, beverages, textile, wood, paper, chemicals, rubber and plastic, electronic
- products, vehicles, etc.)
- Electricity, gas, steam and air conditioning supply
- Water supply; sewerage, waste management and remediation activities
- Construction
- Other.

The generation of waste by sector is presented in thousand tonnes only. The sectors are not exhaustive but may provide insight into particular waste streams and associated flows.

2.7.2 How the Data is Gathered and Managed

The survey 'Questionnaire on the State of the Environment' was developed by the OECD and has been jointly used by OECD and Eurostat since 1998/1990, although it was typically sent out every two years.[107] It aims to gather environmental data from member countries and promote international harmonisation of data. According to the questionnaire guidelines from 2014, the questionnaire was developed by statisticians in 1980, approved by the OECD Group on the State of the Environment (the current Working

[106] https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf
[107] Environmental Data_SOE guidelines.pdf (oecd.org)

Part on Environmental Information), and discussed and amended by consultation with member countries and subsidiary groups of the OECD Environment Committee.

The guideline also mentions that the United Nations Environment Programme (UNEP) uses a simplified version of the questionnaire to collect environmental data from other countries in the world. This demonstrates the international data harmony outlined in the aims of the guidelines.

Currently environmental data is gathered annually by the Environment Policy Committee through Microsoft Excel spreadsheets sent via email.[108] Data is requested from OECD member, accession, and partner countries, as well as other international sources in October and submitted in November. The questionnaire informs the metrics and includes the generation, treatment, and disposal of municipal waste.

The data is available on the OECD Data Explorer. Data can be shown in table, chart, and map views and can be filtered by country and year/s.

2.7.2.1 Agencies Responsible

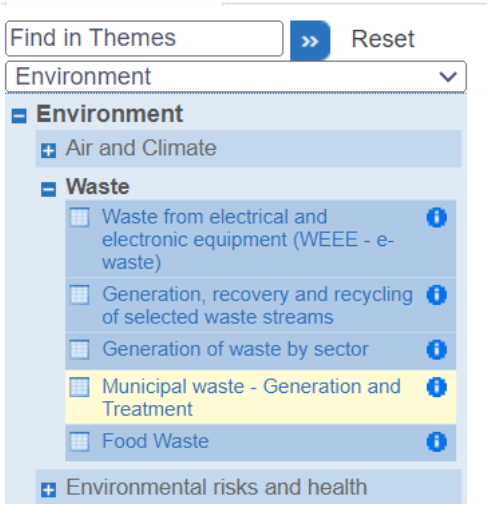
As there is overlap between countries in the OECD, UNSD, and Eurostat the three agencies work together to consolidate the data.[109] They also work with countries to improve data and review emerging demands to update the survey. For example, in 2019 they began requesting data for e-waste generation and recovery.[110]

2.7.2.2 IT systems/reporting mechanisms

The OECD has online data viewers that present the waste metrics mentioned earlier in this section.[111] The first viewer mentioned was taken down on the 1st of July 2024 but is mentioned again within this section.

The defunct data viewer was on the website stats.oecd.org which hosted data that the OECD collected by theme. The waste indicators could be found together in the theme 'Environment'.

Figure 12 OECD Defunct Data Viewer Themes



[108] https://www.oecd.org/statistics/data-collection/
[109] https://unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.33/2019/mtg2/S1_5_International_questionnaires_EN.pdf
[110] https://unstats.un.org/unsd/environment/FDES/EGES6/Session%202_5UNSD%20Waste%20statistics.pdf
[111] https://data.oecd.org/waste/municipal-waste.htm

The municipal waste dataset was comprehensive and at the defunct data viewer the variables could be filtered at three levels as per the table below. The dataset was presented as a table and could be filtered by country and year, it could also be exported in different formats including .xls and .csv for Microsoft Excel.

Table 10 OECD Waste Dataset Overview

List level one	List level two	List level three
Municipal waste generated	By origin	Waste from households
		Other municipal waste
	By type of waste	Household and similar waste
		Bulky waste
		Electric and electronic equipment waste
Municipal waste treated	Amount designated for recovery operations	Recycling
		Composting
		Incineration with energy recovery
		Other recovery
	Disposal operations	Incineration without energy recovery
		Landfill
		Other disposal
	Total incineration	
Municipal waste generated intensity	Municipal waste generated per capita	
	Municipal waste generated per unit of GDP	
Municipal waste generated, Index	Municipal waste generated, Index 1990	
	Municipal waste generated, Index 2000	
Total treatment	% Recovery	
	% Material recovery (Recycling + Composting)	
	% Recycling	
	% Composting	
	% Incineration with energy recovery	

	% Other recovery
	% Disposal
	% Incineration without energy recovery
	% Landfill
	% Other disposal
	% Incineration

The current data viewer is the OECD Data Explorer on the data-explorer.oecd.org website. Unfortunately, it does not host the waste metrics on one page as per the defunct viewer. The datasets for the indicators can be found by searching 'waste' in the search bar or clicking through 'Environment and Climate Change', then 'Resource efficiency and circular economy'.

Figure 13 Example of 'OECD Data Explorer' Site Search

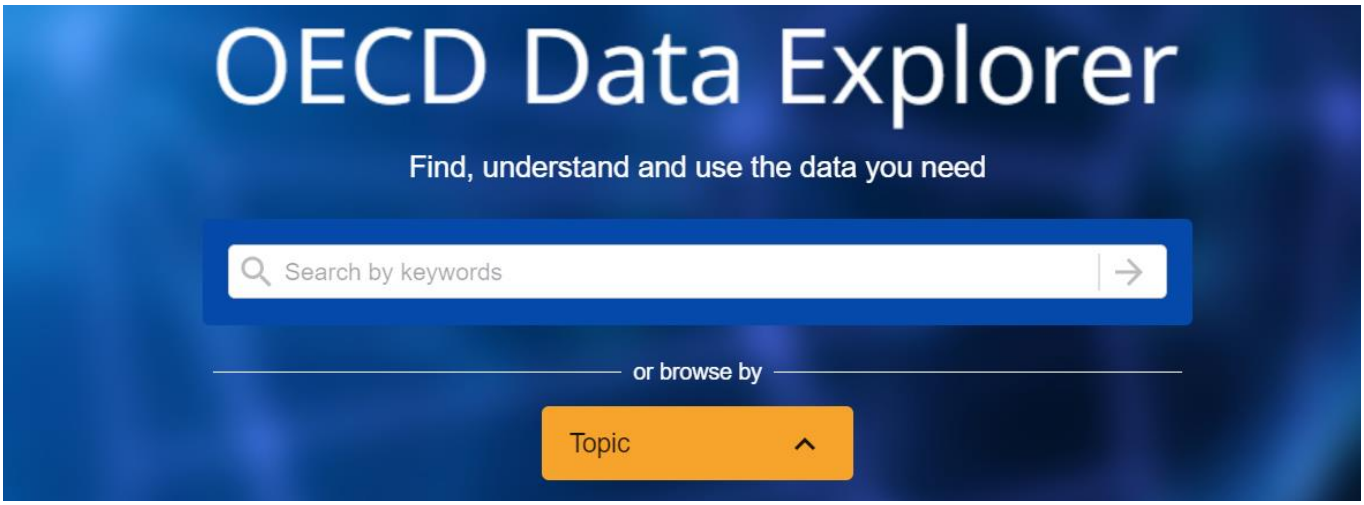


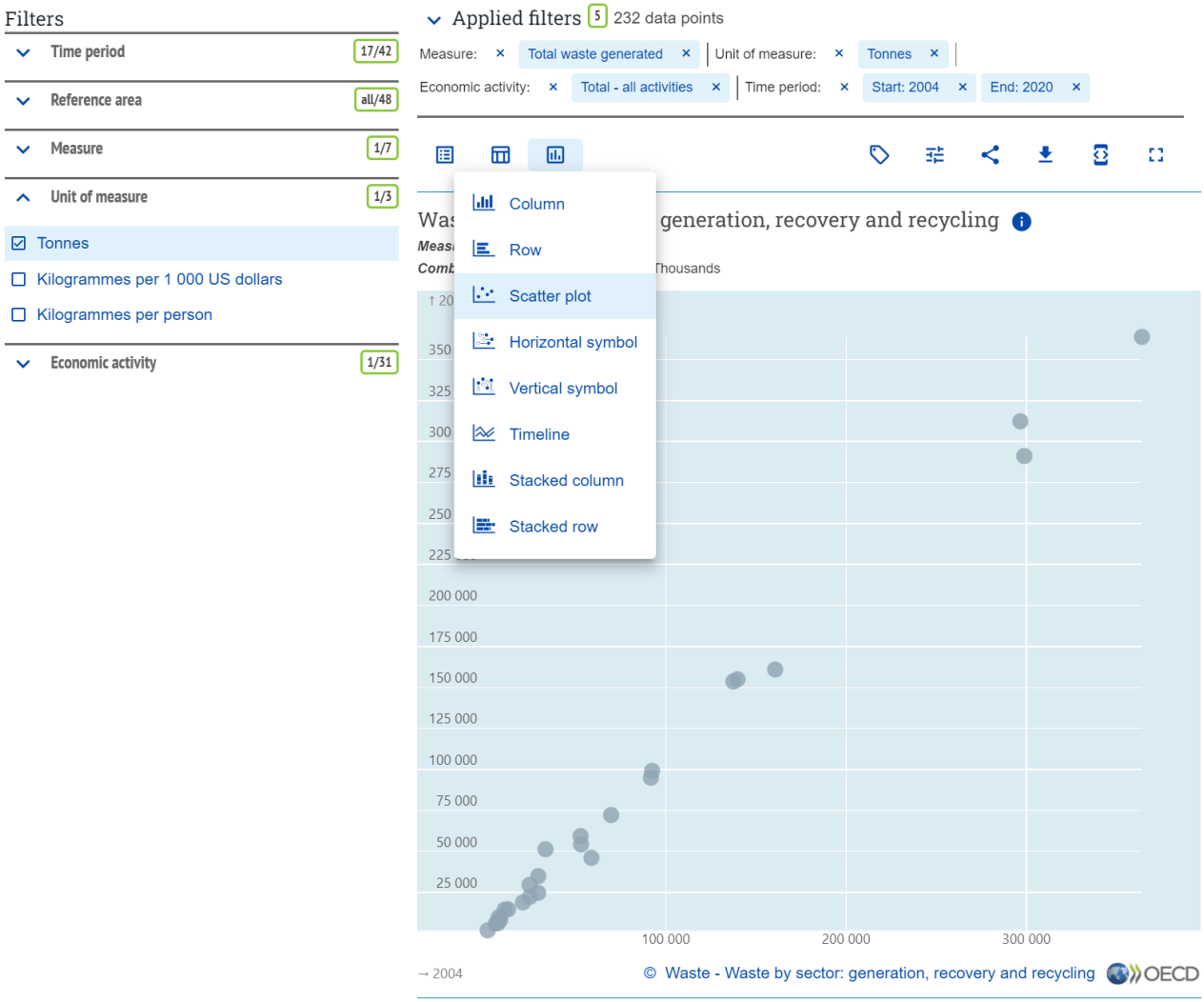
Figure 14 Example of Themes in the OECD Data Explorer Dataset

The data can be filtered and displayed in table and various chart formats and exported as a .png image or Microsoft Excel .csv. The dataset is the same as the previous viewer but doesn't show the last three rows of the level one list in the previous table.

Data for municipal waste can be viewed at two locations. The first is on data-explorer.oecd.org and is more comprehensive with flexibility for customisation, while the latter on data.oecd.org is less customisable.

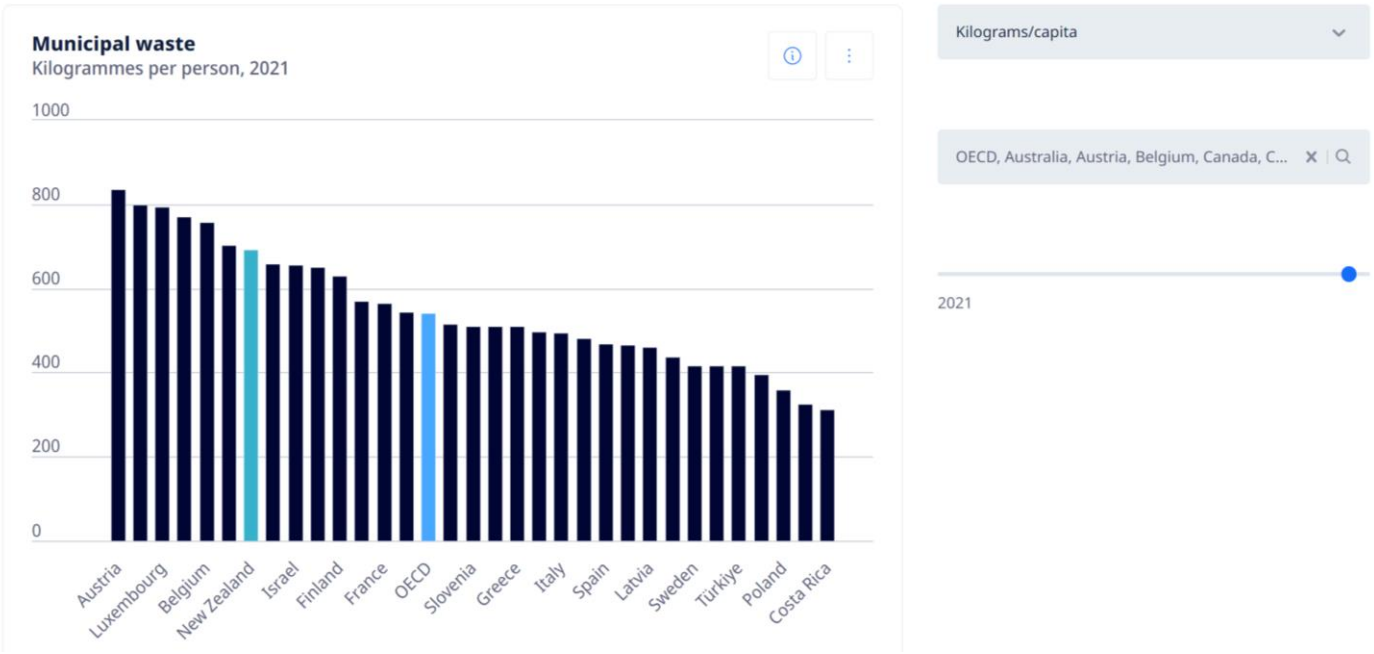
Below is the municipal waste data on the data-explorer.oecd.org website. It allows the user to view as a eight different types of charts and as a table, as well as filter the data by countries and time (yearly, monthly, quarterly). The dataset is able to be interrogated by generation source (households, other municipal waste), waste type (household and similar, bulky, and e-waste), recovery (recycling, composting, incineration with energy recovery, other), and disposal (landfill, incineration without energy recovery, other).

Figure 15 Example of OECD 'Municipal Waste: Generation and Treatment' Data Viewer



Below is the municipal waste metric (per capita and tonnes) on the data.oecd.org website. It allows the user to view as a chart as well as filter the data by countries. Unfortunately only one year can be selected at a time so progress can not be easily gleaned. Countries can be "highlighted" to increase visibility for comparison, as shown below with New Zealand in teal and OECD in blue. Data can be downloaded as a .csv which gives values for countries for the year selected only, the chart can also downloaded as a .png image file.

Figure 16 Example of OECD 'Municipal Waste' Data Viewer



2.7.2.3 Supporting legislation/regulation

One main purpose of the OECD is to produce best practice policies according to international evidence, meaning that data is required from its member countries. In the OECD Convention, Article 3 a) outlines that members will provide necessary information to the OECD for it to accomplish its tasks:[112]

Figure 17 OECD Convention Article 3

Article 3

With a view to achieving the aims set out in Article 1 and to fulfilling the undertakings contained in Article 2, the Members agree that they will:

(a) keep each other informed and furnish the Organisation with the information necessary for the accomplishment of its tasks;

(b) consult together on a continuing basis, carry out studies and participate in agreed projects; and

(c) co-operate closely and where appropriate take co-ordinated action.

The OECD Convention does not discuss waste data requirements explicitly, but accession documents for countries wanting to become members do. Accession documents are published for countries that have joined the OECD since 2007.[113] The accession documents include an appendix with a list of core principles for technical reviews by OECD committees, including the Environment Policy Committee. Some waste-related accession requirements from this committee are listed below:

- "Ensuring that the generation of waste, including hazardous waste, is reduced, the export of waste for final disposal is minimised and is consistent with the environmentally sound and efficient management of such wastes, and that adequate facilities for the environmentally sound management of waste are made available;

[112] https://www.oecd.org/about/document/oecd-convention.htm#Text
[113] https://one.oecd.org/document/C(2013)110/FINAL/En/pdf

- Controlling exports and imports of hazardous waste while allowing trade in waste as end-of-life materials and products destined for economically efficient and environmentally sound recovery operations within the OECD area

- Ensuring the quality and policy relevance of environmental information and its availability to the public;"

Another committee included in the appendix is the Committee on Statistics. Some data-related accession requirements from this committee are listed below:

"Willingness and ability to fulfil the obligation in Article 3 a) of the OECD Convention to "furnish the Organisation with the information necessary for the accomplishment of its tasks", including providing short term, structural and other analytical statistics and their associated methodological information needed for adequate policy analysis and surveillance:

- adequate legal and institutional framework for statistics in the candidate countries and its conformity with the principles applied in OECD countries;

- quality of the data and metadata available in the candidate countries and their comparability with data and metadata available in OECD Member countries;

- integration of the candidate countries in the Organisation's reporting and information systems by the time of accession."

2.7.2.4 Protection of commercial sensitivities

The Working Party on Data Governance and Privacy in the Digital Economy reports to the OECD Committee on Digital Economy policy to address privacy related risks and challenges for international data sharing.[114] The OECD adopted Privacy Guidelines in 1980 that were last amended in 2013, the guidelines are recognised as the global minimum standard for privacy and data protection. In 2022 the Declaration on Government Access to Personal Data Held by Private Sector Entities was released and is complementary to the Privacy Guidelines.

2.7.3 Assessment of Metrics

The OECD is the largest recipient of data reports with 38 member states. The quality of data provided by member states is variable, due to differences in interpretation of requirements and, in some cases, lack of resource to produce the required information. To assist with data consistency the OECD update guidelines as needed and work with countries to improve and assist with data reporting.

The OECD reports on four themes (municipal waste, e-waste, generation, recovery, and recycling by waste stream, and generation of waste by sector data) in per capita and thousand tonnes units. As previously mentioned, the definition of municipal waste is often interpreted differently, and given a significant number (22 of 38) of OECD members are members of the EU (who give a different definition than the OECD) it is likely to be inconsistent between reporters. Two of the metrics (e-waste, recovery and recycling of selected waste streams) focus on specific waste streams, allowing theh ability to identify the need for product stewardship schemes or track the progress of priority products or product stewardship schemes.

The current OECD data viewer (Data Explorer) is updated annually and allows users to find information on the various metrics and filter by country and relevant waste streams, etc. The OECD data viewer is

[114] https://www.oecd.org/digital/privacy/

publicly available and increases the ability for countries to understand where they sit globally in terms of waste management and make improvements where needed.

2.8 Global Recycling League Table

Where the previous sections in the International Review investigated countries and forums that receive reports from various countries, this section discusses the Global Recycling League Table where Eunomia UK has taken publicly available reports on municipal solid waste recycling but does not receive reports from countries itself. The report compares the publicly available data from 2021, adjusts the data so it is comparable, and makes recommendations to countries to improve their data collection and reporting.

In June 2024 Eunomia UK released the Global Recycling League Table Phase One Report.[115] The report poses the question 'which countries are the world's best recyclers?' and compares municipal recycling rates of 48 countries. This is the third iteration of the report with previous reports having been produced in 2017 and 2019. One of the five aims of the report is to bring to light the importance of good, consistent data to enable better waste policies and practice.

The data is taken from official published recycling rates and has been adjusted where possible and appropriate according to existing data sources. The report acknowledges that countries have different approaches to collecting and reporting recycling rates as the primary purpose is tracking waste performance at a national level rather than for global comparison. The countries compared have provided recycling rates to Eurostat and OECD that expects data to align with the definition of municipal waste mentioned in the previous section and summarised by Eunomia below:

"'Municipal waste' is waste from households and waste from other sources that is similar in nature and composition to household waste (e.g. businesses, education establishments, public administration offices.)"

The report discusses how the European Commission has sought to standardise the calculation of recycling rates EU member states. The EU member states make up 22 out of the 38 member countries in the OECD; of the 48 countries in the report 29 are in the OECD and 19 countries are not in the OECD. Even if the EU member states reported consistently there is still room for improvement with waste data consistency for other countries within the OECD and beyond.[116] The report uses the definition of municipal waste used in EU law as their foundation due to the robust work that the EU has done in the space, according to the 2018 amended EU Waste Framework Directive:

"'Municipal waste' means:[117]

> *(a) mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture;*
>
> *(b) mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households;*
>
> *Municipal waste does not include waste from production, agriculture, forestry, fishing, septic tanks and sewage network and treatment, including sewage sludge, end-of-life vehicles or construction and demolition waste.*

[115] https://eunomia.eco/reports/global-recycling-league-table-phase-one-report/
[116] https://www.eeas.europa.eu/paris-oecd-unesco/relations-oecd-and-unesco_en?s=64
[117] More information about what Eunomia's definition of municipal waste includes and excludes can be found in appendix A.3.0

This definition is without prejudice to the allocation of responsibilities for waste management between public and private actors."

The report notes that the definition leaves room for interpretation and inconsistency for materials that arise from a household source that are atypical (wood, rubble, non-packaging glass or plastics), or materials that arise in high quantities from non-household sources. Given that countries have differing views about what municipal waste includes, and varied accessibility to data that is required, Eunomia cite the main differences in recycling rate calculations done by countries to be:

- What activity sources to include in the calculation (e.g. C&D)
- What waste streams to include in the calculation (e.g. biosolids)
- Whether to include waste that is treated by incineration or compost
- Whether to include waste losses (e.g. recycling contamination)
- Whether to include at-home composting and other at-source waste recovery
- Whether to include recycling activities undertaken in the informal economy (e.g. waste collected by individuals to reuse or resell).

A key issue is interpretation of what 'similar in nature and composition to household waste' actually means. A wider interpretation is that if a household produces any of this type of waste, then technically it could be included. This then puts the focus on the level of classification you are dealing with. For example, it could be interpreted that households produce plastic waste therefore all plastic waste should be included but, if different types and uses of plastic are defined (for example pallet wrap, building materials, packaging), then at the lower levels of classification certain types of plastic would be excluded. Not only does this quickly become highly subjective, but there arises the problem that in the real world this data is simply not split out or recorded, and so any adjustments made are based on estimates rather than actual data.

The report makes recommendations for countries looking to improve their waste and recycling reporting and performance below. By collecting data according to the recommendations, it can provide policymakers with better information to improve waste recovery.

- Define municipal waste consistently and clearly
- Report municipal waste and recycling rates annually
- Exclude C&D and other materials that are not household-like in nature from municipal waste calculations
- Account for recycling contamination in municipal waste calculations
- Improve quality and frequency of non-household municipal reporting
- Capture key material streams (different types of beverage containers, rigid and flexible plastic packaging)
- Capture waste data at generation, collection, and recycling/disposal levels to account for waste losses (burning, burial, recycling contamination)
- Account for immediate treatments (MBT plants, mixed waste sorting, incineration with metal recovery)
- Consider and estimate informal recycling and home composting capture.

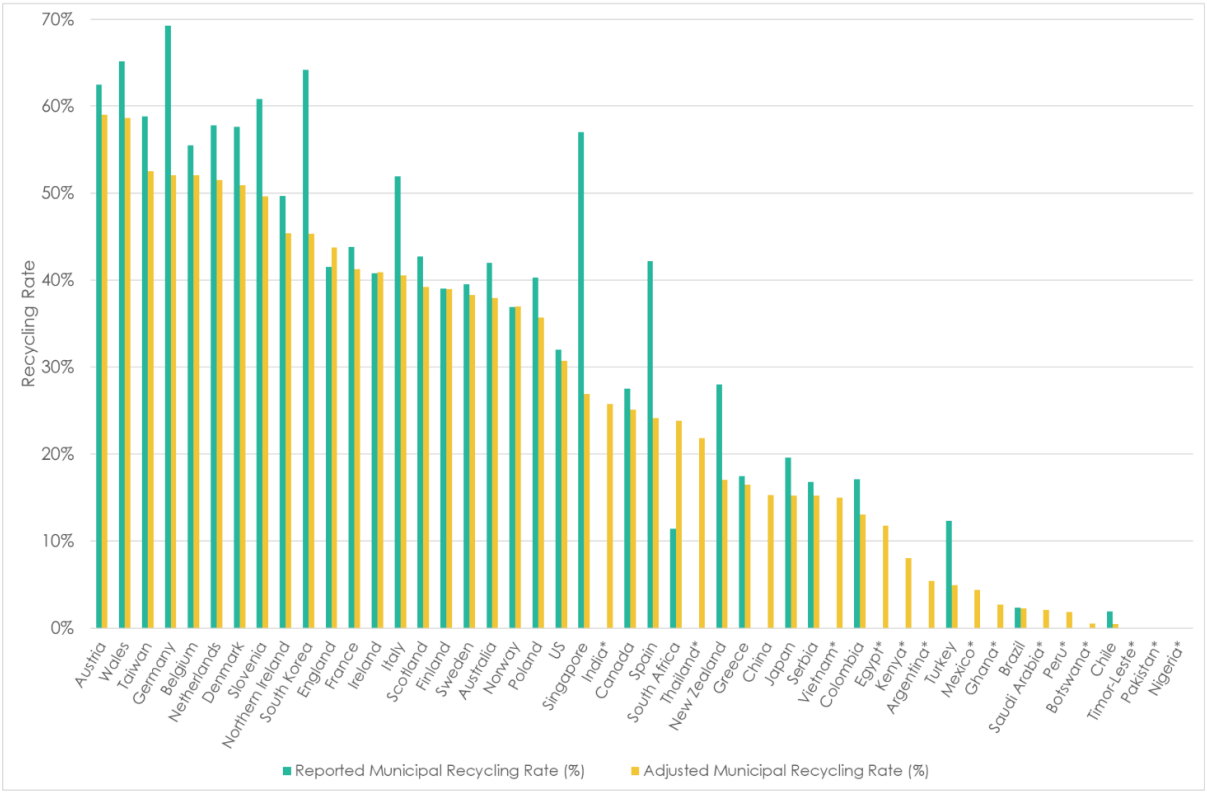
The report compares recycling rates of 48 countries where published datasets have been gathered. Adjustments have been made to the data to make it more comparable and closer to the municipal waste definition provided above. The most common adjustments made across the data were removing construction and demolition (C&D) waste and accounting for recycling contamination waste (losses).

From section 1.2.1 'Definitions and their Application' in the report, Eunomia interprets the EU's measurement method and the data from the countries in the following ways:

- Uses calculation points for recycling at the entry to the final recycling process
- Confirms that countries have accounted for losses between collection and final recycling processes (e.g. contamination), and applies assumptions where required
- Includes metals (and no other material) from incinerator bottom ash for recycling. No other incineration material is counted as recycling
- Includes material that undergoes preparation for reuse
- Includes municipal bio-waste separated and recycled at source (e.g. home-composting) when included by the country in recycling figures. Assumptions/adjustments have not been made for countries that have not measured it
- Where anomalies have been identified, efforts have been made to establish whether it is likely to be an issue with the way the country records data or whether it is a characteristic of the country's waste management, requiring judgement calls
- Adjustments by country are included in the appendices of the report.

The graph below shows the change between recycling rate before (teal) and after adjustment (yellow). The higher the recycling rate the more waste has been recovered and recycled relative to waste disposed to landfill.

Figure 18 Reported and Adjusted Municipal Recycling Rate by Country From Eunomia's Global Recycling League Report



*No reported municipal recycling rate

Note: the graph above shows data from initial findings and has not been updated with the comparable recycling rate found in this report (Metric 2b – MSW (EU) 41.6%).

The following table presents the reported and adjusted recycling rate and the corresponding percentage change, as well as a ranking and a rating for data quality. The report notes that where countries have not published recycling rates, this does not necessarily mean that recycling doesn't occur. The report also notes that some countries with poor data had high recycling rates, shown in the table where Taiwan and Northern Ireland made the top 10. Only three countries (Finland, Norway, and Brazil) did not require adjustments to reported recycling rates, expressing the need for an agreed definition of municipal waste and recycling rate calculations.

In the report New Zealand has fallen from rank 24 to 28 with Eunomia's data adjustment, and the recycling rate has reduced from 28% to 17%.[118] The analysis of New Zealand's data is "Very Poor". The report acknowledges that it may not have found every relevant dataset or document and invites country representatives to provide additional data that may adjust or refine their approach. However, it

[118] The report evaluated NZ's data on a desktop basis and made the following adjustments:
• The published data does not distinguish household and non-household municipal waste. A standardised split therefore had to be applied with non-household waste estimated as 40% of MSW
• Large amounts of construction waste were removed from the municipal waste arisings data
• Figures for municipal wood arisings and recycled are unusually high and were adjusted down
• Figures for municipal hazardous waste arisings are unusually high and were adjusted down
• No organics recycling is reported whilst there are several municipal composting sites in the country, so an estimate of organics recycling was added in
• Post-collection losses from dry or organic recycling do not appear to have been accounted for by New Zealand, and recycling was adjusted down accordingly
However, these adjustments did not correctly account for the actual situation in New Zealand, in particular the estimate of household and non, household and the organics recycling figures

should be noted that an update to the report is pending, and that data generated from this project has now been supplied to the authors and, as a consequence, the New Zealand recycling rate will be updated to reflect the new dataset as presented in this report (refer section 5.1.4).[119]

[119] Notes and recommendations specifically for New Zealand can be found in appendix A.4.1

Figure 19 Reported and Calculated Municipal Recycling Rates by Country from Eunomia's Global Recycling League Report*

	Reported Recycling Rate		Adjusted Recycling Rate		Change Between Reported and Adjusted		Data Quality
	Rank	Recycling Rate	Rank	Recycling Rate	Rank	Recycling Rate	
Austria	4	62.5%	1	59.0%	3	-3.5% ⬇	Good
Wales	2	65.2%	2	58.6%	0	-6.6% ⬇	Good
Taiwan	6	58.8%	3	52.5%	3	-6.3% ⬇	Poor
Germany	1	69.3%	4	52.04%	-3	-17.3% ⬇	Good
Belgium	10	55.5%	5	52.02%	5	-3.5% ⬇	Good
Netherlands	7	57.8%	6	51.5%	1	-6.3% ⬇	Good
Denmark	8	57.6%	7	50.9%	1	-6.7% ⬇	Good
Slovenia	5	60.8%	8	49.6%	-3	-11.2% ⬇	Good
Northern Ireland	12	49.7%	9	45.4%	3	-4.3% ⬇	Poor
South Korea	3	64.2%	10	45.3%	-7	-18.9% ⬇	Good
England	17	41.5%	11	43.7%	6	⬆ 2.2%	Poor
France	13	43.8%	12	41.2%	1	-2.6% ⬇	Good
Ireland	18	40.8%	13	40.9%	5	⬆ 0.1 %	Good
Italy	11	51.9%	14	40.6%	-3	-11.3% ⬇	Poor
Scotland	14	42.7%	15	39.2%	-1	-3.5% ⬇	Good
Finland	21	39.0%	16	39.0%	5	➡ 0.0%	Good
Sweden	20	39.5%	17	38.3%	3	-1.2% ⬇	Good
Australia	16	42.0%	18	37.9%	-2	-4.1% ⬇	Poor
Norway	22	36.9%	19	36.9%	3	➡ 0.0%	Good
Poland	19	40.3%	20	35.7%	-1	-4.6% ⬇	Good
US	23	32.0%	21	30.8%	2	-1.2% ⬇	Poor
Singapore	9	57.0%	22	26.9%	-13	-30.1% ⬇	Very Poor
India	N/A	None	23	25.7%	N/A	N/A	Very Poor
Canada	25	27.5%	24	25.1%	1	-2.4% ⬇	Good
Spain	15	42.2 %	25	24.1%	-10	-18.1% ⬇	Good
South Africa	31	11.4%	26	23.8%	5	⬆ 12.4%	Poor
Thailand	N/A	None	27	21.8%	N/A	N/A	Poor
New Zealand	24	28.0%	28	17.0%	-4	-11.0% ⬇	Very Poor
Greece	27	17.5%	29	16.5%	-2	-1.0% ⬇	Poor
China	34	0.0%	30	15.3%	4	⬆ 15.3%	Very Poor
Japan	26	19.6%	31	15.3%	-5	-4.3% ⬇	Good
Sebia	29	16.8%	32	15.2%	-3	-1.6% ⬇	Poor
Vietnam	N/A	None	33	15.0%	N/A	N/A	Poor
Colombia	28	17.1%	34	13.0%	-6	-4.1% ⬇	Very Poor
Egypt	N/A	None	35	11.8%	N/A	N/A	Very Poor
Kenya	N/A	None	36	8.0%	N/A	N/A	Very Poor
Argentina	N/A	None	37	5.4%	N/A	N/A	Very Poor
Turkey	30	12.3%	38	5.0%	-8	-7.3% ⬇	Poor
Mexico	N/A	None	39	4.4%	N/A	N/A	Poor
Ghana	N/A	None	40	2.7%	N/A	N/A	Very Poor
Brazil	32	2.3%	41	2.3%	-9	➡ 0.0%	Poor
Saudi Arabia	N/A	None	42	2.1%	N/A	N/A	Very Poor
Peru	N/A	None	43	1.9%	N/A	N/A	Very Poor
Botswana	N/A	None	44	0.5%	N/A	N/A	Very Poor
Chile	33	1.9%	45	0.5%	-12	-1.4% ⬇	Very Poor
Timor-Leste	N/A	None	46	0.0%	N/A	N/A	Very Poor
Pakistan	N/A	None	46	0.0%	N/A	N/A	Very Poor
Nigeria	N/A	None	46	0.0%	N/A	N/A	Very Poor

**** Please Note: Please note the figure for New Zealand in this table is out of date. It has been recalculated but yet to be republished.***

2.9 Summary of the International Review

2.9.1 Key findings of the International Review

Key findings that have arisen out of the international review to date include the following:

- Reporting on 'Municipal Waste' or 'Municipal Solid Waste' is a fairly ubiquitous standard – all jurisdictions report on this as a minimum, although the definitions do vary. There are differences around the inclusion of commercial wastes, street sweepings and litter, incinerator bottom ash, hazardous wastes, and privately collected wastes for example. While the OCED and EU definitions include some commercial wastes, Australia for example specifically excludes all commercial waste from MSW.

- There are significant inherent difficulties with the use of the 'Municipal Waste' metric in terms of defining what material should and shouldn't be included. In the EU for example, the key wording in the definition is waste that is *'similar in nature and composition to waste from households'*. This is interpreted to include not just material that arises from activities that are similar to household activities (e.g. lunchroom wastes), but material that is similar to what might be generated by households – such as cardboard boxes, bottles from bars or food waste from cafes and restaurants. This creates issues not only in terms of judgement calls on what meets that definition, but also because this does not necessarily correspond with how waste is collected or recorded. In other words, data does not exist that matches the definitions precisely and so estimates have to made regarding the proportions that are included or excluded. This leads to inconsistencies in how the data is recorded across different EU jurisdictions. An analysis of the differences between different definitions is provided in Appendix A.6.0.

- The focus of reporting on Municipal Waste risks overlooking non-municipal waste streams such as C&D waste and industrial waste, which may represent greater tonnages and with possibly greater potential for diversion or reduction. From our review it appears that in places such as the EU and UK this is indeed the case. Knowledge of and focus on the commercial waste and industrial waste streams from the perspective of monitoring, reporting and targets appears secondary to MSW.

- Australia stands out among the jurisdictions reviewed in that its nationally reported data attempts to cover most activity sources (although from our review it does not appear that biosolids or rural wastes are included in their measures). It is notable that in Australia C&I and C&D activities are reported as having higher recovery rates than MSW. This aligns with the NZ data compiled for this project (provided soil is not included in C&D disposal data).

- None of the international measures appear to consider rural waste and rural waste management.

- There is a lack of clarity around what is counted in different metrics in terms of disposal of soils and inert wastes.

- Municipal waste definitions also exclude biosolids and contaminated soils.

- Only Australia appears to account for different classes of disposal in its reporting. This may be because other jurisdictions do not have the same variety of classes of disposal facilities as Australia or New Zealand.[120]

- As with all recycling rate measures, focusing on recovered material risks de-valuing the contribution that the upper tiers of the waste hierarchy can deliver.

- Similarly, a focus on tonnes is not equivalent to a focus on reduction of harm. Some of the heaviest materials that might be recovered (e.g. concrete), may not produce the same level of environmental benefit through recovery as other lighter materials (e.g. plastic, e-waste, hazardous materials).[121]

- When measuring recovery, the EU, UK and Australia all place an emphasis on counting recovery at the point where it becomes a product, rather than at the point of collection or sale into a commodity market. This effectively overcomes the issue of measuring contamination, although it is not clear how this is accounted for in organic waste, where contamination is often removed during processing, and the product out the end does not provide an equivalent measure due to moisture and mass loss in the processing. It also introduces issues around the point of measurement and how losses might be attributed to individual TAs for example.

- While there is generally good data on quantities disposed of, it is not clear how recovery data is obtained in most jurisdictions particularly for non-municipal recovered materials. In Queensland Australia data from the commercial sector is gathered through an annual survey, while in the USA national recycling figures utilise industry data on recovered materials and material placed on the market to calculate recycling rates.

- The use of per capita figures, as opposed to absolute quantities, is a common metric that is employed across the EU, UK, Australia and OECD.

- Despite attempts at standardisation within many jurisdictions, and across multiple jurisdictions in the case of the EU and OECD, there still exists significant variation in how data is gathered, classified, and reported. This does limit to some degree the usefulness of comparing measures across countries, although Eunomia has attempted to make adjustments for some of these differences in producing a global recycling league table.[122]

- Council services in other countries such as the UK and Australia tend to be more homogenous than in New Zealand. For example, in the UK it is embedded in primary legislation that household rubbish collections cannot be charged for[123], so there is no private market. Similarly, in Australia household collections use wheeled bins for Health and Safety reasons and so this has limited the private market. Consequently, it is easier to develop metrics related to household waste that provide useful performance comparisons.

- It appears that, despite other jurisdictions having more developed data and reporting systems in place, the data obtained through these systems is not complete or consistent, and the entities compiling the data still undertake significant data manipulation and adjustments in order to produce final figures. This highlights the challenges in dealing with waste data such as issues of definition, tracking of material flows, and how data is recorded. It suggests that, while there are lessons to be learned from other jurisdictions and practices that could be adopted or adapted,

[120] For example, in the UK there are only two classes of facility 'Municipal Landfills', which are the equivalent of Class 1 in New Zealand and 'Inert' landfills which are the equivalent of Class 5s. The UK does not consider inert waste (essential rock and soil) as part of the waste stream, and so it is not included in metrics.
[121] The Potential Contribution of Waste Management to a Low Carbon Economy – Eunomia Research and Consulting
[122] Global Recycling League Table – Phase One Report – Eunomia Research and Consulting
[123] Environmental Protection Act 1990 (legislation.gov.uk) (section 45(3), Charging for domestic waste in England: Combining environmental and equity considerations - ScienceDirect

there is no single approach that works, and New Zealand should develop an approach tailored to the New Zealand context, but that can map to other international metrics.

3.0 New Zealand Situation Review

3.1 New Zealand Situation Review Introduction

Following on from the review of international recycling metrics this section aims to assess the situation in New Zealand before developing a New Zealand appropriate approach. As noted in the introduction, New Zealand essentially has no formal recycling rate metrics that are commonly reported (waste data such as disposal to landfill is regularly reported). This section is therefore not a review of existing recycling rate metrics, but of the potential datasets that are available and could be used, now and in the future, to construct appropriate, workable recycling rate metrics that can be tracked over time, and that will enable realistic comparison with international metrics.

3.2 Available Datasets

This section provides an analysis of the key data on waste disposal and recovery in New Zealand that could be used to inform recycling rate metrics. A more detailed assessment of the available data is provided in Appendix A.1.0. The information noted in this section is not intended to be exhaustive but aims to identify the key sources of information that may be readily available to government.

3.2.1 Summary of Government Datasets

The government datasets noted here include information that is supplied directly to central government, whether through mandatory or voluntary reporting. It is the foundational data to consider when reviewing options for developing recycling rate metrics.

Table 11 Government Datasets Summary

Dataset name	Recipient/s	Reporter/s	Available data	Frequency	Requirement
Online Waste Levy System (OWLS) tonnage	MfE	Disposal facility and transfer station operators	Waste tonnage received at and diverted from disposal facilities and transfer stations. Since 2009 for Class 1 landfills, 2022 for Class 2 landfills and transfer stations, and 2023 for all other facilities.	Monthly, quarterly, or annually (depending on the facility) via online portal OWLS	Mandatory

			Waste to be reported by activity source (construction and demolition, residential kerbside, etc) from 1 July 2024.		
TA Waste Reporting	MfE	Territorial authorities	Material type and tonnage, location of facilities, number of properties serviced, and waste levy expenditure. Available from September 2025.	Yearly via online portal (currently TAWLES)	Mandatory
TA Waste Levy Expenditure System (TAWLES)	MfE	Territorial authorities	Waste levy expenditure. Voluntary reporting from 2010, mandatory from July 2024 with first mandatory report due September 2025.	Yearly via online portal (currently TAWLES)	Mandatory from July 2024
GHG Inventory: Waste chapter	UNFCCC	MfE	NZ's GHG emissions since 1990, includes emissions from landfills, composting, incineration, and farm waste. In the context of this section, the Inventory is a guide to waste-related data sources required to produce the emissions model.	Yearly	Mandatory
Import Export	Stats NZ	Customs	Import and export tonnages since 1990, categories include waste from plastic, e-waste, etc.	Monthly	Mandatory

Solid Waste Analysis Protocol (SWAP) waste composition	MfE	TAs, disposal facilities, transfer stations	A compilation of waste composition surveys performed according to standard (SWAP)_ protocols. These include surveys of waste composition kerbside services and at waste facilities since 1993. Most surveys are commissioned by TAs. There is no requirement to supply composition information to MfE; however, many choose to share or publish results publicly in Waste Assessments or WMMPs. MfE does not systematically compile this data.	Ad-hoc	Voluntary

3.2.2 Summary of Key Research

The studies noted here include one-off research that has gathered significant information on the quantities and types of materials collected, recovered, processed or exported. The studies do not necessarily provide a basis for ongoing reporting but do provide a useful snapshot of the state of play for the areas they cover.

Table 12 Key Research Summary

Name	Authors	Date of publication	Usage	Available data	Key sources	Requirement

2020-21 Waste and Resource Recovery: National Infrastructure and Services Stocktake	Commissioned by MfE, report by Eunomia	2023	Produced to inform a national approach to waste infrastructure investment.	Services and facilities available, materials and quantities.	Research and engagement with the waste sector.	Voluntary data survey
Waste Disposal Levy Consultation Document	MfE	2019	Produced for public consultation on the waste levy, WMA, and waste data.	Waste composition, activity source, and corresponding disposal type in tonnes.	Research, existing reports including Eunomia (2017).[124]	Required consultation to increase and expand waste levy.
Container Return Scheme (CRS) Research	Commissioned by MfE, report by Sapere	2022	Produced to present CBA findings of a CRS in NZ.	Tonnage comparison of recyclable containers with and without CRS at years 1 and 4 of	Material volume and flow modelling sources include data from GS1 sales, WasteMINZ, and TA data, as well as PwC's population growth rate from 2021.	Voluntary data provision

[124] Refer to Appendix A.1.2. for details.

				implementation vs. BAU.	Financial modelling from PwC in 2022.	
OPMCSA plastics research	OPMCSA and the Rethinking Plastics panel	2019	Produced to rethink NZ's relationship with plastic/mitigate environmental and health impacts.	Tonnage of plastic in New Zealand (import, export, in use, waste, and leakage). Includes estimates and gaps.	Plastic import/export data from Stats NZ import/export data. Existing reports by Packaging NZ, NRRT, Eunomia, Perrot et al., Plastics NZ, Sustainable Coastlines, and Keep New Zealand Beautiful.	Voluntary data provision
Making zero the hero: Moulding a plastics-circularity and narrative in New Zealand	Scion	2022	Produced with WMF funding as part of producing a NZ new plastics economy roadmap	Tonnage of plastic in New Zealand (import, export, in use, waste, and leakage). Excludes plastic imported in products	Plastic import/export data from Stats NZ import/export data.	Voluntary data provision
OPMCSA food waste research	OPMCSA	2022-2024	Produced to rethink NZ's relationship with	Tonnage estimates from food production, processing, manufacture, retail,	Data sources include existing surveys, reports, and data. The report acknowledges data gaps.	Voluntary data provision

			food/mitigate food loss and waste.	food service, households.		
Looking in the Mirror: A review of circularity in the clothing and textile industry in Aotearoa	Bernadette Casey & Brian Johnston	2020	Background research for voluntary Textiles product stewardship proposal	Estimates of national textile material flows	Stats NZ and industry data	Voluntary data provision
Auckland Council textiles research	Commissioned by Auckland Council, report by Sapere	2023	Produced to inform Auckland Council's WA and WMMP.	Tonnage estimates in material flow charts and tables from imports and local manufacturing to exports, landfill, and recovery.	Data is sourced from existing local and Australian studies as well as Stats NZ import/export and GDP data. The data is extrapolated to fit the Auckland context.	Waste assessment (WA)/waste management and minimisation plan (WMMP) mandatory, report is voluntary.
Auckland Council food system research	Commissioned by Auckland Council,	2023	Produced to inform Auckland Council's WA and WMMP.	Tonnage estimates and associated carbon emissions in tables including	Data is sourced from existing local and Australian studies as well as Stats NZ import/export and GDP	WA/WMMP mandatory,

	report by Sapere			food imports, food manufactured/ processed in NZ, and food in service, prisons, and schools.	data, and MPI. Data has also been gathered from local food processors and manufacturers although it is commercially sensitive. The data is extrapolated to fit the Auckland context.	report is voluntary.
Environment Canterbury (2013) Non-natural Rural Wastes -Site Survey Data Analysis, October 2013	GHD	October 2013	Produced for Environment Canterbury	Quantity and composition estimate of non natural rural waste	Survey of 53 farms	Voluntary
Reusable packaging in Aotearoa	Reuse Aotearoa	2022	Part funded by Tauranga City Council Resource Wise Community Fund	Limited quantitative data	A wide range of sources and anecdotal information	Voluntary

3.2.3 Summary of Industry Data

There are several industry associations that gather data from their membership and some of this information is made public. Industry data is potentially valuable as it is obtained directly from industry, who will have good commercial reasons for understanding their sector well. However, there are also limitations with these datasets as well: industry associations may not represent all of the participants in the sector, there may be constraints around commercial sensitivity in respect of data sharing amongst the members, and industry associations may also have an interest in presenting a particular perspective. Key relevant industry data sources (excluding product stewardship schemes) are noted in the table below.

Table 13 Industry Data Summary

Name	Available Data	Data Period
Waste & Recycling Industry Forum (WRIF)	High-level data in an infographic on WRIF website with waste per capita, recycling rate, tonnage by stream, and recycling rate. Material streams include C&D, fibre, glass, metal, organics, plastic, and tyres.	2021-2023
Plastics NZ	No publicly available data.	N/A
Packaging forum	No publicly available data.	N/A
NZ Association of Metal Recyclers (AMR)	High-level data on AMR website with tonnages of metal collected in and exported from NZ.	2022

3.2.4 Summary of Product Stewardship Schemes

The table in this section outines product stewardship schemes in New Zealand and comments on the data available, it is not an exhaustive list and there are other schemes that MfE could consider when gathering data. There are three types of product stewardship schemes:

- Accredited schemes managing priority products (e.g. Tyrewise)
- Voluntary schemes managing priority products (e.g. TechCollect)
- Voluntary schemes managing non-priority products (e.g. Glass Packaging Forum).

Six priority products were declared in 2020 and schemes for those products are in varying stages of accreditation or development.[125] As priority product stewardship schemes are developed under Ministry-sponsored co-design, public scoping reports are prepared which provide some data on product volume and recycling rates in New Zealand. Therefore, the declaration of priority products under the Waste Minimisation Act (WMA) has the potential to generate useful quality data on those products. As per clause 4(1)(c)(ii): of the Gazette notice that provides guidelines for accreditation of priority product stewardship schemes, schemes must specify how they will help to achieve:

> *"Transparent chain of custody for collected and processed materials, to both onshore and to offshore processors, and published mass balances showing rates of reuse/ recycling or environmentally sound disposal of the priority products."*[126]

Under WMA section 23(1)(i), regulations can be made requiring collection and provision of information about regulated products, whether or not they have been declared as priority products. This has been used recently in relation to the tyre stewardship scheme and tyre stewardship fee.[127]

Under section 14 of the WMA accredited voluntary schemes are expected to keep records and report on scheme performance to the Minister. There is no stipulation under the WMA what data is collected and reported, or that these reports are made publicly available. We assumed that MfE holds reports for all accredited schemes. While there may be useful information from voluntary reporting for most voluntary schemes the key data issue will be completeness as scheme participation is not required and so there is likely to be missing data from non-participants.

Once data from accredited priority product schemes becomes consistently available it will add significantly to the dataset on recovered materials. The below table outlines product stewardship schemes and notes which are accredited.

[125] Corrigendum—Declaration of Priority Products Notice 2020 - 2020-go4533 - New Zealand Gazette
[126] General Guidelines for Product Stewardship Schemes for Priority Products Notice 2020 - 2020-go3342 - New Zealand Gazette
[127] Waste Minimisation (Tyres) Regulations 2023, sections 16 and 17.

Table 14 Product Stewardship Schemes Summary

Scheme Name	Accredited/voluntary	Priority/non-priority product	Publicly Available Data	Data Period
Tyrewise	Accredited scheme	Priority product (tyres)	Report with tyre movements and financial transactions including transportation and processing.	2024
TechCollect	Voluntary scheme	Priority product (e-waste)	Four reports but no quantification.	2020-2023
B.I.G.	Voluntary scheme	Priority product (large batteries)	Research reports are available on the B.I.G. website.[128] Stocktake report mentioned on B.I.G. website submitted to MfE but not publicly available. The Vector New Energy Futures paper (page 13) includes data on estimates of large batteries from 2019-2030[129]	2023
Plastic Packaging Product	Voluntary scheme	Priority product (plastic packaging)	PPPS produced a report to support the design of a plastic packaging product stewardship scheme in NZ. Includes total	2023

[128] Resources – Rauemi - Battery Industry Group (big.org.nz)
[129] vector_new_energy_futures_paper_batteries.pdf

Scheme Name	Accredited/voluntary	Priority/non-priority product	Publicly Available Data	Data Period
Stewardship Scheme			tonnages of resins imported, plastic exported, and processing.	
Cool-Safe (previously Refrigerant Recovery)	Accredited scheme	Priority product (synthetic refrigerants)	Two annual reports with tonnage data for refrigerant collected, exported/destroyed by the scheme. Accredited scheme will be reporting publicly from 2024.	2022, 2023
Green-Farms Product Stewardship Scheme (to replace Agrecovery and Plasback)	Accredited scheme	Priority product (agrichemicals and containers, farm plastics)	Agrecovery commissioned a material flow analysis of agricultural and horticultural related bags, wrap, etc.[130]	2022

[130] Green Farms has just been accredited: Agrecovery's Green-farms Product Stewardship Scheme accredited to create more recycling opportunities for farmers - Agrecovery

Scheme Name	Accredited/voluntary	Priority/non-priority product	Publicly Available Data	Data Period
Agrecovery rural recycling programme	Voluntary	Priority product (agrichemicals and containers, farm plastics)	14 annual reports with infographics with weights of containers, bags, oil, and chemicals collected through the scheme.	2007/08-2020/21
The Australian, New Zealand and Pacific Islands Plastics Pact (ANZPAC)	Voluntary	Priority product (plastic packaging)	A series of report and guides tracking progress against a number of targets that aim to deliver a shared vision of a circular economy for plastic, where plastic never becomes waste or pollution.	2022 latest impact report
Envirocon	Voluntary	Non-priority	Infographic on Envirocon website.	Not specified
Filter Disposal Services	Voluntary	Non-priority	No publicly available data.	N/A
Glass Packaging Forum	Voluntary	Non-priority	5 annual reports with infographics about the glass recovered through the projects funded by the scheme.	2017/18-2021/22

Scheme Name	Accredited/voluntary	Priority/non-priority product	Publicly Available Data	Data Period
Interface ReEntry Programme	Voluntary	Non-priority	Total tonnage of carpet diverted through the scheme since inception.	27 years
Paintwise	Voluntary	Non-priority	No publicly available data.	N/A
Recovering Oil Saves the Environment	Voluntary	Non-priority	No publicly available data.	N/A
Sharp Comprehensive Recycling and Waste Reduction Scheme	Voluntary	Non-priority	No publicly available data.	N/A
Soft Plastic Recycling Scheme	Voluntary	Priority product (plastic packaging)	An accreditation report with tonnage and quantity of soft plastics collected and processed through the scheme.	2019, 2022

3.2.5 Summary of Potential Future Data Sources

Table 15 Potential Data Sources Summary

Name	Available Data	Data Period
Waste Operator Licensing and Data System (WOLDS)	This system is under development for use in the Bay of Plenty and Waikato regions. The system is in two parts – a licensing regime for waste operators based on licensing powers conferred through TA bylaws (which use a common template), and a data collection system. Quarterly data on: • Tonnage collected/received at facilities • Geographic Source (i.e. council district collected from) • Activity Source (from Waste Data Framework) • Tonnage deposited at each licensed facility • Tonnage deposited out of region / unlicensed facility. The data gathered will support TA reporting in line with the NWDF.	Potentially from 2025

3.3 Discussion and Gap Analysis

Although it is acknowledged that New Zealand has generally poor waste data, the review has shown that there are a reasonable number of potential data sources. However, most of these are currently either voluntary, one-off snapshots in time, or are limited in some other way such as through commercial sensitivity or through representing metrics from only a part of the sector.

In order to inform future potential construction of recycling rate metrics we have undertaken a gap analysis as set out below. The gap analysis considers the key types of data that are expected to be required to develop a workable dataset for the purposes of producing recycling rate metrics. It identifies the source, what the data is used for and then rates the quality and availability of the according to the following traffic light system:

Low: Data not available, very limited or unreliable	Medium: Data available at a national level but some limitations on the data and/or based on one-off studies	High: Good quality data available at a national level and in time series.

Table 16 Assessment of Available Data for Producing Recycling Rate Metrics

Metric	Source	Key metrics required for	Data quality/availability
Disposal Tonnes			
Class 1 tonnes	OWLS	Levy reporting, overall recycling rate, OECD reporting	High
Class 2 tonnes	OWLS	Levy reporting, overall recycling rate	High
Class 4 tonnes[131]	OWLS	Levy reporting, overall recycling rate	High
Class 4 tonnes	OWLS	Levy reporting, overall recycling rate	High
Class 5 tonnes	OWLS	Overall recycling/disposal	High
Industrial monofill tonnes	OWLS	Overall recycling/disposal	High
On-farm disposal tonnes	2013 study	Overall recycling/disposal	Low
Tonnes by activity	OWLS	Analysis, Calculation of OECD recycling rate.	High from July 2024

[131] Note: OWLS requires classes 3 and 4 to be reported together

Metric	Source	Key metrics required for	Data quality/availability
Tonnes by geographic source	TA reporting	TA waste reporting	Voluntary reporting currently, TA mandatory waste reporting from July 2024 but only for TA controlled tonnes.
'Municipal tonnes'	Activity data	OECD reporting	Although activity data will provide some alignment to MSW the definition is not fully aligned, and some adjustments would be required
Composition			
Kerbside composition	Voluntary studies. Some MfE Commissioned studies	Determining effectiveness of programmes	Data is gathered according to the SWAP, but availability of data varies by TA area. No regular national level data
Composition by Activity	Voluntary studies. Some MfE Commissioned studies	Targeting waste minimisation actions Determining recycling rates by Activity	Data is gathered according to the SWAP, but availability of data varies by TA area. No regular national level data
Class 1 disposal composition	Voluntary studies. Some MfE commissioned studies	Targeting waste minimisation actions Determining recycling rates by material type	Data is gathered according to the SWAP, but availability of data varies by TA area. No regular national level data
Class 2 disposal composition	Recent audits of two site	Targeting waste minimisation actions, contributing to climate change calculations	Data has been very limited. Recent audits have addressed the gap to some extent but no time series data
Class 3-4 disposal composition	Recent audits of several site	Targeting waste minimisation actions, contributing to climate change calculations	Data has been very limited. Recent audits have addressed the gap to some extent but no time series data
Class 5 composition	No available data	Targeting waste minimisation actions	Although no available data, in theory if facilities have

Metric	Source	Key metrics required for	Data quality/availability
		Addressing beneficial use of soils	complied with consents there should be only virgin excavated natural material (VENM)
Industrial monofill composition	No available data but some assumptions can be made based on the source of material for the fill	Targeting waste minimisation actions Assessing overall disposal quantities from commercial activity	In theory composition should be only one material in each fill
Farm disposal composition	Two studies from 2013	Assessing overall disposal quantities from commercial activity Targeting waste minimisation actions	Studies have methodology issues, data is not necessarily applicable to all regions
Recovery			
Recovery by material type			
Plastic	Export data, stocktake report, OPMCSA report, Valpak report	Product stewardship, national recycling rate, OECD recycling rate	Export data, is regular and accurate, but local recycling data is missing and would need to be gathered regularly
PET, HDPE, PP	Export data, stocktake report, OPMCSA report, Valpak report MRF data	National recycling rate, OECD recycling rate, TA waste reporting	TA waste data should be high based on MRF data, however, it does not account for contamination and losses, and non-TA tonnages are not captured
Other	Export data, stocktake report, OPMCSA report, Valpak report MRF data	National recycling rate, OECD recycling rate	Export data, is regular and accurate, but local recycling data is missing and would need to be gathered regularly. There may be some losses that are not accounted for
Farm plastics	Potentially future product	Product stewardship reporting	High from inception of proposed scheme

Metric	Source	Key metrics required for	Data quality/availability
	stewardship scheme		
Putrescible			
Food	TA waste reporting stocktake report, OPMCSA reports	TA waste reporting national recycling rate, OECD recycling rate	Kerbside food data should be high but other data is only available from snapshots
Garden	TA waste reporting stocktake report,	TA waste reporting national recycling rate, OECD recycling rate	Kerbside FOGO data should be high but other data is only available from snapshots
Other Organic	Stocktake report	TA waste reporting national recycling rate, OECD recycling rate	Although the stocktake data was an advance on previous data, it was not comprehensive and raised issues around definitions and points of measurement
Ferrous metal	Export data, Stocktake report, industry data	TA waste reporting National recycling rate, OECD recycling rate	Export data is good and captures most of recovery, onshore processors are limited in number and could be surveyed regularly to yield a high-quality dataset
Non-ferrous metal	Export data, Stocktake report, industry data	TA waste reporting National recycling rate, OECD recycling rate	Export data is good and captures most of recovery, onshore processors are limited in number and could be surveyed regularly to yield a high-quality dataset
Glass			
Bottles and jars	GPF data, CRS study data	TA waste reporting National recycling rate, OECD recycling rate product stewardship reporting	Although industry data is reported regularly the voluntary nature of data supply limits data quality

Metric	Source	Key metrics required for	Data quality/availability
Flat glass	Stocktake report	National recycling rate	Export data is good and captures most of recovery, onshore processors are limited in number and could be surveyed regularly to yield a high-quality dataset
Textiles	One off report Export data	National recycling rate	Export data is good and captures most of recovery, onshore processors are limited in number and could be surveyed regularly to yield a high-quality dataset
Nappies and sanitary	No data	National recycling rate	No data
Timber	Stocktake report	National recycling rate	Snapshot data only which was incomplete. Issues with definition e.g. combustion for heat and power
Rubber	Stocktake report	National recycling rate	Snapshot data only
Tyres	Tyrewise	National recycling rate Product stewardship reporting	High from 1 Sept 2024
Rubble & Concrete	Stocktake report	National recycling rate	Snapshot data only which was incomplete.
Potentially Hazardous			
e-waste	Techcollect, B.I.G.	National recycling rate Product stewardship reporting OECD reporting	High from inception of proposed scheme
Farm chemicals	Agrecovery	National recycling rate Product stewardship reporting OECD reporting	High from inception of proposed scheme
Contaminated soil	No data	National recycling rate	No data on reuse and rehabilitation of contaminated soils

Metric	Source	Key metrics required for	Data quality/availability
Biosolids	Industry	National recycling rate	Limited sources, could be gathered through regular surveying
Recovery by Activity			
Construction and demolition	Stocktake	National recycling rate, targeting waste minimisation actions	Snapshot data only which was incomplete.
Mixed industrial commercial and institutional	Stocktake	National recycling rate, targeting waste minimisation actions	Snapshot data only which was incomplete
Heavy industrial		National recycling rate, targeting waste minimisation actions	New classification, no existing data
Residential drop-off		National recycling rate, targeting waste minimisation actions	Some anecdotal data but no collated data currently. Will be reported for council managed collections from July 2024.
Residential kerbside	TA waste reporting	National recycling rate, targeting waste minimisation actions, OECD reporting	High quality data from July 2024 for council managed collections
Reuse	Stocktake Reuse Aotearoa	National recycling rate, targeting waste minimisation action	Stocktake only focused on reusable containers and was a one-off study.
Home composting	Limited survey data	National recycling rate, targeting waste minimisation action	Limited local data available. No time series data
Material Placed on the Market	Industry sources, Import data	Material place on the market is one way to calculate	Low. Difficult to access outside of product stewardship schemes. Some industry bodies may be able to supply data.
Population and household data	Statistics New Zealand, TA ratings databases	Population and household data is necessary to calculate per capita or per household metrics	Statistics New Zealand data is generally high quality, however if metrics relate to population or households served this will rely on TA data

3.3.1 Gap Analysis Summary

The gap analysis above shows that, apart from levy data, some TA waste reporting data, and potentially data from product stewardship schemes, most data that would be required for comprehensive recycling rate calculations is of low or medium quality. The biggest issue is with recovered material data on a time series basis. With the exception of some information available from export data (metals), and product stewardship (glass bottles), most recovered material data is only available from one-off studies. Determining the activity that generated recovered waste is also problematic and generally to be able to do this requires subjective judgements when reviewing the data.

4.0 Waste Metrics

4.1 Waste Metrics Overview

This following section outlines the challenges to developing metrics and how they can be used. It also provides recommendations for inclusions and exclusions for core metrics, and further metrics for considerations.

4.2 Key Challenges to Developing Metrics

One of the challenges when attempting to develop useful metrics for measuring recycling/recovery is determining what should be included in the metric. There are a number of aspects:

1. What data is available. This is a function of how waste and recovered materials are collected and processed, how data is recorded through the process, what parties are involved and therefore who owns or has access to the data.

2. How the available data classifications have been defined and understood, and whether these definitions are commonly held and interpreted across the value chain.

3. What is going to be useful. This requires a clear understanding of who is going to be using the metric and what it is going to be used for.

4. Boundaries around what is and is not considered waste or recovered materials. The core materials and streams are usually intuitive (e.g. waste to Class 1 disposal, kerbside collected recyclables), but depending on the metric, waste and recovery can become very difficult to define and subjective (for example, on farm disposal, on farm recovery, second hand goods, by-products, contaminated soils etc.).

5. Considerations around the end of waste and at what point a material is considered to be recovered or recycled. This includes the level of contamination that might be counted at the point of measurement and how this can then be accounted for. For example, if paper recovery is measured at the point of sale into a commodity market, it will still contain a proportion of contamination, which is removed during processing, but it is generally not practical to trace all recovered material to its processing point and obtain data on contamination levels from each plant and batch of input material.

It is beyond the scope of this study to address these challenges, but it is important to note them so that it is clear, when developing metrics, what the shortcomings are. Some of the parameters that we have noted in the study that will continue to require consideration and refinement are discussed below:

Activities. A set of Activity classifications has been developed and instilled in regulation in New Zealand. However, these Activity classifications have some shortcomings, including that they do not define how rural waste, biosolids, litter and illegal dumping, street sweepings, contaminated soil, or VENM are to be classified (refer Appendix A.2.1 for further discussion of these).

In addition, the Activity classifications used in New Zealand do not have direct parallels in other jurisdictions. Commercial and Industrial (C&I) and Construction and Demolition (C&D) are commonly used terms, which have broad analogues in the NZ classifications, although the inclusion of a 'Heavy Industrial' category here means the correspondence is not precise. The categories of Residential Kerbside, Residential Drop off, and 'Unusual' do not have direct comparators elsewhere. In short, interpretation and manipulation of data is likely to be necessary to generate data that is comparable to other international data.

Scope and Definitions. Further discussions and final decisions will be required to determine what precisely should be included in each of the metrics. Issues include how to treat Farm Fills and rural waste, to what extent to include class 3-5 data and uncontaminated soils in metrics, how to

account for unusual wastes when they appear in the data, at what point material is considered recycled or recovered (and how to measure post-processing losses), and how to account for ICI-sourced materials in kerbside collections. How each of these issues has been handled in the metrics developed for this report are discussed below.

Types of disposal. New Zealand is fairly unusual in having a large range of disposal facility classifications. Australia has a similar range but there are differences in the classifications (refer section 2.2.1). When comparing metrics internationally, the total quantity that is counted as being disposed of will vary depending on what material going to which disposal facility classes is included in the metric. In particular the inclusion of industrial monofills, and class 5 fills will have a large impact on overall rates due to the tonnages disposed of in these types of facilities. Some assumptions have been made in respect of the disposal classes included in the metrics developed for this report, but it is recommended that that these be reviewed in more detail.

Types of waste and recovered materials. As noted above there are boundary issues in determining which materials and sources to include in recovery data. For example, recycling of material from an industrial process back into the process, recovery of organic wastes on farms (or between farms), whether a material is a by-product or is considered recovered material. In addition, the Stocktake found that an unknown, but potentially large, quantity of material passes between companies without being handled by a 'waste operator' or otherwise recorded as being waste that is recovered.[132]

Reuse. At present, reuse of materials has not been included in the metrics (with the exception of textiles). Some initial data on reusable packaging was gathered as part of the Stocktake and further work has been done by Reuse Aotearoa.[133] However, there is not any consistent data or methodology to translate the number of reusable items in circulation to reliable tonnage figures. Additionally, diverted tonnage figures from transfer stations and landfills (as collected in OWLS) include some reuse of materials, but the exact proportion of reuse relative to recycling is unclear. This is an area for further research. As noted earlier, not accounting for reuse risks relegating the importance of reuse relative to recycling and energy recovery when examining intervention options.

Reduction/avoidance. As with reuse, reduction and avoidance of waste are not directly included in the metrics examined in this report. This is an inherent flaw in any recycling metric, as any reduction will only affect the denominator (i.e. the amount going to disposal), whereas recycling or recovery are always going to have a greater impact on the recycling rate as they impact both the denominator and the numerator. Taking proper account of reduction and avoidance is one reason to consider metrics based on quantities to disposal rather than recovery rates.

4.3 Use of Waste Data Metrics

In order to determine what the most appropriate recycling rate measures might be, it is important to consider what the measures might be used for. Potential uses are noted below:

4.3.1 Central Government

- OECD reporting
- GHG Inventory reporting

[132] Eunomia (2021) Waste Infrastructure and Services Stocktake. Report for the Ministry for the Environment.
[133] Reusable packaging in Aotearoa June 2022 - Reuse Aotearoa

- Emissions Reduction Plan reporting
- Waste Levy reporting
- Assessing funding applications
- Informing and evaluating policy, legislation, and regulation

4.3.2 Local Government

- Waste Assessments
- Facility and infrastructure planning
- Contract monitoring and performance reporting
- Waste levy spend reporting
- TA waste reporting

4.4 Developing Initial Metrics

When developing an initial set of metrics for this project the key concern was for the metrics to be as immediately useful and practical as possible. In consultation with the Ministry, it was identified that there were three main and immediate purposes for developing standardised recycling rate metrics. These are:

1. To understand Aotearoa New Zealand's actual performance in terms of waste management and minimisation (to the degree that this is possible).
2. To be able to report on progress to the OECD and compare rates with other countries.
3. To measure the impact and progress of kerbside standardisation.

It was further agreed that the key focus should be to understand Aotearoa New Zealand's actual performance in terms of waste management and minimisation. If a clear data set can be established that can provide a reasonable measure of overall performance, then the other metrics should simply be subsets of this. Similarly, a usable overall dataset should allow a variety of different metrics to be developed and tracked.

While it is well documented that New Zealand does not have good waste data, and that improving this will be important, in our view this does not have to prevent developing an initial dataset that can be improved over time and new and better data sources become available.

The approach therefore has focused on developing a comprehensive national dataset, while explicitly acknowledging that many of the components of the dataset require improvement. In addition, the exercise of compiling a national dataset also serves to highlight the existing data gaps and helps provide a focus for where effort can be directed to improve the data.

In total three metrics have been developed with variations on each of them (giving a total of 6 metrics). These are:

1. **Overall**
    a. Overall NZ recycling rate.

b. Australian – aligned overall NZ recycling rate

2. **MSW**

   a. Municipal Solid Waste (MSW) rate (OECD compatible)

   b. Municipal Solid Waste (MSW) rate (EU compatible)

3. **Kerbside**

   a. Kerbside rate (including 'household like' commercial waste)

   b. Kerbside rate (excluding 'household like' commercial waste)

An explanation of what is included in each metric is provided below. Further detail is also provided in the recycling rate model (refer section 5.0 and Appendix A.5.0).

4.4.1 Overall Metrics

Table 17 Overview of the Recycling Rate Model Overall Metrics

Data Type	Rate a) (NZ)	Notes	Rate b) (Aust.)	Notes
Class 1 Disposal	Included		Included	
Class 2 Disposal	Included		Included	
Class 3-4 Disposal	Excluded	In reviewing the data 99.7% of the tonnage to these facilities is 'rubble' – essentially soil and rock and the quantity of this material (over 23 million tonnes or about 66% of all material to disposal) significantly outweighs all other material and obscures what is happening with other materials. As rubble is considered inert it is not considered useful to include it in this metric.	Included	
Class 5 Disposal	Excluded		Excluded	

Data Type	Rate a) (NZ)	Notes	Rate b) (Aust.)	Notes
Industrial Monofills	Included	Industrial monofils have not previously been included in waste generation measures but represent significant tonnage.	Excluded	
Farm Fills	Included	Data on quantities to farm fills is estimated, but farming is one of NZ's main economic activities and so the outputs from this should be included.	Excluded	Farm fill data is not included in Australian data which focuses only on where the end fate of material is known.
Recovered material	Included	All recycling data is included.	Included	Australia's recycling rate includes organics. They also produce a 'recovery rate' figure that includes material recovered through 'energy recovery'
Industrial, Commercial, and Institutional (ICI)	Included	All activities are included in the overall measure	Included	Mixed ICI is combined with Heavy Industrial to make up 'Commercial and Industrial'
Heavy Industrial	Included		Included	
Construction and Demolition	Included		Included	Equivalent to Australian classification
Residential	Included		Included	Combined to make up the MSW classification. MSW includes all waste from council activities.
Residential Kerbside	Included		Included	
Unusual	Included		Excluded	No equivalent in Australia

4.4.2 MSW Recycling Rates

Table 18 Overview of the Recycling Rate Model MSW Recycling Rates Metrics

Data Type	Rate a) (OECD)	Notes	Rate b) (EU)	Notes
Class 1 Disposal	Included	Residential and residential kerbside waste only	Included	Residential and kerbside waste Some mixed ICI is included as similar in nature and composition to MSW
Class 2 Disposal	Included	Class 2 is unusual as a classification and this material would normally go to the equivalent of Class 1 so this is included	Included	
Class 3-4 Disposal	Included	A small amount of residential waste received at Class 3-4 landfills is included	Included	A small amount of residential waste received at Class 3-4 landfills is included Some mixed ICI waste is also included as similar in nature and composition to MSW
Class 5 Disposal	Included	A small amount of residential waste received at Class 5 landfills is included	Included	
Industrial Monofills	Excluded		Excluded	
Farm Fills	Excluded		Excluded	
Recovered material	Included	Residential and kerbside recycling	Included	Residential and kerbside recycling Some mixed ICI recycling is included as similar in nature and composition to MSW

Industrial, Commercial, and Institutional (ICI)	Excluded		Included	Only specific materials that are deemed 'similar in nature and composition' to household waste are included (both disposal and recycling)
Heavy Industrial	Excluded		Excluded	
Construction and Demolition	Excluded		Excluded	
Residential	Included	Waste collected by, or on behalf of municipalities only Includes commercial waste from 'household-like' activities in residential collections	Included	Includes all residential waste (whether or not collected by, or on behalf of municipalities) Includes commercial waste from 'household-like' activities in residential collections
Residential Kerbside	Included		Included	
Unusual	Excluded		Excluded	

4.4.3 Kerbside Recycling Rates

Table 19 Overview of the Recycling Rate Model Kerbside Recycling Rate Metrics

Data Type	Rate a) (All collected)	Notes	Rate b) (Excluding ICI)	Notes
Class 1 Disposal	Included	Residential kerbside only	Included	
Class 2 Disposal	Excluded		Excluded	
Class 3-4 Disposal	Excluded		Excluded	
Class 5 Disposal	Excluded		Excluded	
Industrial Monofills	Excluded		Excluded	

Data Type	Rate a) (All collected)	Notes	Rate b) (Excluding ICI)	Notes
Farm Fills	Excluded		Excluded	
Recovered material	Included	Household. As noted above, reuse, avoidance, and by-products are not accounted for.	Included	
Industrial, Commercial, and Institutional (ICI)	Included	Includes commercial waste from 'household like' activities.	Excluded	Discounts commercial waste from 'household like' activities.
Heavy Industrial	Excluded		Excluded	
Construction and Demolition	Excluded		Excluded	
Residential	Excluded	Includes commercial waste from 'household like' activities in kerbside collections	Included	Excludes commercial waste from 'household like' activities in kerbside collections
Residential Kerbside	Included		Included	
Unusual	Excluded		Excluded	

4.5 Other Metrics

The metrics developed for this study are intended as an initial set only. As discussed, while the above indicator can be further refined, the dataset developed (and which can be further refined also), can potentially enable a range of indicators. Additional indicators which may be worth considering further are noted below.

4.5.1 National Waste Data Framework (NWDF) Waste Indicators

In 2018 WasteMINZ developed a series of indicators for reporting of data gathered under the NWDF. These indicators are:

- Waste to Class 1 landfills
    - Indicator 1A - All waste to Class 1 landfills
    - Indicator 1B - Waste to Class 1 landfills - excluding special wastes
- Domestic waste
    - Indicator 2A – Domestic kerbside waste disposal rate
    - Indicator 2B - Domestic waste disposal rate
- Domestic recycling
    - Indicator 3A - Domestic kerbside recycling recovery rate
    - Indicator 3B - Domestic recycling recovery rate
    - Indicator 3C - Domestic kerbside recycling contamination rate

The definitions of these indicators are noted in Appendix A.1.5.4. The indicators were intended as indicators for territorial authorities (TAs) to report on waste data using a common set of metrics that are compatible with the methods for compiling the data outlined in the NWDF. While the indicators are not nationally focused indicators, they could form the basis for nationally focused indicators. The indicators themselves take the form of quantities per capita, so they do not provide a percentage rate, although they could be combined to derive percentage rates. It should be noted that they were developed as per capita rates rather than percentage rates to avoid issues associated with not taking account of waste reduction.

The indicators reflect data that TAs are likely to have available or be able to access.

4.5.2 Tracking per Capita Composition of Waste to Disposal

As noted above, one of the key issues with recycling rates is that taking proper account of waste minimisation is inherently difficult if not impossible. An alternative approach is to focus instead on the absolute quantities per capita to disposal by composition and activity. In many ways this provides the critical information for waste management planning, as it identifies what the key materials going to landfill are and what is generating them. The use of per capita metrics enables ready comparison by jurisdiction and over time, where absolute figures could simply reflect population changes.

The data gathered by this study should enable ready generation of these types of metrics.

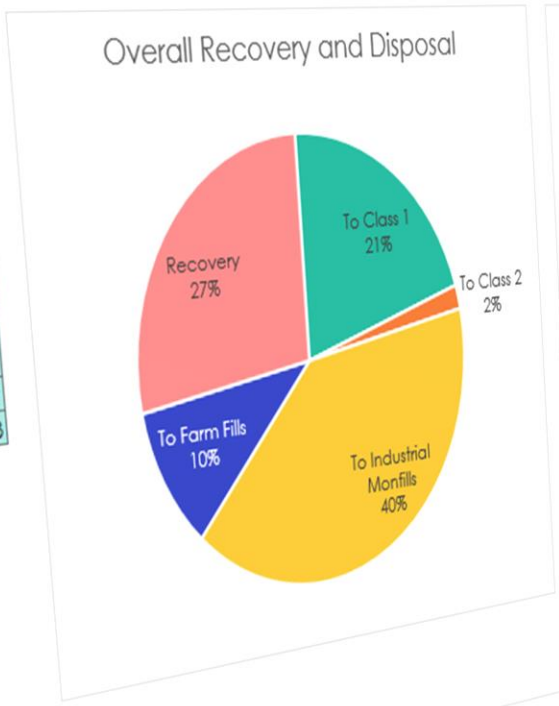
5.0 Recycling Rate Model

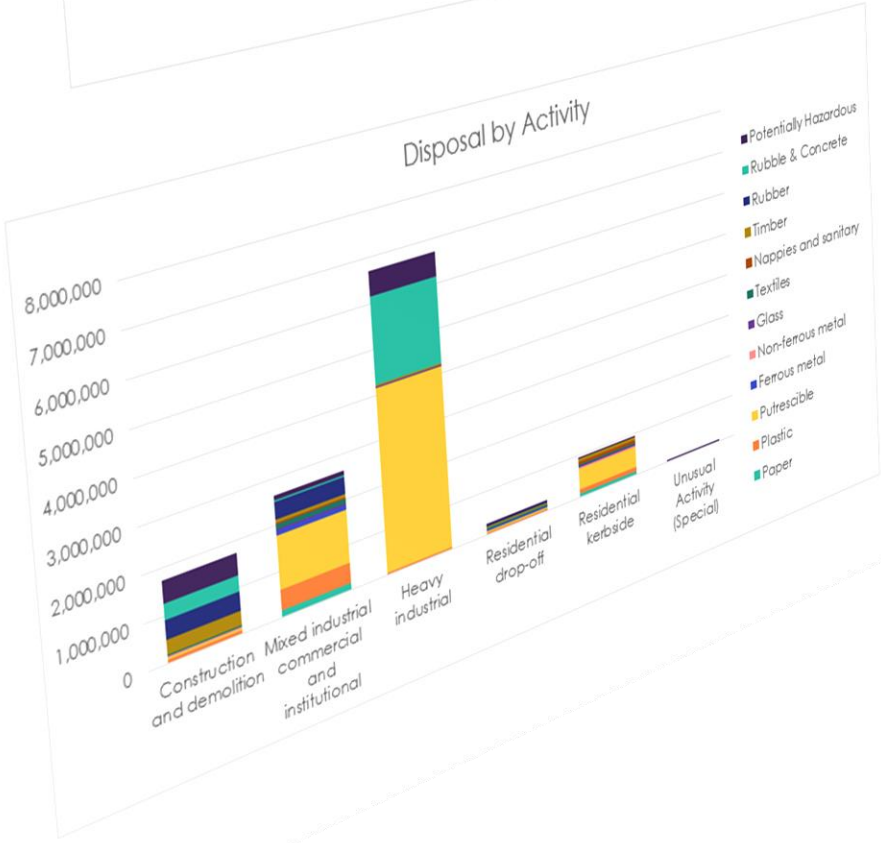
Class 3,4, & 5. These are excluded on the basis that the

al	Unusual Activity (Special)	TOTAL	Tonnes per Capita
948,788	0	3,510,945	0.68
0	7,546	300,564	0.06
0	23,663	6,766,139	1.31
0	0	1,744,056	0.34
0	**31,209**	**12,321,703**	**2.39**
948,788	44,673	4,592,996	0.89
477,681	75,882	16,914,700	3.28
,426,469	**58.9%**	**27.2%**	
33.5%			

0.277	0.015	3.285
0.184	**0.006**	**2.393**
0.093	0.009	0.892

al	Unusual Activity (Special)	TOTAL Disposal
84,925	0	305,098
105,454	0	673,497
479,890	0	5,856,706
18,605	0	155,675
10,193	0	27,169
35,827	0	80,030
37,925	0	264,610
91,684	0	144,919
39,405	0	434,660
25,147	0	887,788
3,706	7,546	2,296,506
16,027	23,663	1,195,043
948,788	**31,209**	**12,321,703**





5.1 Recycling Rate Model Overview

One of the main outputs from this project is the development of data model for calculating a set of recycling rates that can be practically applied.

The philosophy behind the model is to compile the best available data sources to produce a single, integrated dataset that includes all of the data required to produce a range of metrics. Core to this approach is recognition that the quality of the data available is highly variable, and that the best available data should be used while being transparent about the shortcomings of current datasets and highlighting areas where data and methods of calculation can be improved in the future.

In this way functional metrics can be produced now and then refined and improved over time.

The key datasets that are compiled in the model are:

- Tonnes to Class 1 Disposal
- Tonnes to Class 2 Disposal
- Tonnes to Class 3 & 4 Disposal
- Tonnes to Class 5 Disposal
- Tonnes to Industrial Monofills
- Tonnes to Farm Fills
- Tonnes Recovered
- A break-down of tonnes to each destination by Activity and composition.

All data included in the model is calendar year 2023 data or has been adjusted where applicable to align with calendar year 2023 data.

5.1.1 Model Data Quality

In general, tonnage to Class 1-5 disposal facilities and industrial monofills are good quality as it is based on mandatory levy reporting. Data on activity and composition of those tonnages is based on voluntary reporting and survey data which have been compiled. Data on recovered materials is from export data and one-off study data, supplemented by industry sources, and data on farm fills is based on a one-off study. The model notes data sources and provides a rating of data quality within the model to enable improvements to be targeted for future iterations.

Data quality in the model has been assessed according to the following scale:

Rating	Explanation
1	Data is reported at least annually based on recognised definitions, and is quality checked
2	Data is reported at least annually but may be incomplete, or is less regular but complete
3	Data is based on one off survey or study, but is recent and considered substantially complete
4	Data is based on industry self-reported data that has limitations
5	Data is based on one off survey, but is 5 years or more old, is not considered complete, or has other issues
6	Data is based on proxy data or partial data that is extrapolated
7	Data is based on estimates

5.1.2 Model Structure

The model is organised by section with colour coded tabs denoting the functions of the constituent sheets. The tabs are colour coded as follows:

- Orange = model outputs
- Purple = raw tonnage outputs
- Turquoise = consolidated data
- Pink = inputs

The key tab in the model is the 'Raw Tonnage Outputs' tab. This tab compiles all the data sources into a set of 10 tables that can be used to then generate the various output metrics that may be desired. Each table contains the data for a particular destination (e.g. Class 1 Disposal, Class 2 Disposal, Recovery, etc.) broken down by composition and activity source.

Some metrics are provided in the orange output tabs. However, the model is intended to enable different metrics to be constructed from the collated data in the Raw Tonnage Outputs tab.

5.1.3 Model Outputs

Note: For the purposes of this report 'recycling rate' includes all formal recovery reported under that metric,

The key metrics that have been developed in the model are:

An overall recycling rate metric. This metric aims to provide a full picture of waste generation and recycling activity in Aotearoa New Zealand. The key features of this metric are:

- It excludes Class 3,4 & 5 disposal data. In reviewing the data 99.7% of the tonnage to these facilities is 'rubble' – essentially soil and rock and the quantity of this material (over 23 million tonnes or about 66% of all material to disposal) significantly outweighs all other material and obscures what is happening with other materials. As rubble is considered inert it is not useful to include it in this metric (this is not to say that there are not issues with the material going to these facilities that should be considered in other contexts).[134]
- It includes all materials from all sources identified as being recovered.

An overall recycling rate that is equivalent to the Australian Recycling rate measures. This rate is intended to be functionally equivalent to the overall national recycling rate measures calculated by DCCEEW in Australia. The key features of this metric are:

- Recycling includes "activities in which solid wastes are collected, sorted, processed (including through composting), and converted into raw materials to be used in the production of new products (the amount of solid waste recycled is net of any residuals disposed)."[135]

[134] This metric could be further adjusted by excluding material from mining activity, as this is predominantly rock and soil, however some of this material may require careful on-site management, and including it provides visibility of this activity.
[135] national-waste-data-viewer-user-guide.pdf

- The measure is based on all material disposed of and recovered excluding material to Class 5 and any on farm or on-site disposal such as industrial monofill (To be included in the data material must be handled by a waste operator and/or taken off site).

- Ash from coal fired power plants is included in some Australian data but is a relatively small part of the waste stream in NZ and is not broken out in the data in NZ.

A Municipal Solid Waste (MSW) OECD Recycling Rate. This rate has been calculated to provide a measure that is broadly compatible with rates reported to the OECD. The OECD definition of municipal waste is:

"Municipal waste is defined as waste collected and treated by or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, as well as yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste if managed as household waste. The definition ***excludes waste from municipal sewage networks and treatment, as well as waste from construction and demolition activities."***

The key features of this metric are:

- It includes only waste and recovered materials collected and treated by or for municipalities.

- It includes data from kerbside collection and residential transfer station and drop-off material. A proportion of this material is 'similar waste from commerce and trade' which is collected through kerbside or is dropped at recycling points or transfer stations in cars and small vehicles. However, this data will likely not include all 'similar waste from commerce and trade'. Kerbside collections often, but not always, include small business was from CBD, dairies, small shopping precincts etc. Also, large businesses have commercial collections so their 'similar waste from commerce and trade' will be in these ICI streams. However, there is no data available to quantify this.

- It does not include litter and illegal dumping or street sweepings. Once again there is no national data on this, and it is not clear how the data is coded currently in terms of Activity. However, local data indicates that the quantities involved are unlikely to materially impact the overall recycling rate.

- The measure does not include ICI waste, Construction and Demolition, or waste from municipal sewage networks and treatment.

- On the recovery side the rate accounts for losses between when recovered material is collected and when it becomes a product.

A Municipal Solid Waste (MSW) EU Recycling Rate. This rate has been calculated to provide a measure that is broadly compatible with rates reported in the EU and aligns with the data reported in the Global Recycling Index. The EU definition of Municipal Waste is:

"mixed waste and separately collected waste from households including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture" and *"mixed waste and separately collected waste from other sources, where such waste* ***is similar in nature and composition to waste from households****"* (our emphasis)

The key features of this metric are:

- It specifically includes estimates of commercial waste and materials that are 'similar in nature and composition to waste from households'. Under this definition waste collected privately is included as well as waste collected by or for municipalities. For the purposes of the calculation we have

included most paper bottle glass, textiles, and nappies and sanitary as well as 30% of plastics, and a proportion of putrescible.

- It does not include litter and illegal dumping or street sweepings. Once again there is no national data on this, and it is not clear how the data is coded currently in terms of Activity. However, local data indicates that the quantities involved are unlikely to materially impact the overall recycling rate.

- The measure does not include Construction and Demolition, or waste from municipal sewage networks and treatment.

- On the recovery side the rate accounts for losses between when recovered material is collected and when it becomes a product.

Kerbside Recycling Rate: Two variations of the rate are provided for in the model – a simple rate that accounts for kerbside including ICI and a rate that allows for an estimate of ICI in residual and recovered material to be made and subtracted from the total.

Appendix A.5.0 contains an explanation of the data sources used in the model and the rationale for how the calculations are made.

5.1.4 Generated Metrics

The metrics noted above were calculated by the Model. The outcomes for the respective rates from this exercise are shown in the table below:

Table 20: Calculated Recycling Rate Metrics

Metric	Description		Recycling Rate	Waste recycled (tonnes)	Waste generated (tonnes)	Waste generated per capita per annum (tonnes)
1a – Overall (Excl 3-5)	This rate measures all material recycled and disposed of excluding inert material, (material to class 3-5 disposal). It includes rural waste and waste to industrial monofils.		28.6%	4,916,420	17,179,095	3.336
1b – Overall (Australia)	This rate is designed to align with the Australian national recycling rates reported by DCCEEW. It only includes material that is part of the formal waste management system,	NZ	39.4%[137]	4,916,420	12,476,389	2.423[138]

[137] For reference, DCCEEW report 63.0% recycling rate for Australia in 2022/23
[138] For reference, DCCEEW report 2.875 tonnes per capita per annum for Australia in 2022/23

Metric	Description	Recycling Rate	Waste recycled (tonnes)	Waste generated (tonnes)	Waste generated per capita per annum (tonnes)
	and so excludes rural waste, industrial monofil and Class 5 disposal.[136]				
2a – MSW (OECD)	This rate is intended to align with the OCED MSW definition. It includes household waste and some material from commercial sources.	37.6%[139]	780,578	2,077,485	0.403[140]
2b – MSW (EU)	This rate was developed to align with the EU definitions of MSW which include a wider range of	41.6%[141]	1,196,754	2,877,485	0.559[142]

[136] This rate excludes coal ash from power generation, which is a primary energy source in Australia. The principal difference driving a higher rate of recovery in Australia is much higher rates of recovery of C&D waste. New Zealand's data on C&D recovery is however poor, and it is likely that better data measure of this sector could reveal improved rates of recovery.
[139] The average recycling rate for OECD member states has not been published. For reference, Eunomia's Global Recycling League report indicates that most countries have recycling rates between 30 and 50%
[140] The OECD report the average waste generation per capita for all member states is 0.542 tonnes/capita in 2021
[141] Eurostat report the average recycling rate for member states is 48% in 2022
[142] Eurostat report the average waste generation per capital for all member states is 0.253 tonnes/capita in 2022

Metric	Description	Recycling Rate	Waste recycled (tonnes)	Waste generated (tonnes)	Waste generated per capita per annum (tonnes)
	commercial wastes than the OECD definition indicates.				
3a Kerbside (All)	This kerbside rate does not differentiate between household and commercial waste collected in kerbside collections	27%	351,728	1,300,517	0.253
3b Kerbside (HH only)	This kerbside rate excludes commercial waste. There are no reliable datasets, so an estimate is provided based on the best available information	27.6%	325,349	1,179,258	0.229

These new metrics suggest that New Zealand's recycling performance and waste generation is in the middle of the pack compared to other OECD countries. For example the Eunomia Recycling League Tables show top rates of close to 60% with median rates in the mid to high 30's Similarly, the EU-compatible rate aligns with expectations around tonnes per capita for similar economies. The municipal waste per capita estimates are lower than previously reported in the Te Rautaki Para Waste Strategy (0.7 tonnes per capita) and the national recycling rate reported in Transforming Recycling (28%) is towards the lower end of the different recycling rate metrics calculated here.

Overall, the new metrics put forward in this report provide a starting point from which the measures can be further refined as data becomes available and as some of the finer points of the definitions are worked through.

5.2 Future Iterations of the Model

5.2.1 Time series

The model has been constructed with a static set of data, based on (as close as practicable) calendar year 2023 data. It has not been constructed to enable time series data to be compiled. However, the intention is that a new model can be used for each data year and the raw output data (from the "Raw Tonnage Outputs" tab) in the model can be pulled through into a separate spreadsheet model that can then be used to construct time series data.

5.2.2 New Data Sources

As new data sources become available some of the sheets and calculations will need to be updated. This is likely to include data from TA reporting, mandatory reporting of Activity data from transfer stations and disposal facilities, additional composition data and studies, and as new studies and data sources for recovered materials become available.

6.0 Recommendations

Based on the work undertaken in this report, Eunomia offers recommendations to produce reliable recycling rates going forward. The recommendations include refining and extending metrics, improving data quality and filling data gaps, and taking steps toward standardising waste data in New Zealand.

6.1 Metrics Recommendations

- The initial metrics that have been developed as part of this project should be further refined, including looking at what is included in each metric. Key issues to consider include where biosolids, litter and illegal dumping, street sweepings are accounted for, farm fills and rural waste, to what extent to include class 3-5 data and uncontaminated soils in metrics, how to account for unusual wastes when they appear in the data, at what point material is considered recycled or recovered (and how to measure post-processing losses), and how to account for ICI-sourced materials in kerbside collections.

- Based on the dataset that has been compiled, consider developing further metrics. Additional metrics could include per capita metrics that enable waste reduction and avoidance to be correctly accounted for.

- Continue to work on and refine definitions, particularly around the end of waste and point of recovery, and what disposal data should be included. Once the definitions have been agreed these should be formally defined.

6.2 Data Recommendations

While it is outside of the present scope to address the issue of waste data gathering and management, compiling the data for the metrics developed in the study highlighted where the key data issues are. The key areas for improvement in data needed to generate reliable time-series include:

- **Farm fills, and rural waste.** The available data is based on a single study from 2013 in one part of NZ. Given that farming is one of New Zealand's primary economic activities, and that unregulated disposal takes place on farms, better data on farm fills and rural waste should be a priority.

- **Class 1 Composition by Activity**. Most of the available composition data is from studies commissioned by TAs and landfill operators. A programme of composition audits that is able to generate reliable, time series data applicable at a national level will be important for being able to track changes over time and ascertain the impact of policies and investment. The programme could incorporate audits commissioned by other parties, (but potentially with support funding from central government to better specify the scope of the audits and have full access to the data).

- **Class 2-4 Composition by Activity.** Existing data points for this are limited (while an improvement on previous data). A more representative sample of facilities and regular time series data will be important for being able to track changes over time.[143]

- **Paper (Fibre) Recovery.** There is reasonable regular data on paper exports through Statistics NZ data, but domestic processing accounts for roughly 60% of recovery, and there is no regular independent compilation of this data.[144]

[143] There is uncertainty as to whether all landfills that have self-identified as being 'Class 2' actually meet the definition of 'Class 2.
[144] The Waste and Recycling Industry Forum does compile this data but it pertains only to their members, so while this is the majority of material it is not complete.

- **Plastic Recovery.** As for paper there is reasonable regular data on plastic exports through Statistics NZ data, but domestic processing accounts for roughly two thirds of recovery, and there is no regular independent compilation of this data. Existing estimates are based on one-off studies.

- **Organics Recovery.** There is some available information from TAs on the quantities of organics collected through kerbside and transfer stations, and new TA data reporting requirements will improve this. However, this is a small fraction of the overall organic waste recovered. Existing data is primarily from the one-off stocktake. As organics is a significant fraction in terms of recovery it will be important to generate better quality regular time series data. This could be done through a regular annual survey of organic waste processors.

- **Textiles Recovery.** There is some regular data available through Statistics NZ export data, but figures on domestic recovery are reliant on a one-off study from 2021.[145]

- **Construction and Demolition Recovery.** The only available national data is from the stocktake, and this was known to have an incomplete dataset. Construction and demolition is one of the largest waste generation activities and can potentially have high levels of recovery, meaning it will have a significant impact on recovery rates. Reliable and regular time series data will be important for being able to track changes over time. As for organics this could be done through a regular annual survey of construction and demolition waste operators.

- **Reuse.** Further work is needed to be done on developing protocols for the inclusion of reuse. This is likely to need to be looked at on a material-by-material basis, as the definitions, systems and methodologies that may be required are likely to different. For example, for reusable containers would need to be a consistent methodology to translate the number of reusable items in circulation to reliable tonnage figures, while textile reuse would require methodologies to track local reuse of garments and furnishings as well as material exported for reuse. This is an area for further research. As noted earlier, not accounting for reuse risks relegating the importance of reuse relative to recycling and energy recovery when examining intervention options.

6.3 Additional Data Source Recommendations

Improving data collection will be critical to being able to generate meaningful, robust time series data that can accurately track changes that result from changes in policy and practices. Some options that could be considered include:

- **Undertaking a recycling industry survey.** Queensland, Australia gathers its recovered material data in this manner. Such a survey could be supported by regulation (under Section 86(b) of the Waste Minimisation Act). It could target operators who process material for recovery, including organic waste processors, C&D waste processors, plastics recyclers, textile recyclers and metal smelters and manufacturers.

- **Industry data.** There are a number of industry organisations that currently compile recovered material information. This includes the Glass Packaging Forum, and the Waste and Recycling Industry Forum. Headline data is publicly available from these organisations and the Ministry could request more detailed information be supplied to it regularly.

- **Product stewardship scheme data.** Accredited voluntary product stewardship schemes should supply data to the Ministry as part of their accreditation agreement. This information could be compiled and fed into the database. Similarly, as mandatory schemes roll out they should gather high quality data on the flow of materials covered by the scheme and the fate of those

[145] TF_Circularity-Report_AW_201120_compressed-1.pdf (textilereuse.com)

materials. There should eventually be excellent data therefore on tyres, plastic packaging, farm plastics and farm chemicals, e-waste, large batteries (and refrigerants and other synthetic greenhouse gases).

- **Composition Analyses.** It is recommended that a programme of regular national composition analyses be undertaken to generate reliable time series data on Activity and composition across all classes of disposal facility. As noted above the programme could encompass audits commissioned by third parties in order to create a larger, more representative dataset.

6.4 Reporting Recommendations

- It is recommended that the Government establish a comprehensive set of common agreed standards and guidance for reporting all data. The standards and guidelines should all function together to ensure that the data received contributes to an overall dataset that is consistent and meets the needs, not only of central government but of the sector as a whole including TAs, community and private operators. There are different guidelines and advisory documents for reporting on different metrics (for example OWLS, TA performance reporting, levy spending, as well as voluntary reporting under the NWDF). The original concept of the NWDF was for it to be an all-encompassing framework for measuring and reporting data.[146] It envisaged three stages (at the time): Waste to levied disposal sites, an information about waste and diverted material services and facilities; waste to non-levied sites; and diverted materials.

- Once the metrics developed in this study are fully agreed and refined, it is suggested that the measures should be published, and reviewed and updated annually to begin to develop time series data.

- The Ministry should continue to develop the MfE data portal including adding the metrics developed through this study. The data Australian DCCEEW displays are an example of the range of data that New Zealand should aim to present.[147]

[146] National Waste Data Framework Combined Protocols FINAL.pdf (wasteminz.org.nz)
[147] Waste and Resource Recovery Data Hub - National waste data viewer - DCCEEW

Appendices

A.1.0 New Zealand Data Review Detail

A.1.1 Central Government Datasets

The Government datasets noted here include information that is supplied directly to central government, whether through mandatory or voluntary reporting. It is the foundational data to consider when reviewing options for developing recycling rate metrics.

Table 21 Central Government Datasets

Dataset	Description	Assessment
Online Waste Levy System (OWLS) tonnages	• Mandatory reporting of waste tonnages (weight) disposed to and diverted from class 1 through to 5 landfills, industrial monofills, and transfer stations. Reporting is monthly, quarterly or annually depending on the facility. Class 1 landfills have been reporting since the introduction of the levy in July 2009. • Class 2 landfills and transfer stations began reporting in January 2022. • Class 3, 4, and 5 landfills, and industrial monofills began reporting in January 2023.	There is OWLS data from 2009 to present day for Class 1 facilities but only data since 2022 for Class 2 and 2023 for Class 3&4. Most data reported into OWLS is weighbridge data. Weighbridges must be compliant with the Weights and Measures Act 1987. Where there are no weighbridges at a site volume to weight conversions are provided for. An 'average tonnage' methodology may be applied on approval. This allows for average weights to be ascribed to certain classes of vehicle.

Dataset	Description	Assessment
	From 1 July 2024 the tonnage received must have a breakdown by activity category. The activity sources to be reported are: • Construction and demolition • Mixed industrial commercial and institutional • Heavy industrial • Residential drop-off • Residential kerbside • Unusual activity • Transfer station	Overall, the quality of OWLS data is high. The inclusion of activity source data will provide a valuable added dimension to the data and may aid in calculation of measures related to specific waste sources.
TA Waste Minimisation	Mandatory annual reporting by territorial authorities to MfE from 1 July 2024. The first report is due on 30 September 2025. The data covers: • The types of materials collected through TA owned or operated services or facilities • Tonnes of each material type collected • Contamination tonnes in each service • Location of facilities • Number of properties services and whether commercial premises are included.	The types of materials are defined in schedule 4 of the Waste Minimisation (Information Requirements) Regulations 2023 Guidance on how to collect and report on waste minimisation has been published by the Ministry. Further guidance may be forthcoming from the Ministry or other channels (eg the National Waste Data Framework). It will not be possible to comment on data quality until it is received and assessed in the first reports in 2025; however, this data will be a significant advance on existing

Dataset	Description	Assessment
		available data from TAs which is not regularly collated or gathered in a consistent fashion.
TA Waste Levy Spend (TAWLES)	Annual waste levy expenditure reporting by territorial authorities to MfE via online portal TAWLES. Provision of this data has been voluntary since 2010. and able to be submitted via the online portal TAWLES since July 2022. From 1 July 2024 this reporting will become mandatory. Waste spend may have a break down by waste hierarchy classification (e.g. reuse), category (e.g. services), and waste type targeted (e.g. agrichemicals).	Provision of this data has been voluntary. Reporting has been inconsistent among councils since 2010. This should improve with the new mandatory reporting requirement.
Greenhouse Gas Inventory: Waste chapter	Mandatory annual greenhouse gas emission reporting by MfE to the United Nations Framework Convention on Climate Change (UNFCCC). Data sources for waste emissions include managed landfills, unmanaged landfills, composting, incineration, and farm waste (unmanaged landfills (farm fills) and open burning). Emissions are given in methane, nitrous oxide, and carbon dioxide.	In the context of this report, the GHG inventory is a guide to a collection of waste-related data sources that are required to produce the emissions model. The quality of the individual data sources varies. To our knowledge, most of the data sources can be accessed and referenced outside of the context of the Inventory (ie the Inventory itself does not generate new data).

Dataset	Description	Assessment
	Carbon dioxide equivalents in kilotonnes using Global Warming Potentials from AR5 are also available since 1990.	The Inventory does derive tables on annual waste and composition over time that could be considered novel sources as they further extend the source data.
Import Export	Mandatory monthly reporting of import and export tonnages by Customs to Stats NZ since 1990. Data is accessible via InfoShare and is accessible through New Zealand Harmonised System Classification (NZHSC) codes. Weight of material imported/exported from/to other countries over time according to NZHSC categories for Customs officers. Material categories include: • plastic polymers • rubber • wood • textiles • glass • metals • e-waste • paper/card • food processing wastes • slag.	Data can be extracted by the country it is exported to over time, enabling changes in export markets for recyclables to be tracked. The data available, however, is variable as noted below: • Material classifications have been developed for customs purposes, and do not necessarily align with waste industry classifications. For example, plastic polymers are split into Ethylene polymers, Styrene polymers, PVC polymers, and other. This does not correspond to recycling data which (since standardisation) is focused on PET, HPDE, and PP. • Not all classifications have weight data available. Data can include value and units as well as weight

Dataset	Description	Assessment
	The categories often include material that is not treated as waste.	(kg or tonnes). This can make compiling information in a comparable form problematic. • It is noted that there is no requirement to lodge entries in Customs data where the value is less than $1,000. The Customs data may therefore be missing a likely small but unknown amount of exported material. Notwithstanding these issues, Export data can be a valuable source of information particularly where a significant proportion of collected recoverable material is known to be exported including metals, plastic, textiles, paper & cardboard and e-waste.
Solid Waste Analysis Protocol (SWAP) waste composition	The Ministry has access to voluntary ad-hoc reporting of waste composition provided by TAs and waste facilities to MfE since 1993. At the time of writing the database included 207 sets of composition data. There are two main types of composition data gathered: • Procedure 1: Kerbside rubbish • Procedure 2: Disposal facilities and transfer stations	*Note: The assessment here relates to the composition data held by MfE – for an assessment of the SWAP itself refer to section A.1.5.5* The data held by MfE is wide ranging over time. There are 26 Procedure 1 kerbside rubbish audits covering the period 2005 to 2023 and 181 Procedure 2 facility audits covering the period 1993 to 2023 in the database. Of the

Dataset	Description	Assessment
	Data is compiled by percentage composition and material weight (where available) according to primary and secondary composition categories. The database contains information on: • Who commissioned the study • Who carried it out • The year • Type of audit (kerbside or facility, and whether it is a transfer station or class of landfill • Visual or sort and weigh method • Location • Month and season • Whether publicly available	procedure 2 audits 14 are sort and weigh (2012-2023) and 69 are visual surveys with the remainder (98) not specified. In addition, there are 3 audits of Class 2 disposal facilities and 5 audits of Class 3-4 disposal facilities. The small number of audits and facilities covered means the Class 2 – 4 data is less robust than data for Class 1 landfills and transfer stations. The dataset held by MfE can be interrogated to determine patterns over time and variations by region, audit type, seasonality etc. In our view this is a potentially very valuable dataset that can be used to generate national data, including tracking changes over time. Neither collection nor reporting of SWAP data is mandatory, which means the dataset is incomplete and uneven in coverage. Also, SWAP protocols have some discretionary elements which lessen comparability of results between different practitioners.

A.1.2 Key Studies

The studies noted here include one-off research that has gathered significant information on the quantities and types of materials collected, recovered, processed or exported. The studies do not necessarily provide a basis for ongoing reporting but do provide a useful snapshot of the state of play for the areas they cover.

Table 22 Key NZ Studies with Waste Data Summary

Dataset	Description	Assessment
2020-21 Waste and Resource Recovery: National Infrastructure and Services Stocktake (2023)[148]	The stocktake report (2020 Stocktake) was commissioned by MfE and published by Eunomia in 2023. The aim of the report was to inform a national approach to waste infrastructure and investment. The report includes a summary of waste infrastructure and services as of 2020. It also includes waste flows showing tonnage and end-of-life data of waste streams from 2020-21. Waste streams covered include metals, plastics, C&D, e-waste, farm plastics, reusable materials, and tyres from 2020-21. The data was gathered by engaging with 173 stakeholders across the sector.	The report states that the data collected was not intended to form a comprehensive picture of all recovered material (although it is the most comprehensive gathered to date). Key limitations of the data are: • It reports data based on information provided by respondents. Respondent information was of variable quality, not all respondents provided compatible data and not all parties contacted by the project team responded (the response rate was 69%).

[148] https://environment.govt.nz/publications/waste-and-resource-recovery-infrastructure-and-services-stocktake/

Dataset	Description	Assessment
		• No attempt was made to estimate data from non-respondents. Areas that were known to be under-reported included C&D waste and metals. • Not all recovered material was included in the scope. Key materials excluded were textiles, hazardous waste, soils, and second-hand goods. • The study highlighted a key issue of definition in that many recovered materials are simply not viewed or reported as such. They are seen as resources and traded without ever being classified as waste. This is notable in the area of organics with a lot of farm and primary processing material (such as chicken shed waste) simply swapped from farm to farm. Similar issues exist with forestry and wood processing waste. The study was focused on infrastructure and an assessment of capacity and was not designed to generate baseline data, although a lot of the data is useful for this purpose. Questions on data were only a small part of the study.

Dataset	Description	Assessment
		The study was an intensive and relatively costly exercise and provides only a snapshot rather than the ability to produce ongoing data. While the methodology is repeatable it does not provide a robust and cost-effective basis for ongoing performance monitoring.
New Zealand Waste Disposal Levy: Potential Impacts of Adjustments to the Current Levy Rate and Structure (Eunomia 2017)[149]	This study compiled data from a wide range of sources to develop comprehensive estimates on the quantities of waste disposed of by facility type, activity source, composition, as well as estimates of recovered materials. Recovered material and landfilled waste (to Class 1 to 4 disposal facilities, as well as Farm Dumps) were broken down by primary SWAP category (see section A.1.5.5) and by the following Activity Sources: • Domestic Kerbside • Residential • ICI • Landscape • C&D	This was the first time that a full picture of New Zealand's waste and recovered material data had been constructed. The data was sourced primarily from previous studies with only a small amount of new data gathered for the purpose of the study. The new data related to scrap metal and paper and was supplied through interview with relevant industry figures. The data that was compiled related to a wide range of different timeframes including some studies conducted between 2011 and 2016. No timeseries data was developed.

[149] Waste Disposal Levy Research | Eunomia Consulting

Dataset	Description	Assessment
	• Special • Rural	Where data was incomplete estimates, proxy data or interpolation was used to develop a complete dataset. The study was intended to present a credible estimate of NZ activity rather than establish a baseline figure. However, because it was the most complete information available, it has been used as the default estimates in multiple studies since. Interestingly, subsequent new studies, such as the 2020 Stocktake, have been in broad agreement with the estimates from this study, giving some confidence that the actual figures are likely to be similar.
Waste Disposal Levy Consultation Document (2019)[150]	MfE released the 'Reducing waste: a more effective landfill levy' document for a consultation that closed in February 2020. The consultation document sought feedback from New Zealanders regarding the landfill levy, the Waste Minimisation Act (2008), and waste data. Consultation responses are voluntary.	The data in this document is a compilation of data from a variety of other sources with much of the data on recovered materials taken from the previous study by Eunomia 2017 (above) and supplemented with more recent data on disposal to Class 1-5 disposal facilities.

[150] https://environment.govt.nz/publications/reducing-waste-a-more-effective-landfill-levy-consultation-document/

Dataset	Description	Assessment
	With respect to data, the document outlines the limitations of the data that MfE receives. They sought feedback on proposals to improve waste data including voluntary data collection and reporting, collecting data periodically, and a wider application of the New Zealand Waste Data Framework (NZWDF). Table 15 in the appendices of the report there are estimates for waste composition, activity source, and corresponding disposal type adapted from Eunomia's 'The New Zealand Waste Disposal Levy' report (2017).	
Container Return Scheme (CRS) Research (2022)[151]	The cost benefit analysis report was commissioned by MfE in 2022 to present findings of a CRS in NZ. The CBA presents modelling financial impacts from a CRS in NZ - typically year one, year four, and year 35 of implementation. The CBA notes imperfect data and estimations for	This research included an in-depth approach to attempting to quantify the total numbers and tonnages of containers placed on the market in NZ as well as the quantities recovered. It is understood that the market and recovery figures for glass packaging presented had some discrepancies with

[151] https://environment.govt.nz/assets/publications/A-container-return-system-for-New-Zealand-cost-benefit-analysis-update.pdf

Dataset	Description	Assessment
	material flows. Consumption and recycling tonnages and their source (recycling, refuse, litter) are presented in Table 3 comparing BAU and CRS at years 1 and 4. Some key inputs for material volume and flow modelling for beverage containers include GS1 container sales data, WasteMINZ and TA data on beverage container flows, and PwC's population growth rate (2021).	data gathered by the Glass Packaging Forum, with the GPF figures showing a slightly better recovery rate. This data is likely to be useful as a baseline figure, however, in the absence of a regulated product stewardship scheme being in place, updating the numbers would be time consuming and relatively costly.
OPMCSA plastics research (2019)[152]	The Office of the Prime Minister's Chief Science Advisor (OPMSCA) aimed to tackle the problem of plastic waste and commissioned the report 'Rethinking Plastics in Aotearoa New Zealand' in 2019. This report reviews plastics material flows and average lifetimes and identifies data gaps. There is an infographic on page 203 and a table on 204 illustrating plastic flows with corresponding confidence in the estimate and leakage.	This is the best estimate of plastic flows in New Zealand to date. The data was used as a reference in the 2020 Stocktake. However, a crucial data gap is the quantity of plastics that are imported as part of products, or as incidental transit packaging. The PCE is currently undertaking a study to develop estimates for this.[153]

[152] Quantifying Aotearoa's plastic | Office of the Prime Minister's Chief Science Advisor (pmcsa.ac.nz)
[153] The study is due for completion in July 2024. It is being undertaken by Eunomia and Whirika Consulting

Dataset	Description	Assessment
	Data was gathered from published reports by Packaging NZ, NRRT, Eunomia, Perrot et al., Plastics NZ, Sustainable Coastlines, and Keep New Zealand Beautiful. Data also includes import export data from Stats NZ InfoShare (2018).	The study provides a useful baseline figure but does not provide a method for tracking changes over time.
Scion (2022) Making zero the hero: Moulding a plastics-circularity and narrative in New Zealand	Produced with WMF funding as part of producing a NZ new plastics economy roadmap. The study compiles tonnages of plastic in New Zealand (import, export, in use, waste, and leakage), and provide a flow of plastics by polymer through the economy. It excludes plastic imported in products.	The data in the study is essentially derived from Stats NZ import and export data, alongside some industry data. Updating the data will essentially entail reviewing import and export data annually.
Packaging Forum: Research to Support the Co-design of a Plastic Packaging Product Stewardship Scheme (PPPS) for New Zealand	The report was to provide baseline data for the development of a regulated product stewardship scheme. It found the following: "The total amount of plastic packaging recycled in 2022 was found to be 45,113 tonnes, of which 23,496 was from the consumer sector and 21,616 tonnes were from the non-consumer sector. When compared to the total amount of plastic packaging placed onto the market, this gives a total recycling rate of 17.1%.	The report notes the following: "This project found significant gaps in the availability of data in several key areas. For the POM section of the project, there were limitations in data collected by producers of packaging." "For the collection and recycling section of the project, data was limited from local authorities, MRFs and reprocessing facilities. Much of the required information

Dataset	Description	Assessment
August 2023 Valpak[154]	The amount of plastic packaging exported for recycling was estimated to be 16,159 tonnes. When combined with current onshore reprocessing tonnages of 28,954 tonnes, this gives a total recycling figure of 45,113 tonnes"	was considered as commercially sensitive either from MRFs or reprocessors," Upon examination, much of the data contained in the report is proxy data and relies on application of UK data to the NZ context. As with other similar studies this is a one-off snapshot, which does provide some useful estimates of the size of the plastic packaging market but, it would be expensive to reproduce to track change over time. The study does note introduction of a plastic packaging product stewardship scheme would provide a more reliable source of data as systems would have to be set up to track product.
OPMCSA food waste research (2022-2024)[155]	OPMCSA has published five reports on food loss and waste (FLW), the first collates data and identifies NZ'S FLW data gaps.	While the OPMCSA research identifies a range of data sources, it does not attempt to consolidate the data into a single dataset and calculate overall flows.

[154] NZ-Plastic-Flow-Report-released-as-part-of-PPPS-research.pdf
[155] Food rescue, food waste (pmcsa.ac.nz)

Dataset	Description	Assessment
	Table 1 on page 23 presents what is known about food waste in Aotearoa New Zealand including tonnage. Data sources include surveys, existing reports, and existing data, and acknowledge the incompleteness.	The various sources may be useful metrics for constructing future metrics for recovery, but further work would be required.
Looking in the Mirror: A review of circularity in the clothing and textile industry in Aotearoa (2020)[156]	This study attempted to provide a fully system documentation of textile flows in New Zealand. It derives overall flows and breaks these down into carpet, apparel and other textiles. It quantifies imports, local manufacture, exports, consumer and commercial reuse, recycling and repurposing, and disposal pathways.	The study provides a useful and reasonably comprehensive breakdown of textile flows. The study notes data limitations and gaps and that some of the numbers are 'indicative' and based on extrapolation from limited data.
Auckland Council textiles research (2023)[157]	Auckland Council commissioned the report 'Fashion Clothing Consumption and Waste Flows in the Auckland Region' for their 2023 Waste Assessment. The report reviews textile material flows in Auckland. Import and export data was gathered from Stats NZ InfoShare and in places informed by GDP, as well as	This study was focused only on Auckland and looks only at 'fashion' clothing, which limits its application. It does not consider fabrics, carpets, work wear, furnishings, and other textiles such as sails, awnings, matting etc. Other limitations include that import data notes ports of arrival but not destination w/in NZ.

[156] TF_Circularity-Report_AW_201120_compressed-1.pdf (textilereuse.com)
[157] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/environmental-plans-strategies/docswastemanagementplan/waste-assessment-appendix-i.pdf

Dataset	Description	Assessment
	existing local and Australian studies. The report notes the limited data of local manufacture.	The study also did was able to ascertain the quantity of textiles manufactured in NZ
Auckland Council food system research (2023)[158]	Auckland Council commissioned the report 'Mapping Auckland's Food System' for their 2023 Waste Assessment. This report quantifies food, waste, loss, and GHG emissions. Data was gathered from existing reports and datasets as well as Stats NZ, Ministry for Primary Industries (MPI), and food processors and manufacturers who supplied commercially sensitive data. Not all parts of the system were able to be quantified.	This study was focused only on Auckland which limits its application. It was noted that "Areas that would benefit from investigation in subsequent work include, schools, rest homes, food services, takeaways, and food manufacturing."
Environment Canterbury (2013) Non-natural Rural Wastes -Site Survey	This study surveyed 53 farms to determine the quantities of Non-natural Rural Wastes (NNRW generated and disposed of on farms. The survey identified and recorded a total of 490.4 tonnes of NNRW from the 53 farms. This means the average farm in this survey produced nearly 10 tonnes of NNRW each year (this average figure	This was one of two surveys of Non-natural Rural Wastes (NNRW) conducted in NZ (There were some methodological issues with the other survey (conducted in Waikato) hence it is not considered here). To date this remains the most reliable data source for NNRW, quantity and composition. However, it still has some issues:

[158] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/environmental-plans-strategies/docswastemanagementplan/waste-assessment-appendix-f.pdf

Dataset	Description	Assessment
Data Analysis, October (2013)[159]	does not include domestic refuse and animal remains). Extrapolating this over 8,826 farm holdings and applying a correction factor indicates that they could be producing and disposing of 75,132.1 tonnes of NNRW over 66% of the area of Canterbury each year. In addition, the 53 farms also produced 741.9 tonnes of organic materials (includes offal/carcasses and other organic waste fractions) and 25.8 tonnes of domestic waste. The most prevalent NNRW were plastics, bags (seed, feed, foil) packaging materials (card) and timber-based materials. From the survey 92% of the sites surveyed used the '3B' (burn, bury and bulk store indefinitely) disposal strategy. The survey analysed data by the following farm types: • Dairy • Livestock • Arable • Viticulture • Small holdings	• The surveys were one-off surveys, therefore they assessed all material found at the sites, so there was no way of knowing they period of accumulation the material represented. It could have represented several years for some items or only a month or less for other items. • It is known that farmers use the 3B strategy but there is no data on how that strategy is applied across material types. • Items in the survey were counted not weighed and then proxy weights applied to the item counts. • The study was conducted in Canterbury, so it is not certain how applicable this data is to other parts of the country.

[159] Environment Canterbury (2013) Non-natural Rural Wastes -Site Survey Data Analysis, October 2013, https://ecan.govt.nz/your-region/your-environment/waste-management/rural-waste-minimisation/

Dataset	Description	Assessment
Reusable Packaging in Aotearoa[160]	Reusable Packaging in Aotearoa details current reusable packaging systems in New Zealand, outlines the barriers and opportunities for growth, and makes recommendations to councils, industry groups and government on how to support reuse. The report's findings and recommendations are based on interviews with businesses, desktop research, and a literature review.	The report provides primarily qualitative rather than quantitative information. It does not provide a basis for assessing and monitoring reusable packaging on an ongoing basis.
Looking in the Mirror: A review of circularity in the clothing and textile industry in Aotearoa (2020)[161]	Bernadette Casey & Brian Johnston produced the report to provide background research for a voluntary textiles product stewardship proposal. The report included estimates of national textile material flows using stats NZ and industry data.	The report presents textile flows across NZ - 70 priority stakeholders were identified and information was gathered from 36 interviews between August and October in 2022. Data was also gathered from Stats NZ, WasteMINZ, university research, and councils. The flows are based on tonnes per year and estimates the entire textiles waste stream.

[160] Reusable packaging in Aotearoa June 2022 - Reuse Aotearoa
[161] https://www.textilereuse.com/wp-content/uploads/2020/11/TF_Circularity-Report_AW_201120_compressed-1.pdf

A.1.3 Industry Data

There are several industry associations that gather data from their membership. Some of this information is made public. Industry data is potentially valuable as it is obtained directly from industry, who will have good commercial reasons for understanding their sector well. However, there are also limitations with these datasets as well: Industry associations may not represent all of the participants in the sector, there may be constraints around commercial sensitivity in respect of data sharing amongst the members, and industry associations may also have an interest in promoting a particular perspective. . Key relevant industry data sources are noted in the table below.

Table 23 Waste Industry Data Summary

Dataset	Description	Assessment
Waste and Recycling Industry Forum (WRIF)[162]	The WRIF has nine members who operate private waste and recycling services in New Zealand. High-level data from nine WRIF members is collated and published in a 'Snapshot'. Data includes waste per capita (kg), recycling rate (%), tonnage by stream, and processing rate (%). Data has been compiled annually since 2021. The latest snapshot (2023) breaks recovered material data down into: • C&D waste • Cardboard and paper	The data presented relates to the WRIF members only. The WRIF claims to collect close to 100% of household waste and recycling collected at kerbside, and 90% of municipal landfill waste. Recycling numbers include tonnage received at MRFs and single-stream materials received directly at composting and recycling facilities. They include kerbside collections and recycling form commercial and industrial sources.

[162] National-Waste-and-Recycling-Snapshot-2022.pdf (wrif.org.nz)

Dataset	Description	Assessment
	• Glass • Metal • Organics • Plastic • Tyres In addition, it notes a split of 'recovered' material that is sent offshore, recovered onshore or 'landfilled'.	Total waste handled (the denominator in the recycling rate) is recycling plus disposal tonnages from class 1-4 facilities run by WRIF members. The recycling rate is not readily comparable to others in this report because it is scoped to WRIF membership rather than services, sources and facilities. The total recovery tonnage in the data model in this report is about 7.5 times the recycling tonnage reported by WRIF (700K tonnes), and consistently higher in every material category. An advantage of this dataset is it is regularly reported, includes data from private services not elsewhere available, and tonnages are known with a high degree of confidence. It is, however, only a partial picture of and difficult to interpret in isolation or translate to a national figure.

Dataset	Description	Assessment
Plastics NZ[163]	Plastics NZ is an industry association for the New Zealand plastics industry. There is no publicly available data.	A one-off snapshot of plastic packaging data has been developed through the PPPS noted above.
Packaging Forum	The Packaging Forum is a membership organisation for the New Zealand packaging industry. There is no publicly available data.	A one-off snapshot of plastic packaging data has been developed through the PPPS noted above.
NZ Association of Metal Recyclers (AMR)[164]	The NZ Association of Metal Recyclers is the national association for metals recycling. There is limited publicly available data. The website notes that "In calendar year 2022, AMR members processed over 842,000 tonnes of metal in their service of communities across NZ. 630,628 tonnes were exported from New Zealand."	It should be noted that while NZAMR is the largest industry body for the sector it does not represent all scrap metal operators, with some large operations not involved.

[163] https://www.plastics.org.nz/images/documents/Conference/2023/AGM_2023/PNZ_Annual_Report_2023_High_Compression.pdf
[164] Media - Metal Recyclers (nzamr.org.nz)

A.1.4 Product Stewardship Schemes[165]

A.1.4.1 Priority Product Stewardship Schemes

The introduction of priority product schemes for six priority products in 2020 has the potential to generate useful quality data on those products. Clause 4(1)(c)(ii): of the Gazette notice that provides guidelines for the regulated product stewardship schemes stipulates the that schemes must provide:

> *Transparent chain of custody for collected and processed materials, to both onshore and to offshore processors, and published mass balances showing rates of reuse/ recycling or environmentally sound disposal of the priority products.*[166]

Once this data becomes consistently available it will add significantly to the dataset on recovered materials. The table below notes any additional data that is currently available

Table 24 Priority Product Stewardship Schemes Summary

Dataset	Description	Assessment
Tyrewise	Tyrewise released a report in 2020 that includes import data (Stats NZ) for both new and used tyres sorted by tyre type (e.g. car, tractor), quantity, tonnage (estimated with conversion factors), and EPU. It also identifies the quantities of end-of-life tyres by tyre type. There is a materials flow diagram but no quantification.[167]	Tyrewise is the only currently operative regulated product stewardship scheme. From 1 March 2024 liable parties (importers, manufacturers in NZ) began paying the tyre stewardship fee on regulated tyres when they first enter the NZ market, with the fee passed on through the supply chain. From 1 Sept 2024 the first end of life tyres will be

[165] Product stewardship accreditation | Ministry for the Environment
[166] General Guidelines for Product Stewardship Schemes for Priority Products Notice 2020 - 2020-go3342 - New Zealand Gazette
[167] https://www.tyrewise.co.nz/wp-content/uploads/2022/07/Tyrewise-2.0-Master-Report-Final-Released-22July2020-with-disclaimer.pdf

Dataset	Description	Assessment
		accepted under the scheme.[168] It is expected that data will become available after a year of scheme operation.
TechCollect	The TechCollect E-waste product stewardship scheme has completed an initial scheme design, which indicated further work needed for scheme design finalisation. It is understood that TechCollect are expected to submit a formal application for accreditation this year.[169] A series of 4 reports on the scheme design have been completed by TechCollect, however no comprehensive mass flow data was compiled in the studies.	Before the scheme can be progressed there are additional pieces of work to be completed as per the "Further Activities" section of the recommendation report. It is our understanding that work on the mass flows will be undertaken at some point.
Battery Industry Group (B.I.G.)	B.I.G. website mentions a stocktake in 2023 but it is not publicly available. This information has however been submitted to the Ministry.[170]	The mass flow data was based on a series of estimates based on assume EV and stationary storage adoption projections. These projections preceded both the clean car discount and the discontinuation of the subsidy, and so the impact of these policy changes is not accounted for in the data.

[168] How Tyrewise Works With The Tyre Life Cycle - Tyrewise
[169] https://techcollect.nz/2023/06/techcollect-nz-publishes-recommendations-for-aotearoa-new-zealands-e-product-stewardship-scheme/
[170] https://big.org.nz/our-work-mahi/

Dataset	Description	Assessment
	BIG submitted a series of four reports as part of the scheme design exercise.[171] Report two contained projected mass flows for large batteries.[172]	It is understood that Auto Stewardship NZ who are the Product Stewardship Organisation (PSO) have undertaken further work in this regard.[173]
Plastic Packaging Product Stewardship Scheme	A one-off snapshot of plastic packaging data has been developed through the PPPS noted above.	As above.
Cool-Safe	Annual reports for 2022 and 2023 with data on weight of refrigerant collected, exported/destroyed and the chemical composition (CFC, HCFC, HFC).[174] The Cool-Safe website is starting to showcase case studies that quantify the amount of fridges, air conditioners, heat pumps, etc. degassed across the country.	
Green-farms Product	The Green-farms Product Stewardship Scheme (GPSS) is now an accredited scheme. The GPSS is expected to	A number of data issues were noted in respect of the mass flow report including the following:

[171] Resources – Rauemi - Battery Industry Group (big.org.nz)
[172] Battery-Product-Stewardship-Research-Milestone-2-FINAL.pdf (big.org.nz)
[173] Resource Efficiency - Report - Non-EV Batteries in New Zealand - Final Eunomia Report Dec 2022.pdf - Standard View (sharepoint.com)
[174] https://coolsafe.org.nz/about-us/programme-performance

Dataset	Description	Assessment
Stewardship Scheme	collect and treat the most voluminous farm plastics across four farm plastics waste streams by 2026 and then add-on other farm plastics waste streams over the following four years. The goal being to effectively and sustainably collect and treat most farm plastics by 2030.[175] The four plastic waste streams covered are: 1. Agri-chemicals and their containers stream, including any complementary farm plastics 2. Bale wrap and silage sheet stream, including any complementary farm plastics e.g. baling twine - mostly plastic film packaging 3. Small bags stream, including any complementary farm plastics - 10 to 25kg seed, feed, and fertilizer plastic packaging 4. Large sacks stream, including any complementary farm plastics – typically half and one tonne grain and fertiliser packaging	• Limited information on the weight of plastic packaging for seed and feed • Some information on 'units sold' missing • Some stakeholders chose not to respond to the survey • Risk of double counting. survey participants included both retailers and producers, giving rise to the possibility that volume has been counted multiple times, although steps were taken to mitigate this.

[175] Recycling project tackles soft plastics - Agrecovery

Dataset	Description	Assessment
	A material flow analysis was commissioned by Agrecovery and completed in 2022.[176] The study consisted of a survey to collect data on the volume of seed, feed and fertiliser bags and crop packaging films (eg silage wrap/covers and horticultural films/netting). 42 retailers and producers were surveyed with 71% of all recipients responding, including all major participants.	

A.1.4.2 Voluntary Product Stewardship Schemes

Under section 14 of the WMA accredited schemes are expected to keep records and report on scheme performance to the Minister. There is no stipulation however that these reports are made publicly available. In the report we have assumed that MfE holds reports for all accredited schemes.

While there may be useful information from voluntary scheme reporting for most voluntary schemes the key data issue will be completeness as scheme participation is not required, there may also be issues like accuracy and consistency in reporting.

The current schemes and any publicly available data are noted in the table below.

[176] Farm-Plastics-Materials-Flow-Analysis-web.pdf (agrecovery.co.nz)

Table 25 Voluntary Product Stewardship Schemes Summary

Dataset	Description	Assessment
Agrecovery	The Agrecovery product stewardship scheme targets the collection of farm plastics and agrichemicals via on-farm collections and 160 collection points across New Zealand. The scheme has been operating since 2007 and has recycled 5,040,80kg of plastic and recovered 173,952 kg of agrichemicals. Annual reports from 2007/08 to 2020/21 including infographics with weights of containers, polypropylene bags, waste oil, agrichemicals, etc. collected through the scheme.[177] Agrecovery (and Plasback) is now expired and will be replaced by Green-Farms.	
Envirocon	The Envirocon product stewardship scheme targets the collection and aggregation of concrete into blocks for building walls. The scheme has been operating since 2015.	

[177] https://agrecovery.co.nz/foundation/agrecovery-foundation/

Dataset	Description	Assessment
	Infographic on website but no time period specified.[178]	
Filter Disposal Services	The Filter Disposal Services product stewardship scheme targets the collection and recycling/correct disposal of oil filters, plastic containers, and oily rags. They operate in the lower North Island. There is no publicly available data.	
Glass Packaging Forum (GPF)[179]	The GPF product stewardship scheme targets the recovery of glass packaging by funding projects across NZ. The GPF releases an annual report on the performance of the scheme each year. The most recently published accreditation report includes	The data gathered by GPF attempts to provide a full accounting of all the glass put on the market, recovered and disposed of. It should, in theory, provide a good measure of the recycling rate for glass. However, there are some issues with the data: The main issue is that they are reliant on third parties to supply data, which is supplied voluntarily. This means that

[178] https://www.envirocon.co.nz/pages/product-stewardship
[179] https://www.glassforum.org.nz/glass-packaging-forum-annual-report-2021/

Dataset	Description	Assessment
	high-level data from 15 projects that GPF funded in 2020/21. Each year the GPF reports a mass balance for glass packaging. Data includes recovery rates for glass containers, bottle-to-bottle recycling rate, estimated tonnage impact of the projects, and some tonnage data for material flows.	data is not always complete, and it is time consuming to gather. In addition, there are no standards for how data is gathered, recorded or provided. The GPF report notes: "The biggest challenge we have in ascertaining a mass balance and outcomes is accuracy of data, given that there is no standardised reporting required, and measures are often taken at different points in the system by different data suppliers. Additionally, a high level of staff turnover means we must carry out extensive follow up to obtain data. It is notable that some data sources show significant fluctuation of tonnage recovered and its outcomes from year to year, with no commentary provided about possible contributing factors.".
Interface ReEntry	The Interface ReEntry product stewardship scheme targets the collection and reprocessing of carpet into carpet tiles for flooring.	

Dataset	Description	Assessment
	Total tonnage of carpet diverted over 27 years only.[180]	
Paintwise[181]	The Be PaintWise product stewardship scheme targets the collection and recycling/disposal of paint and paint packaging. The scheme launched in 2004 and has collection points at Resene ColorShops across NZ. No publicly available data.	
Recovering Oil Saves the Environment (R.O.S.E.)	The R.O.S.E. product stewardship scheme targets the collection of used oil to be reused as an alternative fuel source. No publicly available data.	

[180] https://www.inzide.co.nz/product-stewardship
[181] Resene PaintWise - how to recycle unused paint

Dataset	Description	Assessment
Sharp Comprehensive Recycling and Waste Reduction Scheme [182]	The Sharp product stewardship scheme targets the collection and recycling/disposal of ink toner, packaging, and e-waste. Offices are encouraged to opt-into the toner recycling programme and will have a box delivered for collection. No publicly available data.	
Soft Plastics Recycling Scheme	The Soft Plastics Recycling Scheme product stewardship scheme targets soft plastic collection and reprocessing into fence posts (Future Post) and building materials (SaveBOARD). Collection points are at supermarkets across NZ. Accreditation reports for 2019 and 2022. The 2022 report provides high-level data with tonnage and quantity collected and processed as well as breakdown by category (e.g. bread bags, potato chips bag).[183]	

[182] https://www.sharp.net.nz/csr/recycling-programmes
[183] https://www.recycling.kiwi.nz/application/files/5216/8066/1140/The_Soft_Plastic_Recycling_Scheme_Accreditation_Report_2022.pdf

Source: Product stewardship accreditation | Ministry for the Environment

A.1.5 Legislation, Regulation and Protocols

(a) Waste Minimisation Act (WMA)

The WMA contains a number of clauses relating to waste data and reporting, these are noted briefly in the table below.

Table 26 WMA Clauses Related to Waste Data and Reporting

Clause	Description	Assessment
14	**Requirements for product stewardship accreditation** This clause sets out requirements for accreditation. The specific clauses relating to scheme data collection and reporting are: To qualify for accreditation, a product stewardship scheme must— (c) set— (i) measurable waste minimisation, treatment, or disposal objectives for the product; and (ii) time frames for meeting the objectives: (f) specify the arrangements for— (iii) keeping records and making reports under the scheme: (h) identify the processes for compliance and enforcement of any agreements between participants to the scheme:	The requirements for accreditation apply to voluntary schemes (for priority and non-priority products) and contain several clear clauses that establish an expectation of data collection and reporting to the Minister.

Clause	Description	Assessment
	(i) provide for assessing the scheme's performance and for reporting on its performance to the Minister:	
20	**Monitoring of accredited product stewardship schemes** The Secretary may— (a) monitor the performance of an accredited scheme; and (b) recover the costs of doing so from the scheme manager (on behalf of the scheme) as a charge in the prescribed manner.	In addition to self-reporting by accredited schemes there is provision for government to monitor scheme performance and recovery of those costs. This clause has been utilised for the Waste Minimisation (Tyres) Regulations 2023.
23(1)	**Regulations in relation to products (whether or not priority products), materials, and waste** Information to be collected and provided (i) requiring specified persons or specified classes of person to collect, and provide to the Secretary, information about any requirements imposed in regulations made under paragraph (a), (b), (c), (d), or (e):	This clause enables regulations to be made in relation to different products, materials or waste. This clause has been utilised for the Waste Minimisation (Tyres) Regulations 2023.

Clause	Description	Assessment
24	**New Zealand Customs Service to provide information about priority products** (1) The Secretary may request, in writing, the New Zealand Customs Service to provide to the Secretary any information that the New Zealand Customs Service holds about the importers and importation of priority products. (2) The New Zealand Customs Service must comply with a request as soon as practicable. (3) Information provided to the Secretary under this section may be used by the Secretary only for the purpose of administering and enforcing regulations made under this Part.	This is a necessary clause to enable sharing of customs import data for the purposes of administering and monitoring a priority product scheme.
37	**Minister may direct Secretary to retain payment to territorial authority** The Minister may direct the Secretary to retain 1 or more payments of levy money to a territorial authority in respect of a financial year if he or she is satisfied that the territorial authority has not met any of the following requirements or standards in respect of the previous financial year: (a) the requirement to spend levy money in accordance with section 32:	This clause provides for a penalty to be applied if TAs do not provide data that is required. We are not aware that this clause has been utilised.

Clause	Description	Assessment
	(b) a performance standard set by the Minister under section 49: (c) any prescribed requirement to provide records or information.	
51	**Requirements for waste assessment** (1) A waste assessment must contain— (a) a description of the collection, recycling, recovery, treatment, and disposal services provided within the territorial authority's district (whether by the territorial authority or otherwise); and (b) a forecast of future demands for collection, recycling, recovery, treatment, and disposal services within the district; and (3) Information is required for an assessment to the extent that the territorial authority considers appropriate, having regard to— (a) the significance of the information; and	This is the enabling clause that requires TAs to gather information for the purposes of managing waste in their district. They are required to do so but not if the costs of collecting the data are considered to outweigh the benefits.

Clause	Description	Assessment
	(b) the costs of, and difficulty in, obtaining the information; and (c) the extent of the territorial authority's resources; and (d) the possibility that the territorial authority may be directed under the Health Act 1956 to provide the services referred to in that Act. (4) However, an assessment must indicate whether and, if so, to what extent, the matters referred to in subsection (3)(b) and (c) have impacted materially on the completeness of the assessment.	
56	**Territorial Authority powers to make bylaws** 1. A territorial authority may make bylaws for 1 or more of the following purposes: (b) regulating the collection and transportation of waste: 3. Bylaws made under subsection (1)(b) may provide for the licensing of persons who carry out the collection and transportation of waste, and the conditions specified in the	These are the enabling clauses for TAs to make bylaws that require licensed operators to supply data. (Refer to the WOLDS discussion in section A.1.6.1).

Clause	Description	Assessment
	bylaws as conditions of the licences may include conditions requiring each licensee— (a) to provide a performance bond or security, or both, for the performance of the work licensed: (b)to provide to the territorial authority, at times or periods specified in the bylaws, reports setting out the quantity, composition, and destination of waste collected and transported by the licensee (for example, household waste to a disposal facility).	
86	**Regulations in relation to records, information, and reports** 1. *Information from operator of disposal facility* (a) requiring the operator of a disposal facility to keep, and provide to the Secretary and any appointed levy collector, records and information to enable amounts of levy payable by the operator to be accurately calculated: *Information from any class of person*	This is a catch-all clause enabling regulations to be developed that could information to be gathered from 'any class of person'.

Clause	Description	Assessment
	(b) requiring any class of person to keep, and provide to the Secretary, records and information to assist the Secretary to compile statistics in order to—	
	(i) measure progress in waste management and minimisation:	
	(ii) report on the state of New Zealand's environment:	
	(iii) assess New Zealand's performance in waste minimisation and decreasing waste disposal:	
	(iv) identify improvements needed in infrastructure for waste minimisation:	
	Information from territorial authority	
	(c) requiring a territorial authority to keep, and provide to the Secretary each year, records and information about the territorial authority's—	
	(i) spending of levy money; and	
	(ii) performance in achieving waste minimisation with the services, facilities, and activities provided or funded	

Clause	Description	Assessment
	in accordance with its waste management and minimisation plan; and (iii) performance as measured against any performance standards set by the Minister under section 49:	

A.1.5.2 Regulations under the WMA

Table 27 WMA Regulations Relating to Waste Data and Reporting

Regulation	Description	Assessment
Waste Minimisation (Calculation and Payment of Waste Disposal Levy) Regulations 2009[184] (SR 2009/144)	Clause 6 requires disposal facility operators to provide monthly returns on waste and diverted materials. Clause 7 provides for approved facilities (essentially very small facilities) to provide annual returns.	The is the regulation that requires Class 1-4 landfill data that is collected through OWLS to be supplied.

[184] Waste Minimisation (Calculation and Payment of Waste Disposal Levy) Regulations 2009 (SR 2009/144) (as at 13 May 2021) – New Zealand Legislation

Regulation	Description	Assessment
Waste Minimisation (Information Requirements) Regulations 2021[185]	These regulations introduced the requirement for "class 5, an industrial monofill facility, or a transfer station", to report data to central Government. These regulations came into force on 13 May 2021.	A separate regulation was required as these facilities are not liable to pay the levy and so they are information requirements only. Data from this reporting is now available. As with the other OWLS data the quality and reliability of this data is considered high as reporting is mandatory.
Waste Minimisation (Information Requirements) Amendment Regulations 2023[186]	Clause 5A introduces requirements for operators to keep records and provide reports about activity categories. This adds to the tonnage reporting requirements already incumbent on disposal facilities Class 5 facilities, industrial monofils, and transfer stations. Returns are to be provided as frequently and on the same dates as levy returns. Clause 8A introduces requirements for TA reporting (refer section A.1.1 TA Reporting) These regulations came into force on 1 July 2024.	These are the regulations that enable extended reporting on activity source as well as additional reporting from TAs. Because reporting is mandatory, data quality is expected to be good.

[185] Waste Minimisation (Information Requirements) Regulations 2021 (LI 2021/69) – New Zealand Legislation
[186] Waste Minimisation (Information Requirements) Amendment Regulations 2023 (SL 2023/262) – New Zealand Legislation

Regulation	Description	Assessment
Waste Minimisation (Calculation and Payment of Waste Disposal Levy) Amendment Regulations 2023[187]	This introduces the requirement for facilities already reporting under the waste disposal levy regulations to also now report activity categories for all waste and diverted materials (A new Section 37A is introduced).	This will extend activity category reporting to Class 1-4 disposal facilities.
Waste Minimisation (Tyres) Regulations 2023[188]	Regulation specific to the tyres product stewardship scheme. It provides the necessary regulatory powers for the scheme to operate including specifying the information to collected by the NZTA and the Scheme Manager.	The data requirements mean the scheme should be able to track the number of regulated tyres imported or manufactured in New Zealand. Unit weights will allow the total tonnage of tyres placed on the market each year to be calculated.

A.1.5.3 Climate Change Response Act 2002 & Regulations

The CCRA and associated regulations have a number of clauses that pertain to gathering and reporting of data, however this data is primarily focused on calculation of landfill gas emissions, and the data gathered does not materially add to the data reported through OWLS.[189]

[187] Waste Minimisation (Information Requirements) Amendment Regulations 2023 (SL 2023/262) – New Zealand Legislation
[188] https://www.legislation.govt.nz/regulation/public/2023/0263/latest/LMS823610.html?search=qs_act%40bill%40regulation%40deemedreg_waste+minimisation+(tyre)+regulations_resel_25_h&p=1&sr=1
[189] Not all of the Class 1 facilities reporting under the levy are registered participants under the NZETS. (Personal communication with Roderick Boys, MfE, 04 June 2024)

A.1.5.4 National Waste Data Framework

The National Waste Data Framework (NWDF) was developed in 2015 by WasteMINZ with funding support from the Waste Minimisation Fund. It established a set of voluntary methods for compiling waste data. [190]

The NWDF proposes a staged approach for developing a national waste data framework, focusing initially on the most important elements while also setting out a clear 'upgrade' path to include other elements.

The first stage of the framework, published in 2015 includes data on waste disposed of at levied disposal sites, information on waste services and infrastructure as well as other areas where practicable

Subsequent stages of the framework are proposed to include more detailed data on diverted materials and waste disposed of at non-levied disposal sites.

The National Waste Data Framework does the following:

- Establishes a set of definitions to act as a common language for collecting and reporting waste data
- Determines what data is gathered
- Determines who gathers this data
- Specifies how the target data is gathered
- Directs who data is reported to
- Sets out how the data that is collected is collated and presented.

At the time the NWDF was developed central government was not in a position to take on centralised collection of data The Framework therefore identified territorial authorities (TAs) as being the primary agent for collating and analysing waste data and presenting it into the public domain. As a result, the protocols developed for the Framework are intended primarily for use by TAs, with a particular focus on data required for the preparation of waste assessments under section 51 of the Waste Minimisation Act 2008.

[190] National Waste Data Framework Combined Protocols FINAL.pdf (wasteminz.org.nz)

Because the NWDF is voluntary uptake as been limited. There has been widespread use of elements of the framework, such as the use of activity source classifications in composition analysis and waste assessments, and use of the framework classifications and processes in setting up weighbridge codes and reporting at transfer stations, but no TA has fully implemented it.

In 2018, in response to requests from the sector, a set of standard reporting indicators was developed. The Framework established how to gather consistent data, but it did not provide any direction for its use. The reporting indicators are recommended for use in conjunction with the Framework protocols. Given the central role of TAs in implementing the Framework, the reporting indicators cover the waste streams and services that are of greatest significance to TAs' involvement in waste management. The 2018 indicators are:[191]

1. Waste to Class 1 landfills

Indicator 1A - All waste to Class 1 landfills

The quantity of waste generated within a district that is disposed of at Class 1 landfill(s) and upon which the waste levy is paid, expressed in kilograms per capita per annum for the usually resident population of that district.

Indicator 1B - Waste to Class 1 landfills - excluding special wastes

The quantity of waste generated within a district, excluding special wastes, that is disposed of at Class 1 landfill(s) and upon which the waste levy is paid, expressed in kilograms per capita per annum for the usually resident population of that district.

2. Domestic waste

Indicator 2A - Domestic kerbside waste disposal rate

The quantity of domestic kerbside waste collected by the TA (or by a contractor on behalf of the council) or by private waste collectors (through kerbside or similar collections) from residential premises, expressed in kilograms per capita per annum for the usually resident population of that district that is served by such collections.

Indicator 2B - Domestic waste disposal rate

The quantity of domestic waste collected from residential premises by the TA (or a contractor on behalf of the council) or by private waste collectors (through kerbside or similar collections), or similar waste disposed of by other means by the householder, expressed in kilograms per

[191] National-Waste-Data-Framework-Standard-Reporting-Indicators-Final.pdf (wasteminz.org.nz)

capita per annum for the usually resident population of that district. Domestic waste that is disposed of on-site, such as by burning or burying, is not included in the quantity of waste collected.

3. Domestic recycling

Indicator 3A - Domestic kerbside recycling recovery rate

The quantity of domestic kerbside recycling collected by the TA (or a contractor on behalf of the council) or by private service providers from residential premises, expressed in kilograms per capita per annum for the usually resident population of that district that has access to kerbside recycling collections. Material that is collected and subsequently disposed of to landfill is deducted from the total quantity collected before the recovery rate is calculated.

Indicator 3B - Domestic recycling recovery rate

The quantity of domestic recycling collected from residential premises by the TA (or a contractor on behalf of the council) or private service providers, or similar materials generated by domestic activity and collected by whatever means by a TA or privately, expressed in kilograms per capita per annum for the usually resident population of that district. Material that is collected and subsequently disposed of to landfill is deducted from the total quantity collected before the recovery rate is calculated.

Indicator 3C - Domestic kerbside recycling contamination rate

The quantity of domestic kerbside recycling collected from residential premises, by the TA (or a contractor on behalf of the council) or by private service providers, that is disposed of to landfill rather than becoming a diverted material. The indicator is calculated as being the quantity of landfilled material expressed as a percentage of the quantity of kerbside-collected material.

In 2022 WasteMINZ in collaboration with the Ministry for the Environment, undertook a project to update the NWDF to accommodate new mandatory data reporting requirements. This update aimed to make sure the Framework aligns with:

- The expanded disposal facility and transfer station reporting requirements under recent regulations
- The additional incoming data reporting requirements of disposal facilities and transfer stations and by Territorial Authorities (TAs) agreed to by Cabinet in May 2021, and
- New reporting requirements developed as part of the transforming recycling initiative. These are intended to provide standard measures for TA performance reporting.

The revised protocols have been completed but not formally published. A draft NWDF: Guide to Reporting has been prepared. Transfer of ownership of the document from the Ministry to WasteMINZ is scheduled for June 2024. A series of fact sheets on mandatory waste data reporting with a partial overlap in content has been published by the Ministry (see below) and additional fact sheets are scheduled for release mid-June 2024 (on resource recovery facility, activity category and contamination reporting).

A.1.5.5 Solid Waste Analysis Protocol (SWAP) 2002

6.4.1.1 Overview

Although the current version of the SWAP dates from 2002, a revision was undertaken in 2012, but this was never published. A further draft update to SWAP protocols was prepared in 2022. These protocols are under review by the Ministry and there is no set publication timeline. Among other changes, the draft update customises SWAP protocols for different types of waste facilities (e.g. Class 1-5 landfills, transfer stations, industrial monofills).

The SWAP consists of two procedures:

- Procedure One – Classification of domestic wastes at source (i.e. kerbside)
- Procedure Two – Classification at disposal facility

The SWAP establishes the following primary categories:

- Paper
- Plastic
- Putrescible
- Ferrous metal
- Non-ferrous metal
- Glass
- Textiles
- Nappies and sanitary
- Timber
- Rubber
- Rubble & Concrete
- Potentially Hazardous.

The SWAP outlines procedures for

- Survey design
    - Location
    - Load and source categories
    - Sampling plan, including tiered sampling, allocation of sampling effort and number of samples
    - Seasonality
    - Disposal site catchments.
- Set up and training
- Survey execution including data recording, weighing vehicles, sorting and weighing, sub sampling, moisture content and visual classification
- Data analysis and reporting, including appropriate statistical analysis.

6.4.1.2 Procedure One

Procedure One consists of

- collecting refuse put out for municipal collection from selected 'households' or properties, and transporting to a sorting station
- sorting the refuse from each household into 12 primary categories
- weighing and recording of data
- statistical analysis and reporting.

The main issues with procedure One of the SWAP that have been noted relate to refinements to make it more efficient and safer, including sorting of bag lots rather than households, procedures for collecting from wheeled bins, and health and safety protocols.

6.4.1.3 Procedure Two

In broad terms Procedure Two consists of:

- weighing all or most large vehicle loads entering the site and a proportion of smaller vehicle loads
- sampling a proportion of incoming loads in each vehicle category, (large or small) and sorting and weighing a sample of refuse from these into 12 primary categories
- statistical analysis and reporting

Procedure Two also provides for the use of visual classification to be used at 'larger facilities' to economically extend the dataset and potentially increase precision. It recommends that sort and weigh only be used but that if a visual classification is used it must be in conjunction with sort and weigh.

Issues with the 2002 version of the SWAP (Procedure Two) that have been noted include the following:

- The procedures are relatively time consuming and expensive to administer
- There are significant health and safety issues associated with the physical sorting of waste at landfill sites
- The subsampling method recommended in the SWAP is impractical and leads to bias in sample selection[192]
- The classifications used require updating to better align with contemporary needs
- The complexity of the procedures means there are few practitioners, which limits the capacity to undertake more SWAPS and gather more data
- As stated in the SWAP, the greater sample size achievable by visual surveys than sort and weigh audits (for an equivalent cost) can improve the precision of estimates

[192] The recommended method in Figure 5.6 of the SWAP 2002 involves spreading out a load to a depth of 0.5-075 metres deep and a worker walking across the load and collecting samples of 20 kg from randomly determined points. For a large truck, such as a transfer station bulk-haul vehicle, spreading the load out would take up 100s of sq metres, which is not practical. In addition a worker should never be required to walk over waste. This method may was considered suitable in 1992 when it was conceived and most waste was transported in trailers and small trucks. It's totally impractical for the current waste environment, where ~80% of waste arrives in landfills in 20 tonnes loads from transfer stations.

- The practical experience of some leading practitioners is that visual classifications are not only more practical and safer in relation to procedure two but, by virtue of enabling a much greater sample size, are able to generate more reliable composition data, in particular for primary classifications. Under the current SWAP visual only surveys may not be considered to be compliant with the 2002 guidelines.

In undertaking the most recent review of the SWAP in 2021-2022, the Ministry for the Environment noted that the revised SWAP should "ensure that it facilitates the collection of consistent and reliable data on solid waste that can be used in waste emissions modelling and improves the collection of composition data".

A.1.6 Potential Future Datasets

A.1.6.1 Waste Operator Licensing and Data System

Table 28 Waste Operator Licensing and Data System Overview

Name	Description	Assessment
Waste Operator Licensing and Data System (WOLDS)	This system is under development in the Bay of Plenty and Waikato regions. It is being led by the BOPLASS[193]. The system is in two parts – a licensing regime for waste operators based on licensing powers conferred through TA bylaws (which use a common template), and a data collection system. The system will require quarterly reporting of data from waste collectors and facilities to an independent 'Data	This system has been in development for a number of years and is now in the process of being implemented. The IT system provider has been appointed and implementation issues are being worked through. The data classifications are intended to align with the Waste Data Framework and mandatory TA reporting.

[193] Bay of Plenty Local Authority Shared Services. It is a pan council organisation focused on facilitating deployment shared services across the constituent councils.

Administrator'. The Data Administrator will be responsible for ensuring reporting compliance, reviewing submitted data and resolving data issues (such as conflicts, reconciliation, missing data, inaccuracies etc.). Data requirements are based on the Waste Data Framework and will include the following:

- Tonnage collected/received
- Geographic Source (i.e. council district collected from)
- Activity Source (from Waste Data Framework)
- Tonnage deposited at each licensed facility
- Tonnage deposited out of region / unlicensed facility.

All data will be collated and reconciled by the Data Administrator and made available to councils in aggregated form (e.g. by Geographic Source, Activity Source, and destination). Initially the system is only collecting data on waste to Class 1 disposal, but it will be progressively expanded to include Class 2-5 and recovered materials.

The regional approach to data gathering is designed to preserve commercial confidential, by ensuring councils do not have access to raw data or any information on individual operators, and to facilitate reconciliation of data to avoid double counting, gaps, or significant errors.

The challenges faced by the project include the following:

- A lack of funding and resourcing that has slowed its progress. While the system is expected to be largely self-funding once operational there will be further development work required for it to become fully operational.
- Varying levels of commitment by constituent TAs. Smaller TAs with relatively simple operator landscapes will realise less value. There is also some confusion on the added value in relation to MfE data reporting initiatives.
- Cooperation by operators. Operators were consulted early in the project and their views taken into account, however the project has not had a high profile with them recently and they are likely to see this as duplication in reporting with the Ministry. If operators do not cooperate the bylaw, they may face a fine of up to $20,000, but enforcement powers are otherwise limited.

	WOLDS has the potential to generate good quality data that is useful not only for the Waikato region councils but in gathering and managing data required for mandatory TA reporting. A number of other Councils and regions have been keeping a watching brief on the project and expressed and interest in adopting the system if it works. If this were to happen it could provide a consistent national approach for generating data that is useful to both TAs and Central Government.

A.1.6.2 Previously Proposed Changes to the Waste Minimisation Act in relation to Data

A cabinet paper produced in March 2023 proposed a range of improvements to data management. The degree to which any of these changes may be implemented in the future is unclear, they are noted below.[194]

The basic structure and approach of the current provisions in section 86 of the WMA are retained but the proposed changes aim to clarify and modernise waste data provisions, and bring the purpose of reporting in line with the overall proposed purpose for new waste minimisation legislation. The key elements of the proposed changes are outlined in the table below.[195]

Table 29 Proposed Data Changes to WMA

Name	Description	Assessment

[194] waste-legislation-4-waste-levy-collection-and-administration-waste-data-and-general-compliance-regime.pdf (environment.govt.nz)
[195] Following the change of government the status of the proposed changes are currently unknown.

Disposal facility operators	Records and information on waste and materials, including materials received, disposed of, stockpiled, and diverted, and site management (e.g., greenhouse gas generation and capture).	The current requirements only specify information that is needed to calculate levy payments. This requirement adds to clarity around the types of information needed and also adds greenhouse gas generation and capture.
Waste facility operators	This update would cover a wider range of sites that may or may not be subject to waste disposal levy e.g., transfer stations, material recovery facilities. Records and information on waste and materials, including materials transported, received, disposed of, stockpiled, diverted, recycled, reused and otherwise managed and site management (e.g., greenhouse gas generation and capture).	This is a new class of person required to report data. It adds specific requirements around recording the movements of waste and diverted materials.
Territorial authorities	Records and information on: provision of waste management and minimisation services, facilities and activities spending of levy money performance against any performance standards set by the Minister, report to the Secretary and publicly on progress against their WMMPs and contribution to AIP and strategy goals.	This clause adds reporting against action and investment plan and the waste strategy goals.
Any class of person regulated	Records and information relating to regulated obligations.	This clause would clarify the need for regulated parties to supply information.

under the new legislation		
Any class of person	Information required for the prescribed purposes, including information on the circulation of materials within the economy and their status and fate (e.g., for recycling, final disposal etc), including information on imports, exports, and domestic production/sale of materials.	This revised wording puts information in the context of the circulation of materials within the economy, not strictly for waste management and minimisation or reporting on the state of NZ's environment. It also makes explicit that information required can extend beyond final disposal.

A.2.0 New Activity Source Classifications

Source: Waste Minimisation (Information Requirements) Amendment Regulations 2023 (SL 2023/262) – New Zealand Legislation

Table 30 New Activity Source Classifications

Activity category	Description
Construction and demolition	Waste derived from the construction or demolition of buildings, structures, and infrastructure. This includes residential, industrial, and commercial structures, pipelines (above– ground and underground assets), roading, land development (including site clearance for building or subdivision construction), and regular slips or other debris not associated with a major natural hazard.
Mixed industrial, commercial, and institutional	General waste from activities wholly or mainly for the purposes of a trade, business, or industry, or for the purposes of sport, recreation, education, healthcare, or agriculture, and not including residential premises. This includes retail and light manufacturing or industrial activities.
Heavy industrial	General waste primarily derived from heavy industrial or manufacturing activities, in dedicated loads generated by the primary activity of an industry. This includes, but is not limited to, tanneries, canning factories, dairy factories, timber or pulp mills, incineration activities, fisheries, and horticulture processing.
Residential drop-off	Waste generated by residential premises that is dropped off to a facility and that is not entirely from construction, renovation, or demolition of the premises. Residential waste is composed of wastes from normal household activities and originating from residential premises or workplace activities that result in domestic-type waste (for example, lunchrooms, cafeterias). This does not include waste produced in the process of commercial or industrial undertakings. Loads of waste entirely from construction or demolition activities should be categorised as "Construction and demolition".

Activity category	Description
Residential kerbside collections	Waste generated by residential activity that is collected at kerbside and that is composed of wastes from normal household activities and originating from residential premises or workplace activities that result in domestic-type waste (for example, lunchrooms, cafeterias). This does not include waste produced in the process of commercial or industrial undertakings.
Unusual activity	This category should be used as an exception to capture waste that does not fit into any of the other categories and that is from a distinct activity that occurs irregularly and significantly affects the overall composition of the waste stream. This includes, but is not limited to, animal disposal, waste generated by natural hazards that occur irregularly, and the clearing out of sludge from stormwater detention ponds or private lagoons used as wastewater treatment (but not sludge from industrial wastewater treatment plants).
Transfer station—mixed activities	Waste or diverted material that enters into the facility from a transfer station. This includes loads from a transfer station to another transfer station and loads from a transfer station to a landfill. Waste that enters a transfer station must be recorded under the relevant activity category associated with the activity that generated that waste.

A.2.1 Comments on Activity Source Classifications

Rural Waste. The new activity source classifications do not have a separate category for rural waste. Instead 'agricultural' is included in 'Mixed industrial, commercial, and institutional'. It is not clear whether this classification is intended simply to include for example farm waste that is taken to transfer stations, or whether it also includes NNRW managed on farms. If it also includes NNRW then this is problematic as the quantities of NNRW are not measured, and this will result in uncertainty over this classification.

Landscaping as a category has been removed. We understand that the rationale for this is that landscaping material is considered as something that can be accounted for under composition and will either be Residential or Mixed ICI. However, not including this as a separate category means this is lost as a dataset. In reality, because a lot of garden waste is collected by mowing contractors and landscapers, it is not clear what the source actually is. This puts the onus on determining the source of a load onto weighbridge operators or surveyors.

VENM. This category has been removed from the classifications. It is not clear whether the material would be picked up under C&D, and accounted for through composition analyses, or if this information will be simply not be recorded.

Litter. It is not clear under what classification litter would sit. In terms of common definitions of municipal waste, litter is usually included. This would suggest that it would more naturally fit under ('Residential', which broadly aligns with Municipal).

Illegal dumping. It is not clear under what classification illegal dumping would sit. In terms of common definitions of municipal waste, illegal dumping ('flytipping') is usually included. This would suggest that it would more naturally fit under 'Residential', (which broadly aligns with Municipal).

Street Sweepings. It is not clear under what classification Street Sweepings. would sit. In terms of common definitions of municipal waste, Street Sweepings. is usually included. This would suggest that it would more naturally fit under 'Residential', (which broadly aligns with Municipal).

Biosolids. It is not clear under what classification biosolids would sit. The definition of 'Unusual waste' includes "the clearing out of sludge from stormwater detention ponds or private lagoons used as wastewater treatment" In terms of common definitions of municipal waste, is not usually included. This would suggest that it would more naturally fit under 'Residential', however this would skew previous time series data which does not include biosolids under Residential but under Special.

Contaminated soil. It is not clear where contaminated soil is intended to fit. Previously this was classified as potentially hazardous under the C&D classification.

Street sweeping, biosolids, and contaminated soils would all have been classified as 'special' wastes under the legacy classification system. Class 1 landfills regularly classify biosolids and contaminated soils generically as 'special' wastes, but usually have a specific weighbridge for each.

A.3.0 Recycling Data Model Explanation of Data Sources and Rationale

Table 31 Key and Comments for the Recycling Rate Data Model

Sheet	Reference	Title	Comment
Rate 1 Overall	General	Rationale	This metric excludes Class 3,4 & 5 disposal data. In reviewing the data 99.7% of the tonnage to these facilities is 'rubble' – essentially soil and rock and the quantity of this material (over 23 million tonnes or about 66% of all material to disposal) significantly outweighs all other material and obscures what is happening with other materials. As rubble is considered inert it is not useful to include it in this metric (this is not to say that there are not issues with the material going to these facilities that should be considered in other contexts).
Rate 1 Overall AUS Eq	General		This rate is intended to be functionally equivalent to the overall national recycling rate measures calculated by DCCEEW in Australia. The key criteria used in the Australia data is that all material managed in the formal waste management system is included. In the NZ context this means material to Class 5 and any on farm or on-site disposal such as industrial monofil is excluded. Ash from coal fired power plants is included in some Australian data, but is a relatively small part of the waste stream in NZ and is not broken out in the data in NZ. 'Recycling' includes composting and other organic waste recovery but does not include recovery out of the incineration processes (e.g. bottom ash). The

Sheet	Reference	Title	Comment
			Australian 'Recovery' rate metric includes these materials.
Rate 2 MSW OECD	Row 6	MSW Definition	We have used the OECD definition as the reference point. This definition is as follows: *"Municipal waste is defined as waste collected and treated by or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, as well as yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste if managed as household waste. The definition* ***excludes waste from municipal sewage networks and treatment, as well as waste from construction and demolition activities."*** MSW here includes residential drop-off and residential kerbside material. The current definition of these streams as defined by NZ regulations includes 'household quantities' of material from businesses.[196] This broadly aligns with international definitions of MSW. Similarly, kerbside recycling and organics includes some material from commercial sources.
Rate 2 MSW OECD	Row 6	Litter and Illegal Dumping in MSW	The current definitions do not explicitly include (or exclude) litter and illegal dumping, which is one of the categories included in the OECD definitions of MSW. Studies have identified that there is between 0.4 and 1kg of litter and illegal dumping per person collected annually.[197] This equates to approximately

[196] Waste Minimisation (Information Requirements) Amendment Regulations 2023 (SL 2023/262) – New Zealand Legislation
[197] Eunomia 2014, Service Review: Review of Illegal Dumping Prepared for Hamilton City Council. Auckland Council reports 136 tonnes per month (1,632 tonnes per annum).

Sheet	Reference	Title	Comment
			2,000 to 5,000 tonnes per annum nationally. This figure is well within the margins of error for the current tonnage estimates. How these tonnages are coded at transfer stations and disposal facilities however varies and it is not known if they are coded to one of the Residential categories or other categories. On the basis that adding these tonnages to the MSW figure could double count them, and that the quantities involved will not materially alter the calculations, (it would change the rate by up to 0.1 of a percentage point) it is recommended that they be excluded until a clear practice for their reporting has been established. Similarly, data on street sweeping waste is poorly accounted for. Available data indicates that there is in the order of 15,000 tonnes of street sweeping waste disposed of annually at a national level.[198] Again, it is not clear how this is accounted for in the data. At most, including this would result in a change of approximately 0.35 of a percent in the recycling rate, which is within margins of error. Cell N6 allows the user to adjust how much of the estimated litter, illegal dumping and street sweeping is included in the total. Cell O6 allows the user to adjust the proportion of ICI material that is deemed to be 'household quantities'.
Rate 2a – MSW (EU)	General	Rationale	This metric differs from the OECD-compatible Metric in that it attempts to make adjustments that align with an interpretation of the European definition that

[198] https://civicwaste.nz/new-innovation/our-latest-innovation-diverting-waste-from-landfill/

Sheet	Reference	Title	Comment
			includes some commercial materials if they are 'similar in nature and composition' to household materials, even if they do not arise from household-like activities (for example cardboard boxes or catering wastes would be considered 'similar in nature' to household materials). The adjustments made were: including most paper, bottle glass, carpet and nappies and sanitary as these are considered similar in nature; including a proportion of putrescibles to disposal and recovery that approximates catering wastes and garden waste, but does not include food processing wastes, sludges or agricultural materials, including plastics apart from pallet wrap or post-industrial. Other materials were not considered similar. It should be noted that there is no reliable data on these splits so they should be considered estimates only. However, the figures produced from the estimated data align relatively well with EU data.
Rate 3 Kerbside	General	Rationale	Two options for a kerbside rate are given here. The first option does not differentiate between commercial and household sources, but reports on the quantities of material collected through kerbside services – the majority of which service households.
	Cells M6 and M7		The second rate provides the option for the user (Cells M6 & M7) to make an estimate that excludes commercial sources. Initial values are provided based on expert judgement and limited commercial audit data that indicates that businesses generate in the order of 1kg per person per week of 'household-like' waste (This is equivalent to approximately

Sheet	Reference	Title	Comment
			100,000 tonnes per annum). It should be noted that not all of the household-like waste generated by businesses is deposited in kerbside collections, but this fraction is currently unknown.
Disposal Data	General	Rationale	This table consolidates and displays total disposal facility tonnages from the pink input tabs. In the case of the Class 1 and Class 3-4 data (Cells F4 & F6) the data displayed is taken from the MfE website[199] as the data supplied by MfE in the tabs is slightly different and the website figures are considered the most up to date.
Activity	General	Rationale	Activity Estimates are compiled to provide a basis for calculating tonnages to each type of disposal facility by Activity, when this information is not reported. Activity data is based on voluntary reporting. It is anticipated that the data in this table for Class 1-5 and Industrial Monofills will be able to be largely superseded by data from new mandatory reporting requirements. Data from Farm Fills and Recovery will not be captured by the new reporting requirements so these estimates will still be necessary. The following adjustments have been made to the above data to align with 2023 Activity classifications: • Landscape has been split between Mixed ICI and Residential drop-off (according to splits on the 'Class 2-4 Composition tab)

[199] Waste facilities and disposal | Ministry for the Environment

Sheet	Reference	Title	Comment
			• Rural has been included in Mixed ICI • Special has been classified as Unusual Activity • Industrial monofills are a new disposal classification and have been assumed to have an activity source split based on the ownership and location of the facility and using reported tonnages provided by MfE
Composition	General	Rationale	This tab consolidates and displays percentage composition data for each destination type by Activity. The data for the calculations are taken from other tabs. The totals for each destination are conditionally formatted to highlight the key material streams.
2019 MfE	General	Rationale	This data represents the previous best estimate of waste by Activity, facility type and recovery. In the model all of the data has been superseded apart from the estimate for Farm Dumps, which is taken forward and used in the current model dataset (with growth adjustment). The 2019 MfE dataset provides a useful comparator to the current dataset. The most significant changes have been a massive increase in the tonnes attributed to class 5 facilities and the inclusion of Industrial Monofills, which also have significant tonnages.
Growth Projections	General	Rationale	This sheet was developed to provide a basis for applying a growth factor to older data so that all data reported in the model aligns as closely as possible with calendar year 2023 data.

Sheet	Reference	Title	Comment
			The growth projections utilise three metrics Population, GDP and Construction. These are combined for an overall metric based on the proportion of equivalent Activity source material in the overall Class 1 figures. Population growth is based on Stats NZ population projections, interpolated for intermediate years. This is used to apply to residential Activity data GDP data is from Stats NZ Gross GDP data. These growth rates are applied to ICI Activity data A construction growth rate is calculated from Stats NZ total building consent data. This is applied to C&D data.
Population	General	Rationale	This tab simply compiles the Stats NZ population data.
Class 1 Composition by Activity	General	Rationale	This sheet includes the key data used to calculate the composition by Activity for Class 1 disposal. It should be noted that some of the calculations link to an external sheet which contains proprietary data. The overall composition of waste to Class 1 landfills has been calculated specifically for the model and is unrelated to the 2018 composition used in the NZ Greenhouse Gas Inventory. The composition used in the Greenhouse Gas Inventory was not used as it lacked secondary classifications and a breakdown into legacy activity sources. The overall composition developed for the model is based on an aggregation of the compositions and proportions of legacy activity sources taken from a range of SWAP surveys undertaken by Waste Not

Sheet	Reference	Title	Comment
			Consulting and other sources. Data from the legacy activity sources is used as there is no available data from the activity categories defined in Schedule 3 of the Waste Minimisation (Information Requirements) Amendments Regulations 2023. The relative proportions of the six legacy activity sources in the overall waste stream to Class 1 landfills are based on seven data sources that, when combined, represented 66% of waste by tonnage going to Class 1 disposal. The compositions of the individual legacy activity sources are based on a subset of the data used for the estimating the relative proportions. Details of the data sources used for the calculations have been provided separately to MfE. To convert tonnage data on the legacy activity source data into activity category data, the tonnages of the six legacy activity sources were broken down into ten intermediate categories. Using the estimated conversion factors in the Conversion from Legacy Activity Sources to Intermediate Classifications table, the ten intermediate categories were recombined into the activity categories. Compositions from the legacy activity sources were applied to the relevant activity category. The final adjustment that was made was to weight the data from the composition datasets so as to more accurately reflect NZ overall composition – specifically Auckland composition was markedly different to the rest of the country. Auckland data was therefore weighted so it only applied to the proportion of waste from Auckland.

Sheet	Reference	Title	Comment
Class 2-4 Composition	General	Rationale	Composition studies commissioned by MfE on Class 2 and 3-4 fills are analysed to arrive at a consolidated dataset. The Class 2 audit results are analysed separately. Secondary classifications are consolidated into primary categories and the results are weighted by the numbers of vehicles observed from each study, with an option to apply a manual weighting. This gives an overall primary %.
Class 2-4 Composition	Row 24 & 25, Columns M-R	Weighting	In our estimation the plastic fraction is unusually high for C&D activity and may be skewed by audit data from a particular fill that is known to take MRF reject material . In recognition of this the weighting can be altered manually (Cells N24 to Q24) to produce a more appropriate composition.
Class 2-4 Composition	Class 2 Allocation of Tonnage by Composition and Class 3-4 Allocation of Tonnage by Composition	Allocation of tonnes to Activity & composition	These tables make assumed allocations by Activity for each material. Allocations have been made to align with the percentage splits from OWLS self-reported Activity data. The crosscheck splits in row 22 should match those in row 8.
Class 1 Class 2 Class 3-4	General	Rationale	These tabs contain MfE OWLS data. The 2023 data is selected for use in the model. Activity is voluntarily reported so this data is considered indicative only. In order to expand the

Sheet	Reference	Title	Comment
Class 5 Industrial Monofills			dataset on Activity the entire dataset for Activity is applied not just the 2023 calendar year. Activity proportions generated in these tabs are used in the Activity tab.
Farm Fills	General	Rationale	Tonnages for Farm Fills are taken from 2019 MfE data and a GDP related growth factor applied. Composition is taken from "Environment Canterbury (2013) Non-natural rural wastes Site survey data analysis " The Environment Canterbury data is translated into SWAP categories in the table starting on row 27.
Recovery	General	Rationale	This sheet compiles data from a range of sources to develop estimates of quantities of material recovered. Recovered material data is generally the least reliable data, and the figures here derive from one off studies, export data, industry association data, and estimates. Recovered material data faces issues of definition, commercial sensitivity, and a lack of comprehensive data gathering.
Recovery	Cella K21 - L21	Recovery adjustment	Raw recovery data does not take account of process losses before recovered material becomes a product. The Adjusted figures apply loss rates (from columns L &M and based on figures from Eunomia 2024, as set out in the 'Recovery Adjustments' tab).

Sheet	Reference	Title	Comment
Recovery	Paper	Data sources	Paper data was taken from Eunomia and TNC 2021: National Resource Recovery Project – Fibre Investigation and Response report for MfE. This figure can be manually adjusted to account for growth.
Recovery	Plastic	Data sources	Plastic data was assembled from a range of sources including the Eunomia 2021 Stocktake, Valpak 2023 product stewardship report, export data and WRIF supplied data (to assist with kerbside splits).
Recovery	Putrescible - Food	Data sources	The primary source was the Eunomia 2021 Stocktake. This allowed for splits by material and Activity. The kerbside data was updated with Auckland Council food waste collection tonnages added.
Recovery	Putrescible - Garden	Data sources	The primary source was the Eunomia 2021 Stocktake. This allowed for splits by material and Activity.
Recovery	Putrescible – Agriculture and processing	Data sources	The primary source was the Eunomia 2021 Stocktake. This allowed for splits by material and Activity. Rendering was not specifically surveyed in the stocktake but an estimate of rendering tonnages was calculated for the Stocktake based industry data of meat waste by animal and livestock numbers.
Recovery	Ferrous metal	Data sources	The primary data source was export data, supplemented by stocktake and industry data for the quantities recovered onshore.

Sheet	Reference	Title	Comment
Recovery	Non-ferrous metal	Data sources	The primary data source was export data, supplemented by stocktake and industry data for the quantities recovered onshore.
Recovery	Glass	Data sources	Bottle glass was taken from the most recent (2022) Glass Packaging Forum data. Splits by Activity were based on previous data held by Eunomia from modelling glass flows in NZ. Flat glass was taken from Stocktake data.
Recovery	Textiles	Data sources	Textiles data was taken from a report by UsedFully (2021), which mapped textile flows in NZ.
Recovery	Nappies and sanitary	Data sources	No data.
Recovery	Timber	Data sources	The primary source was the Eunomia 2021 Stocktake. This allowed for splits by material and Activity.
Recovery	Rubber	Data sources	The primary source was the Eunomia 2021 Stocktake. This in turn relied on data from Tyrewise.
Recovery	Rubble & Concrete	Data sources	The primary source was the Eunomia 2021 Stocktake. This allowed for splits by material. Some data was estimated based on known operations that did not supply data. Rubble and concrete in the ICI data is slag from steel-making based on publicly available information from NZ steel.
Recovery	Potentially Hazardous	Data sources	This is WWTP sludge based on data from the Eunomia 2021 Stocktake.

Sheet	Reference	Title	Comment
Recovery Adjustments	General	Rationale	This data estimates losses due to removal of contamination or mis-sorting during the recovery process. All assumptions are taken from Eunomia 2024: Global Recycling League Table Report. The data from this tab is utilised in the Recovery tab (cells K24 to L35).
Metal Exports	General	Rationale	This tab contains Stats NZ export data for relevant tariff codes. Various grades of ferrous and non-ferrous are split out. Some data is in kg and this is identified and converted to tonnes.

A.4.0 Eunomia Global Recycling League Table Report - Examples of Municipal Waste

This section provides further detail of the definition of municipal waste, based on the EU definition mentioned previously in the report, and provides examples of what is included in the definition of municipal waste in practical terms.

Municipal waste includes household waste and similar waste. It includes for example:

- paper and cardboard, glass, metals, plastics, wood, textiles;
- packaging;
- bio-waste (e.g. garden waste, leaves, grass clippings, street sweepings, the content
- of litter containers, and market cleansing waste); and
- mixed and/or undifferentiated wastes, and market cleansing waste.

It also includes materials that are likely to appear in household waste in relatively small quantities, but which in large quantities may be non-municipal in character:

- hazardous household waste (e.g. spent solvents, acids, alkalines, photochemicals,
- pesticides, used oils, paints, inks, adhesives and resins (partly hazardous), detergents (partly
- hazardous), hazardous medicines);
- bulky waste (e.g. white goods, furniture, mattresses etc);
- other waste: Edible oil and fat, rubber waste, ceramics, etc; and
- waste electrical and electronic equipment, waste batteries and accumulators;

Municipal waste includes waste originating from the following (whether collected by municipal or by private collectors):

- households (including recycling of biowaste at source, e.g. home composting, but excluding sewage sludge and construction and demolition [renovation] waste);
- commerce and trade, small businesses, office buildings and institutions (e.g. schools, hospitals, government buildings);
- other enterprises if the waste is similar in kind and composition to household waste and does not come from production;
- all small businesses should be included (including, for instance, waste from repair shops, handicraft, household scale businesses etc.); and
- waste from selected municipal services, i.e. waste from park and garden maintenance, waste from street cleaning services (e.g. street sweepings, the content of litter containers, market cleansing waste).

It includes waste from these collection methods:

- door-to-door through traditional collection (mixed household waste);
- fractions collected separately for recovery operations (through door-to-door collection and/or through voluntary deposits / drop off locations e.g. container parks, civic amenity sites);
- wastes collected directly by the private sector (business or private non-profit institutions); not on behalf of municipalities (mainly separate collection for recovery purposes); and wastes originating from rural areas not served by a regular waste service, even if they are disposed of by the one generating the waste.

As mentioned in the main text, the definition is without prejudice to the allocation of responsibilities for waste management between public and private actors.

A.4.1 Eunomia Global Recycling League Table Report – Notes and Recommendations for New Zealand

Report Notes	Addressed in Model
The published data does not distinguish household and non-household municipal waste. A standardised split therefore had to be applied with non-household waste estimated as 40% of MSW.	An actual split based on Activity source from SWAP data was used.
Large amounts of construction waste were removed from the municipal waste arisings data.	C&D waste was not included in the model for MSW equivalent metrics.
Figures for municipal wood arisings and recycled are unusually high and were adjusted down.	Actual composition by Activity source was used.
Figures for municipal hazardous waste arisings are unusually high and were adjusted down.	Actual composition by Activity source was used.
No organics recycling is reported whilst there are several municipal composting sites in the country, so an estimate of organics recycling was added in.	Actual organics recovery data was used.
Post-collection losses from dry or organic recycling do not appear to have been accounted for by New Zealand, and recycling was adjusted down accordingly.	A post collection loss figure was applied based on defaults used in the Global Recycling League Table report.
Recommendations: Distinguish between household and non-household waste in data to	The primary issue and difference between the figure developed for

	enable a better assessment of the relative performance of the two sources of MSW. Review the waste being reported as municipal to remove construction waste. Review how wood and hazardous waste are categorised to exclude non-municipal material. Ensure that a methodology is implemented to account for post-collection losses and show its impact in published statistics. Account for municipal composting and home composting.	the Global Recycling League table report is that it took as its starting point an overall recycling rate (28%) rather than an MSW recycling rate and then adjusted that down. Our revised calculations in the data model build up the various recycling rates from available data applying appropriate definitions.

A.5.0 Comparison of EU and OECD MSW Reporting

There are 27 countries in the EU, 22 of which are also members of the OECD. As discussed in section 2.6 OECD Reporting the OECD release a questionnaire to member countries as well as Eurostat countries.

To understand whether countries report differently to the EU and OECD the below table compares municipal waste per capita from the OECD and Eurostat websites. The Eurostat website compares 2004 and 2022 whereas the OECD website has annual data available since 1985. Given that the Eurostat website has data for 2022, that year was chosen to compare to the OECD data; however, of the 22 EU and OECD members eight had not reported data for this period.

The definition of municipal waste for EU and OECD differ which means these numbers are expected to be different, although it is up to the reporting countries to interpret the definitions and in some instances they may not have data at the right level to differentiate the two definitions. As mentioned in section 2.3 European Union, the European Commission defines municipal waste as:
"mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture" and *"mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households"*.
The OECD definition of municipal waste is outlined in section 2.6 OECD Reporting as:
"waste collected and treated by or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, as well as yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste if managed as household waste. The definition excludes waste from municipal sewage networks and treatment, as well as waste from construction and demolition activities."
The key difference between the two definitions is that the EU includes waste from sources that is "similar in nature and composition to wastes from households". This could be interpreted as including all tonnages of relevant waste streams regardless of the source, for example because households produce cardboard waste, every industry that produces cardboard waste would also be counted toward the municipal waste metric.

For countries that have reported to both OECD and Eurostat ten gave identical numbers (Estonia, France, Germany, Hungary, Luxembourg, Netherlands, Slovakia, Sweden, Norway, and Switzerland). Five countries gave different numbers (Belgium, Denmark, Lithuania, Poland, Slovenia, and Spain), which differ between 0-3%, where 3% is relatively considerable given it is a per capita figure. In particular, Lithuania reported 465kg/capita to EU and 479kg/capita to OECD, or 14kg/capita which is the equivalent of 39,620 tonnes. From the definitions of municipal waste outlined above, the most likely interpretation of the two would produce a higher number for EU reporting, although four countries reported higher values to EU and two reported higher values to OECD. The different numbers reported could also be due to data entry error at some point in the reporting process.

Table 32 Per Capita Data to OECD and EU by Country for 2022

	Country	OECD member	EU kg/capita	OECD kg/capita
European Union (EU)	Austria	Y	835	No data for 2022
EU	Belgium	Y	677	680
EU	Bulgaria	N	445	NA
EU	Croatia	Accession candidate	478	NA

EU	Republic of Cyprus	N	673	NA
EU	Czech Republic	Y	570	No data for 2022
EU	Denmark	Y	787	786
EU	Estonia	Y	373	373
EU	Finland	Y	630	No data for 2022
EU	France	Y	539	539
EU	Germany	Y	593	593
EU	Greece	Y	509	No data for 2022
EU	Hungary	Y	406	406
EU	Ireland	Y	644	No data for 2022
EU	Italy	Y	495	No data for 2022
EU	Latvia	Y	461	No data for 2022
EU	Lithuania	Y	465	479
EU	Luxembourg	Y	721	721
EU	Malta	N	618	NA
EU	Netherlands	Y	473	473
EU	Poland	Y	364	355
EU	Portugal	Y	513	No data for 2022
EU	Romania	N	301	NA
EU	Slovakia	Y	478	478
EU	Slovenia	Y	487	488
EU	Spain	Y	467	468
EU	Sweden	Y	395	395
European Free Trade Association (EFTA)	Iceland	Y	659	No data for 2022
EFTA	Liechtenstein	N	No data	NA
EFTA	Norway	Y	768	768
EFTA	Switzerland	Y	677	677

A.6.0 MSW Definitions found in the International Review

The tables below summarise municipal waste definitions within section 2.0 International Review by inclusions and exclusions of relevant waste sources and streams. The sources of the municipal waste definitions chosen have the most cohesive information available, although there is room for interpretation for all of them. The waste streams/sources below were chosen to reflect questions that are commonly raised when confirming what variables to include in MSW calculations.

Table 33 MSW Waste Sources According to Definitions

Waste source	Australia	European Union	OECD	New Zealand
Household waste collected by councils	MSW	MSW	MSW	MSW
Household waste collected by private waste sector	X	MSW	MSW	MSW
Commercial waste similar in nature and composition to household waste	X	MSW	X	X
All waste streams that are produced by households even in non-household settings (i.e. all cardboard)	X	MSW	X	X

Waste source	Australia	European Union	OECD	New Zealand
C&D	X	X	X	MSW (if from residential sources)
C&I/ICI	X	If similar in nature to household materials	If household streams	X
Litter and illegal dumping	MSW	MSW	MSW	X
Municipal parks and trees	MSW	MSW	MSW	MSW
Council facility operations	MSW	MSW	MSW	MSW
Informal economy (e.g. home composting, farm fills)	X	MSW	MSW	X

Table 34 MSW Waste Streams According to Definitions

Waste stream	Australia	European Union	OECD	New Zealand
Agriculture/forestry/fishing	X	X	X	X
Bio-waste (organics)	If managed by council	MSW	MSW	MSW
Bulky waste/inorganic	MSW	MSW	MSW	MSW
Energy recovery/W2E	X	X	X	X
E-waste	If managed by council	MSW	unclear	MSW
Household hazardous waste	If managed by council	MSW	unclear	MSW
Non-packaging glass	If managed by council	unclear	unclear	If not C&D waste

Waste stream	Australia	European Union	OECD	New Zealand
Rubble	X	If similar to household waste	X	From household sources
Scrap metal	If managed by council	If similar in nature to household materials		From household sources
Sludge	X	X	MSW, excludes sewage	X
Soil	X	If similar to household waste	X	From household sources
Timber	If managed by council	If similar in nature to household materials	X	From household sources
Tyres	If managed by council	If similar in nature to household materials	X	From household sources