Incineration Review

Capacity Analysis

Report for: Scottish Government on behalf of the Independent Review of the role of Incineration in the Waste Hierarchy of Scotland

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Table 1: Glossary of terms

Term	Description
ATT	Advanced thermal treatment
BAU	Business as usual
BE	Best efforts
BMW	Biodegradable municipal waste
BNMW	Biodegradable non-municipal waste
C&D	Construction & demolition
C&I	Commercial & industrial
CCP	Climate change plan
CV	Calorific value
CXC	ClimateXChange
EfW	Energy from Waste
GDP	Gross domestic product
Kt	Kilotonnes
MBT	Mechanical biological treatment
MT	Meeting targets
Mt	Megatonnes
NRS	National Records of Scotland
OBR	Office for Budget Responsibility
PHS	Public Health Scotland
RDF	Refuse derived fuel
SCM	Scottish carbon metric
SEPA	Scottish Environmental Protection Agency

1. Introduction

1.1 Background

In May 2021, the Cabinet Secretary for Net Zero, Energy and Transport set out a commitment to review the role of incineration in the waste hierarchy in Scotland. On the 3rd August 2021, a shared policy programme agreed between the Scottish Government and the Scottish Green Party was published and stated that the review would include an assessment of the need for new incineration capacity.

A statement to Parliament in September 2021 by the Minister for Green Skills, Circular Economy and Biodiversity set out the intention for the review to:

- Be led by an independent chair.
- Prioritise consideration of national capacity requirements for incineration.
- Have scope to consider how emissions from existing incinerators can be reduced and residual heat may be reused; and consider the societal impacts of residual waste treatment, including health and community impacts.

In addition, the Minister set out the timeline for this review to be undertaken between December 2021 and March 2022. Further, in November 2021 the Minister appointed Dr Colin Church as the independent chair of the review. Dr Church indicated the intention for the review to include opportunities for all stakeholders to provide their views and evidence. To achieve this a call for evidence was launched in December 2021 which closed in February 2022 in addition to other stakeholder consultation events.

1.2 Scope Of Works

Recent work undertaken by Ricardo considered the capacity requirements of residual waste infrastructure in light of Scottish Government policy targets. This focussed on the national residual waste capacity requirements to inform delivery planning for the ban on the landfilling of Biodegradable Municipal Waste (BMW) by the end of 2025 and the potential extension of this ban to include Biodegradable Non-Municipal Wastes (BNMW). This was undertaken due to the Scottish Government's commitment to extend the ban, subject to further consultation and impact assessments, as set out within their Climate Change Plan (CCP). The work was primarily focussed upon Household and Commercial and Industrial (C&I) waste sources and for the period up to the end of 2025 when the landfill ban is due to be implemented.

This scope of works builds upon this previous work and aims to establish future capacity requirements to treat residual waste in Scotland. This was undertaken through updating the recent work delivered by Ricardo and considering new data and evidence provided through the independent review's call for evidence. The scope of works therefore:

- Updates the current estimates of capacity requirements to meet the BMW landfill ban in 2025.
- Extends the current modelling beyond 2025 to consider capacity requirements over the subsequent 25 years to 2050.
- Considers the impact of extending the ban beyond BMW and C&I waste to include other waste sources, such as sorting residues from Construction and Demolition (C&D) wastes.

The capacity analysis was also required to apply any additional and relevant evidence submitted within the duration of the review's call for evidence.

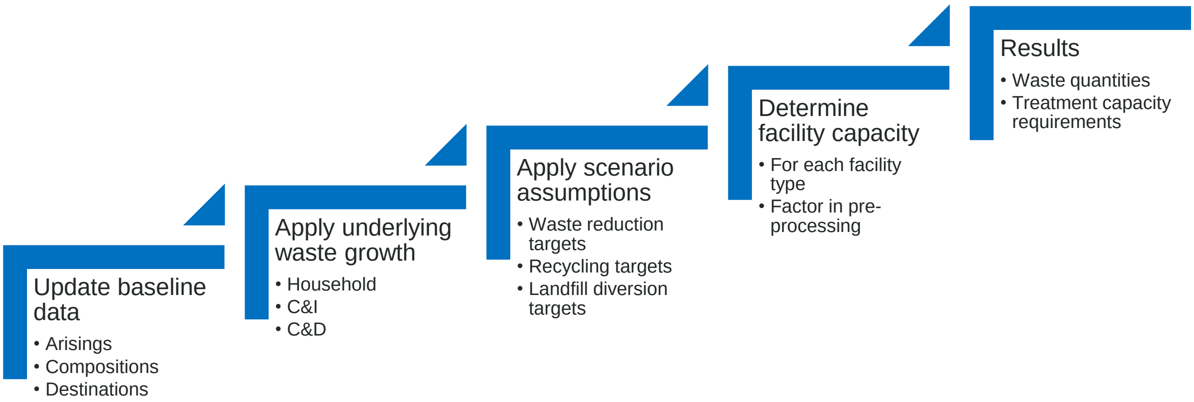
2. Modelling Approach

2.1 Overview

Ricardo utilised an existing residual waste model previously developed for the Scottish Government in 2015 and adapted it to consider the updated parameters for this assessment.

The overarching modelling approach is outlined in Figure 1. The model was reviewed and updated with the latest available data, which is for the year 2018 and referred to as the 'baseline' year throughout this report. Underlying waste growth assumptions were then applied to the baseline data to assess how waste quantities may change in the future. Scenarios were then modelled to assess the impact of a range of potential future performance scenarios. Finally, the infrastructure capacity was then reviewed and overlaid with the waste projections. More detail on the assumptions and scenarios modelled can be found in the following sections.

Figure 1: Waste Forecasting and Capacity Gap Modelling Approach



2.2 Modelled Scenarios

Due to the inherent uncertainty in forecasting the future, Ricardo examined three future scenarios to provide a range of possible future outlooks, these are:

- **Business As Usual (BAU)**: This scenario projects historical trends forward into the future, to examine what the future could look like if there are no significant changes to current trends.
- **Meeting Targets (MT)**: This scenario amends historical trends in order to meet Scotland's waste reduction and recycling targets for 2025.
- **Best Efforts (BE)**: This scenario examines what Scotland's future could look like if it emulated the performance of high-performing nations, with regard to waste reduction and recycling performances.

The following sections go into further details on the assumptions that make up each scenario.

2.3 Baseline Data

The raw baseline data was taken from the Scottish Environmental Protection Agency (SEPA) website, ‘waste from all sources’ for the most recent year available, which at the time of the study was 2018. The baseline data excludes hazardous waste and waste from mining, as these components are not a consideration for the capacity review. To determine the destinations of the baseline waste (i.e., how much of each material is recycled, landfilled etc.), SEPA’s data was used for household waste destinations and the Scottish Carbon Metric (SCM) from Zero Waste Scotland for C&I and C&D waste destinations. The raw data used, and the final destinations or ‘fates’ applied for the baseline are shown in Appendix 1.

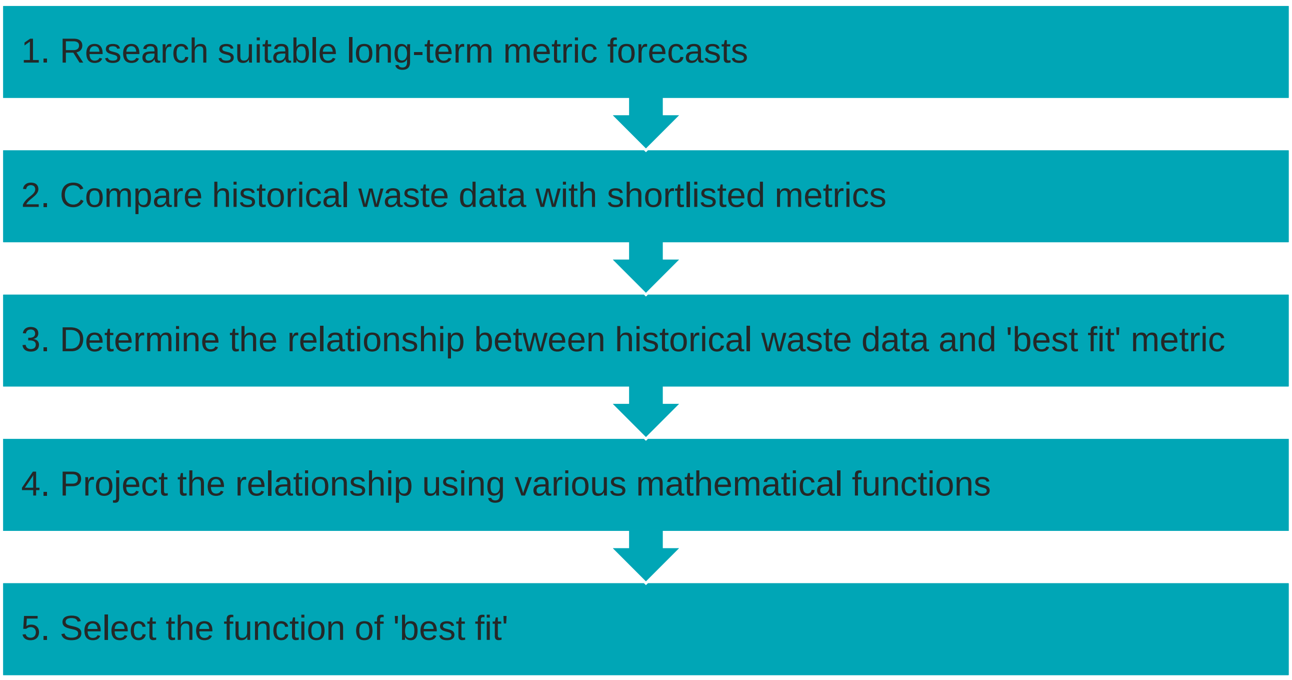
2.4 Underlying Waste Growth Assumptions

To quantify the potential future waste quantities in Scotland, a number of assumptions were made. These are outlined in the following sections.

2.4.1 Arisings Forecasting Method

Forecasting how waste arisings may change in the longer-term future is uncertain and complex, as there are many factors that can impact on changes to the generation and composition of waste in the future. The method used by Ricardo has been previously used for long-term forecasting (more than 15 years) and is outlined in Figure 2. Further details are provided below. This method has been applied to forecast total waste arisings, i.e., prior to any efforts to divert waste through reuse, recycling and composting.

Figure 2: Waste growth forecasting process



Step 1 is fundamental because it provides a robust platform for the waste projections, based on actual long-term forecasts, which have been developed through detailed analysis. Without relying on an actual long-term forecast, these projections would not be grounded in an evidence-based approach. The relevant metrics for which long-term forecasts were available include:

- Scotland's household growth forecast: *Table 1: Overall projections for Scotland, 2018 to 2043* data from National Records of Scotland (NRS)[1] for projections up to and including 2043. For 2044 to 2050, Ricardo assumed a rolling growth rate based on the previous five years.
- UK's GDP growth forecast[2]: Real GDP growth (i.e., adjusted for inflation) from the UK Office for Budget Responsibility (OBR).

Analysis in Step 2 showed that Scotland's historical C&I waste data better correlated with the UK's GDP data, and Scotland's historical C&D waste data better correlated with Scotland's household growth data. Scotland's Household waste data is considered to be strongly linked to the number of households, so the household growth forecast was used as the metric for Household waste. Step 3 involved calculating the mathematical relationships between the historical waste arisings trends and the selected metrics. In this case, the relationships were:

- Household waste (tonnes) per Scottish household (no.)
- C&I Waste (tonnes) per unit of UK GDP (£)
- C&D Waste (tonnes) per Scottish household (no.)

Step 4 involved the projection of this relationship using three shortlisted mathematical functions. Figure 3, Figure 4 and Figure 5 show the mathematical functions examined for each of the waste streams. All three functions shown are mapped to the historical waste data trend, however there is a wide range in the projected quantities due to the long-term period being examined. For this reason, Step 5 involved selecting the most suitable function to be used for forecasting. The justification of each selection is outlined in Table 2.

Table 2: Selected Forecasting Functions

Waste Stream	Selected Forecasting Function	Justification
Household Waste	Logarithmic	While historical data does show a slight decrease in Household waste arisings despite a growth in households, the exponential and linear projections depict a much steeper reduction in Household waste. The logarithmic curve seemed most suitable, especially considering the widely experienced increase in Household waste arisings due to the impact of the covid-19 pandemic and associated home-working trends, which is not yet apparent in the 2018 data. (Figure 3)
C&I Waste	Exponential	Historical C&I waste data shows a significant declining trend, reducing from 3.6M in 2011 (exc. hazardous and mining waste) to 2.7M in 2018. Of

[1] NRS Household Projections for Scotland, 2018-based, available at: National Records of Scotland Website, accessed February 2022.

[2] UK Office for Budget Responsibility's Long-term economic determinants, available at: UK Office for Budget Responsibility Webpage

		the shortlisted projections, the exponential curve seemed the most realistic, resulting in a steady, but not an overly steep reduction in arisings. (Figure 4)
C&D Waste	Linear	Historical C&D waste data shows an increasing trend, growing from 5.0M in 2011 (exc. hazardous waste) to 5.8M in 2018. While the data points in this period are a little erratic, the overall trend is a steady increase of 1.8% per year. Of the short-listed functions, the linear projection most closely matches this trend. (Figure 5)

These waste arisings growth assumptions were applied consistently across the three modelled scenarios.

Note: the curves are named based on the mathematical function of the relationship between the historical data and the selected metric, however the curves in Figure 3, Figure 4 and Figure 5 depict how these functions look when the forecasted metrics are applied to the functions, to project waste arisings. For this reason, as an example, the 'linear' curve in Figure 4 may not look linear, as the forecasted metric is also impacting the shape of the curve.

Figure 3: Household Waste Projection function comparison

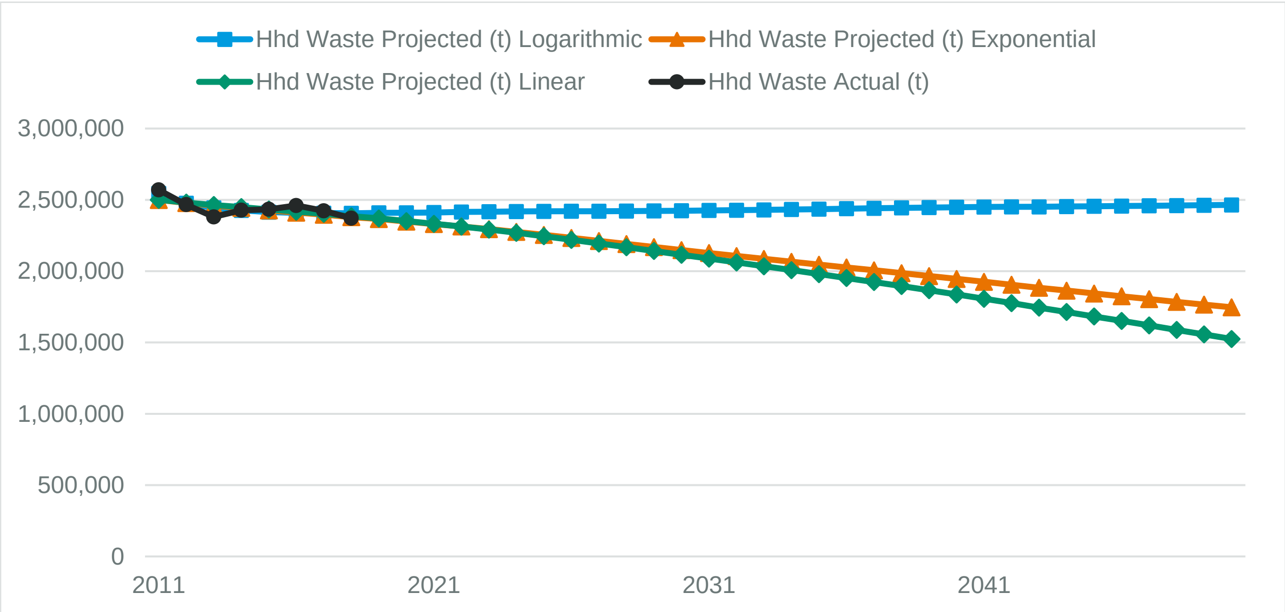


Figure 4: C&I Waste Projection function comparison

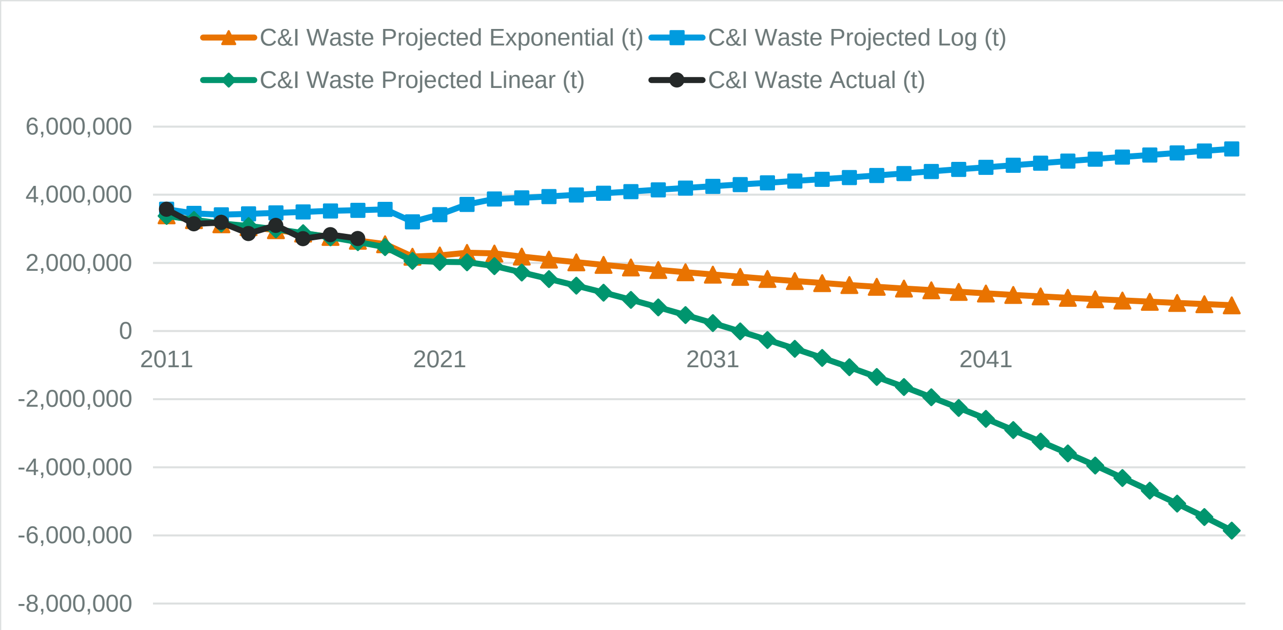
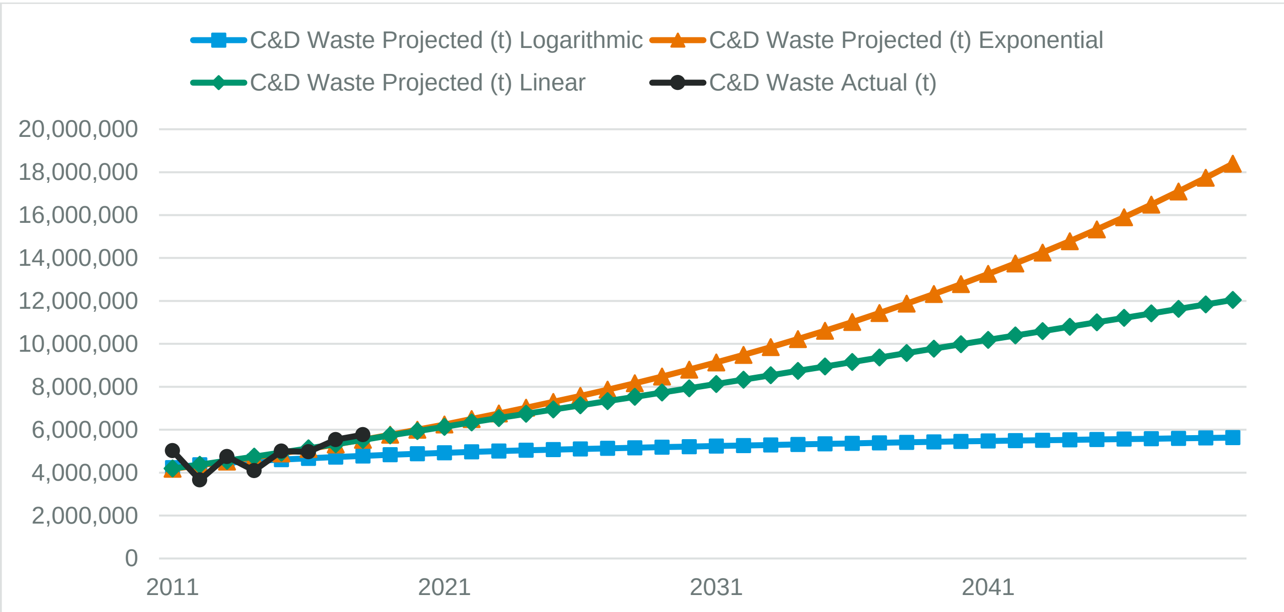


Figure 5: C&D Waste Projection function comparison



2.4.2 Arisings Forecasting Results

With all the projections selected, it was possible to combine the projections to determine the shape of the overall waste arisings projection. This is shown in Figure 6. The 'Total' line is an aggregate of the three waste streams. Data prior to 2018 is historical data, and data from 2019 onwards is projected data. The chart shows that:

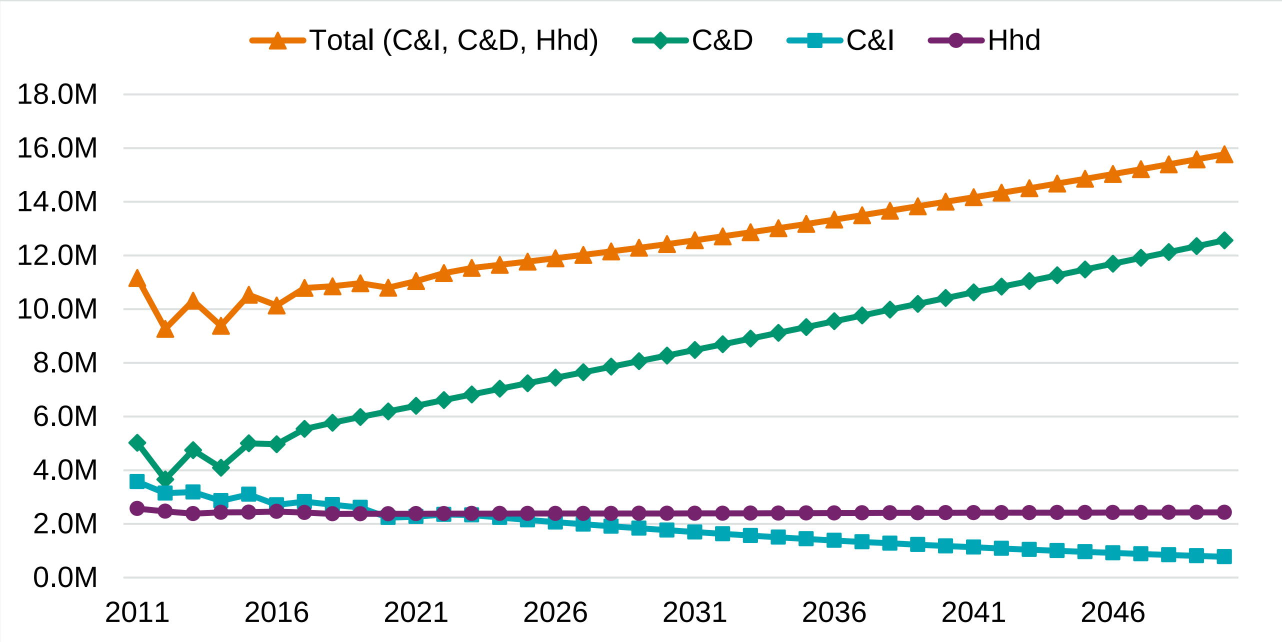
- Household waste arisings grow gradually from 2.37Mt in 2018 to 2.43Mt in 2050, due to a combination of per-household waste reduction and a growth in the number of households expected in that time period.

- C&I waste arisings reduce from 2.72Mt in 2018 to 0.77Mt in 2050, due to the continuation of a reducing trend of arisings as shown in the historical data.
- C&D waste arisings grow significantly from 5.76Mt in 2018 to 12.56Mt in 2050, continuing the trend of growth as shown in the historical data.

Total waste arisings are expected to grow significantly from 10.85Mt in 2018 to 15.77Mt in 2050, principally due to the projected growth in C&D arisings. It should be noted that this growth in arisings is not expected to impact significantly on residual waste treatment capacity, because C&D waste has a very high recycling rate, and a high proportion of C&D residual waste is not suitable for energy recovery facilities.

Due to the particular methodology outlined above, to consider waste arisings to 2050, direct comparison with the previous work undertaken for ClimateXChange (CXC) is not possible, as the arisings projected are not a like for like comparison.

Figure 6: Final Waste Arisings Projections



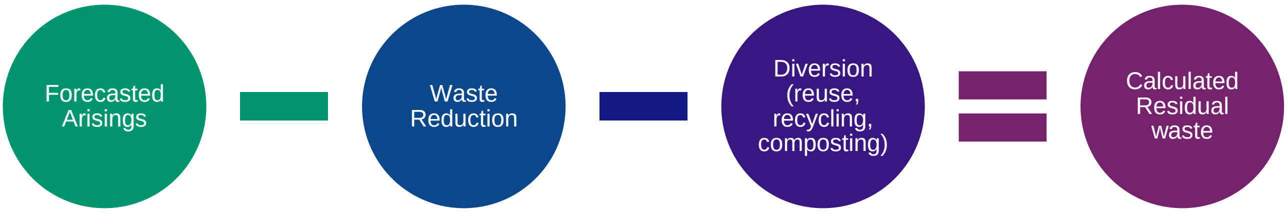
2.5 Scenario Assumptions

Layered on top of the underlying assumptions described in the previous section are additional assumptions for each scenario. These examine:

- Changes to waste arisings due to initiatives implemented in order to meet Scotland's policy targets.
- Changes to waste diversion (reuse, recycling and composting) that are projected to occur.

Figure 7 provides an overview of how the model calculates the residual waste, which is the focus of this analysis. The model examines the total forecasted arisings based on the calculations detailed in section 2.4. From these arisings, the impacts of waste reduction initiatives and waste and recycling diversion (through reuse, recycling and composting) are subtracted, which leaves the calculated amount of residual waste. This residual waste is then compared with the current and pipeline infrastructure, detailed in section 2.6.

Figure 7: Model Process Flow



2.5.1 All Scenarios

2.5.1.1 Diversion of Soil

Baseline C&D data for 2018 showed that 1.4M tonnes of soil was being landfilled. Ricardo considered this to be unrepresentative, particularly as the purpose of this analysis is to examine residual waste quantities primarily going to energy from waste facilities, and soil would not be a suitable input to these facilities. For this reason, Ricardo diverted all C&D soil from residual waste tonnages in the model.

2.5.1.2 Diversion of other materials

All three scenarios examine how waste diversion might change in the longer-term future. As shown in Figure 7, these assumptions impact the quantities of residual waste remaining that requires treatment infrastructure such as Energy from Waste (EfW) facilities, Advanced Thermal Treatment (ATT) facilities, Mechanical Biological Treatment (MBT) facilities and landfills.

For scenarios that explore an increase in diversion rates (i.e., primarily through an increase in recycling rates), it was assumed that it is not possible to increase the recycling rate of all material groups. For this reason, Ricardo built upon the previous work which was developed in conjunction with SEPA to determine which material groups could be targeted for further recycling. Based on this initial guidance from SEPA and reviewed with the inclusion of C&D waste, it was assumed that the recycling rates of the following material groups could be increased:

- Used oils.
- Chemical wastes.
- Metallic wastes (ferrous, non-ferrous and mixed).
- Glass wastes.
- Paper and cardboard wastes.
- Rubber wastes.
- Plastic wastes.
- Wood wastes.
- Textile wastes.
- Discarded equipment and vehicles.
- Batteries and accumulators wastes.
- Animal and mixed food waste.
- Vegetal wastes.
- Animal faeces, urine and manure.

- Household and similar wastes.[3]
- Mixed and undifferentiated wastes.[3]
- Mineral waste from construction and demolition.

2.5.2 Business as Usual (BAU)

2.5.2.1 Waste Reduction

The BAU scenario did not apply any further waste reduction assumptions to the projections shown in section 2.4.

2.5.2.2 Diversion

The BAU scenario applied a 0.5% uplift per year to the recycling rate of each of the targeted material groups specified above, this resulted in an overall average uplift in recycling of 0.4% per year. Table 3 provides further details. For comparison purposes, Scotland has seen an overall increase in recycling rates of 1.9% per year between 2011 and 2018, however it should be noted that recycling rates are impacted by the law of diminishing marginal returns, so as recycling rates rise it will take more and more effort to continue the increasing trend.

Table 3: Business As Usual (BAU) Diversion Assumptions

Waste Stream	Baseline Recycling Rate (2018)	Modelled Average increase per year	Modelled Recycling Rate in 2050
Household Waste[4]	44.7%	0.3%	54.5%
C&I Waste[5]	57.8%	0.2%	64.7%
C&D Waste[6]	97.0%	0.04%	98.3%

2.5.3 Meeting Targets (MT)

2.5.3.1 Waste Reduction

The MT scenario examined the impact of further waste reduction in order to achieve Scotland's targets, which are:

- Reduce total waste arisings in Scotland by 15% against 2011 levels, by 2025.
- Reduce food waste by 33% against 2013 levels, by 2025.

Further details on how these targets were applied are provided below.

Food waste arisings reduction target: SEPA indicated that the quantity of food waste in the published 2013 SEPA data (246k tonnes in the 'Animal and mixed food waste' material

[3] During discussions with SEPA, it was identified that further recycling from 'household and similar wastes' and 'mixed and undifferentiated wastes' may be difficult, however it was not possible to achieve the Scottish targets without uplifting the recycling rates of these material groups. It can be assumed that with better waste separation, the quantities in these material groups will move to other, cleaner material streams to allow for additional recycling.

[4] Excluding hazardous waste.

[5] Excluding hazardous waste and mining waste.

[6] Excluding hazardous waste and soils.

line) was too low. SEPA suggested that additional food waste could be contained within the ‘Household and similar wastes’ material line, which totalled 2.37M tonnes in the same year. SEPA proposed a re-allocation of this hidden food waste from the ‘Household and similar wastes’ material line to the ‘Animal and mixed food waste’, to the amount of 753k tonnes. This figure has been derived from the estimated 1 M tonnes of total food waste in 2013[7] minus the amount already in the ‘Animal and mixed food waste’ material line. This proportion[8] of ‘hidden food waste’ was used to determine the estimated total amount of food waste (identified and hidden) in 2018, in order to model the total food waste reduction to meet 2025 targets.

Total waste arisings reduction target: this has been calculated for all waste except food waste to avoid double counting the food waste reduction performance to meet the target summarised above. As such, food waste arising reductions were modelled first, followed by total waste arisings (minus food waste) reductions. For the Meeting Targets scenario (the only scenario modelled to reach specific targets), it was found that applying the food waste reduction target on its own meant that the total waste arisings reduction target was met in its’ entirety. This is because of the high total waste arisings in 2011, (the year that the total waste arisings reduction target is based on), compared to the baseline year (2018) for this analysis. For this reason, the total waste arisings reduction target was not applied to any of the scenarios.

2.5.3.2 Diversion

The MT scenario applied uplifts to the recycling rates of each of the targeted material groups specified above, in order to meet Scotland’s target of ‘recycling 70% of remaining waste’ by 2025. This required a significant uplift in recycling rates (by up to 20%) by 2025. From 2025 to 2050, it was assumed that recycling rates for targeted materials would increase by 1% per year. This resulted in an overall average uplift of 0.5% per year. Table 4 provides further details.

Table 4: Meeting Targets (MT) Diversion Assumptions

Waste Stream	Baseline Recycling Rate (2018)	Modelled average increase per year	Modelled Recycling Rate in 2050
Household Waste[9]	44.7%	0.8%	69.8%
C&I Waste[10]	57.8%	0.4%	70.8%
C&D Waste[11]	97.0%	0.04%	98.2%

[7] Scottish Government, Managing Waste – Food Waste Webpage

[8] Hidden food waste made up an estimated 31.8% of the ‘Household and similar wastes’ material line in 2013. It was assumed that this proportion would be consistent over the time period examined.

[9] Excluding hazardous waste.

[10] Excluding hazardous waste and mining waste.

[11] Excluding hazardous waste and soils.

2.5.4 Best Efforts (BE)

2.5.4.1 Waste Reduction

The BE scenario did not apply any further waste reduction assumptions to the projections shown in section 2.4.

2.5.4.2 Diversion

The BE scenario applied a 1% uplift per year to the recycling rate of each of the targeted material groups specified above, this resulted in an overall average uplift in recycling of 0.5% per year. Table 3 provides further details. This uplift is in line with evidence provided for other European nations in the call for evidence. The evidence reported on household waste recycling rates over time in England, Netherlands, Germany, France, Sweden and Ireland. Those countries were stated as being selected on the basis of data availability. The evidence shows that where recycling increases, it becomes progressively harder to sustain the annual rate of increase. The evidence also outlines that once recycling rates are around 45%, the average annual increase in household waste recycling is approximately 0.6% per year. A particular example given within the evidence was for Germany, where once a recycling rate of 50% was reached, the rate of increase dropped to 0.5% per year. However, caution should be applied when directly comparing to Scotland, as there may be some variability in how recycling rates are reported, such as whether countries include IBA recycling within their recycling data.

Table 5: Best Efforts (BE) Diversion Assumptions

Waste Stream	Baseline Recycling Rate (2018)	Modelled Average increase per year	Modelled Recycling Rate in 2050
Household Waste[12]	44.7%	0.6%	62.7%
C&I Waste[13]	57.8%	0.4%	71.3%
C&D Waste[14]	97.0%	0.04%	98.3%

2.5.5 Calculated Residual Waste

The application of the scenario assumptions in this section results in the residual waste quantities shown in Figure 8. The scenarios estimate a total residual waste amount of between 2.07Mt and 2.29Mt in 2022, reducing to between 1.02Mt and 1.44Mt in 2050. In contrast with the previous CXC project, the BAU scenario anticipates a reduction in residual waste quantities, due to the current trend of increasing recycling. The CXC project assumed a constant recycling rate, however this analysis has projected an increasing recycling rate in line with historical trends. This has resulted in a different residual waste figure for 2025 when compared to the CXC project, due to the different scenario and waste growth assumptions. This highlights the impact that different assumptions can make when

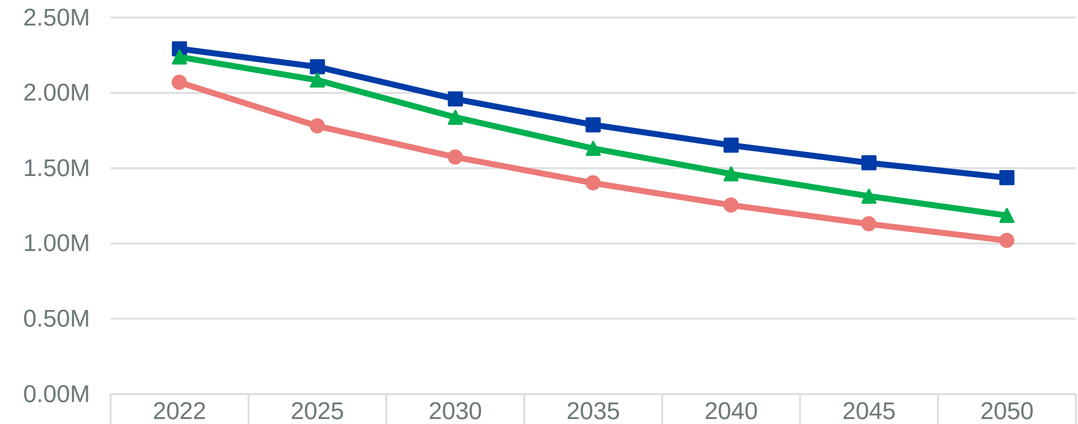
[12] Excluding hazardous waste.

[13] Excluding hazardous waste and mining waste.

[14] Excluding hazardous waste and soils.

estimating future waste quantities and it is recommended that the Scottish Government monitor emerging data against future projections.

Figure 8: Calculated Residual Waste Quantities (All Scenarios)

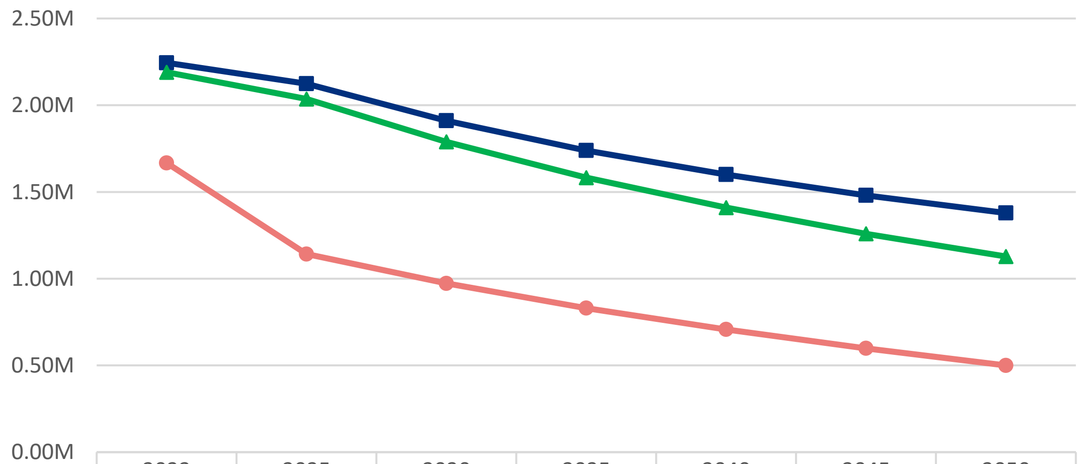


	2022	2025	2030	2035	2040	2045	2050
BAU	2.29M	2.17M	1.96M	1.79M	1.65M	1.54M	1.44M
Best Efforts	2.24M	2.08M	1.84M	1.63M	1.46M	1.31M	1.19M
Meeting Targets	2.07M	1.78M	1.57M	1.40M	1.25M	1.13M	1.02M

2.5.6 Exclusion of C&D Waste

As C&D waste has a very high recycling rate, and a high proportion of C&D residual waste is not suitable for treatment at energy recovery facilities. Further modelling was undertaken with C&D waste excluded, with the calculated residual waste quantities shown in Figure 9.

Figure 9: Calculated Residual Waste Quantities (excluding C&D waste)



	2022	2025	2030	2035	2040	2045	2050
BAU	2.24M	2.12M	1.91M	1.74M	1.60M	1.48M	1.38M
Best Efforts	2.19M	2.04M	1.79M	1.58M	1.41M	1.26M	1.13M
Meeting Targets	1.67M	1.14M	0.97M	0.83M	0.71M	0.60M	0.50M

The residual waste quantities under the BAU and BE scenarios are slightly reduced compared to Figure 8, as only a small proportion of C&D waste enters the residual waste stream, due to the high recycling rates already achieved. The main difference occurs within the MT scenario, as a higher quantity of household and C&I waste is required to be diverted to meet Scotland's performance targets. This results in a much sharper decline in the residual waste quantities under this scenario. Whilst this scenario is similar to the previous work undertaken for CXC, the final residual waste quantities vary due to the different growth factors applied.

2.5.7 Materials Included within the Landfill Ban

The materials included within the scope of the landfill ban are detailed in Appendix 2. These inclusions were determined in conjunction with SEPA and the Scottish Government.

2.5.8 Waste Composition

Similar to the waste arising changes and diversion changes mentioned above, it is almost certain that the composition of the waste streams being examined will change between now and 2050. Ricardo explored options to examine waste composition changes based on foreseeable trends, however there is minimal data available. Where Ricardo has previously modelled potential future waste composition changes, this has been primarily focussed upon England. Due to this lack of an available robust evidence base for Scotland, in the modelling a constant waste composition has been assumed. Ricardo acknowledges that this is not ideal and recommends further investigation, such as sensitivity analysis on the residual waste composition is undertaken to examine the shape of potential future composition changes such as the impacts of a deposit return scheme for example.

2.6 Infrastructure Assumptions

In addition to quantifying the potential future waste tonnages under the different scenarios, an equally important task was to establish the available infrastructure treatment capacity now and, in the future, to treat residual waste. When overlaid with the waste quantities this allowed for analysis to determine whether a capacity gap might exist now, in the future, and the scale of the capacity gap.

2.6.1 Operational Facilities

Currently operational facilities were determined through discussions with the Scottish Government and information submitted through the call for evidence. In total eight operational facilities were included within the analysis with a modelled capacity of approximately 1Mt as shown in Table 6.

Table 6: Operational Facilities

Facility Name	Technology Type	Modelled Capacity	Operational Date
DERL (MVV Baldovie)	EfW	92,000	1994
Moleigh	Composting / MBT	3,000	1998
Lerwick	EfW	23,000	2000
Dalinlongart Compost	Composting / MBT	13,000	2001

Facility Name	Technology Type	Modelled Capacity	Operational Date
Lingerton Compost	Composting / MBT	24,000	2001
Eco Deco Dumfries	MBT	15,300	2006
Levenseat	MRF and ATT	160,000	2018
GRREC	MBT and ATT	120,000	2019
Millerhill	EfW	155,000	2019
Dunbar ERF*	EfW	310,000	2019
Dundee ERF	EfW	110,000	2021

* The operator is looking to potentially expand the facility's capacity, but due to a lack of specific information, this has not been taken into account.

The modelled capacity was derived through evidence submitted through the call for evidence and compared to waste returns data. However, direct comparison to waste returns data is not necessarily robust, as this is the quantity of waste received at a facility and does not always reflect the tonnage processed through a facility. Waste returns data for the facilities which became operational around 2019, which is the year of most recent data, may not be truly representative of capacity if they were not operational for the full year, or if they were ramping up to full operational throughput.

This cross referencing was in undertaken in an endeavour to model the true treatment capacity for each facility, as opposed to the facility's consented capacity. This is because the consented capacity is often higher to allow for operational flexibility and might not be a true reflection of the technical capacity of each facility. More detail can be found in Appendix 3.

For each operational facility, lifespan assumptions were applied to estimate when the facility might decommission and close. The expected lifespan assumptions for each facility type are outlined below and more detail, including the assumed closure date are shown in Appendix 3:

- ATT: 20 years
- EfW: 40 years
- MBT: 30 years

Regarding the provided MBT capacity within Table 6, MBT is not a final treatment destination and waste effectively passes through the facility, with a reduction expected due to moisture loss and the extraction of some recyclables. To not overestimate the treatment capacity, the modelled capacity provided contains the expected waste reductions at each facility. This has been based upon Tolvik's[15] analysis and Ricardo's own experience of MBT facilities, crossed referenced with information submitted during the call for evidence. This has also been factored into the two operational ATT facilities at GRREC and Levenseat where there are pre-treatment operations prior to the pre-treated waste entering the gasification processes.

[15] Tolvik (2017) Briefing Report: Mechanical Biological Treatment – 15 years of UK Experience. Available at: Tolvik Consulting Report Webpage (Accessed 9 March 2022)

Regarding the composting / MBT facilities of Moleigh, Dalinlongart and Lingerton. Ricardo has some reservations as to whether these facilities are actually MBT technologies. The facilities do not appear to involve sequential and combined mechanical and biological processes treating one input waste, but instead appear to involve standalone processes treating separate input wastes. The sites are also home to other waste activities (e.g., civic amenity, transfer etc.) and it is unclear, from the site returns data, what waste data applies to each treatment activity. The analysis, therefore, compared the site's waste inputs and outputs to quantify what is potentially being treated at each site. Although these facilities are of modest capacity, it is nonetheless recommended that they are investigated further to understand the role (in terms of treatment capacity) that they play in managing Scotland's waste.

2.6.2 Pipeline Facilities

Pipeline facilities were again determined through discussions with the Scottish Government and information submitted through the call for evidence. In total 12 pipeline facilities have been considered, which are at different stages of development. These facilities are shown in Table 7.

Table 7: Pipeline facilities

Facility Name	Technology Type	Modelled Capacity (tpa)	Status	Assumed Operational Date
Earls Gate	EfW	201,000	In Construction	2023
Aberdeen Recycling & Energy Recovery (NESS)	EfW	127,500	In Construction	2022
Westfield	EfW	212,500	In Construction	2025
Glenfarg (Binn Group)	EfW	71,400	Planning Granted	2025
Oldhall (Dover Yard)	EfW	153,000	Fully Consented*	2026
South Clyde (Fortum)	EfW	299,200	Fully Consented	2026
Drumgray (FCC)	EfW	255,000	Fully Consented	2026
Avondale MRF/MBT	MRF / MBT	60,000**	Fully Consented	2026
Inverurie (Agile Energy)	EfW	170,000	Planning Granted	2027
Avondale EfW	EfW	127,500	Planning Granted	2027

Facility Name	Technology Type	Modelled Capacity (tpa)	Status	Assumed Operational Date
Levenseat 2	EfW	267,800	Planning Granted	2027
Killoch EfW	EfW**	141,100	Proposed	2027

* Understood that the facility has not yet received a permit but listed as fully consented due to reaching financial close

** Modelled capacity takes into account the expected pre-treatment and waste reduction from the consented capacity (200 ktpa)

*** Understood that the facility has a current consent for an ATT facility and is looking to change this to conventional incineration technology.

The modelled capacity within Table 7 was taken from the facilities' stated capacities when applying for planning and/or permit consent. This was then cross referenced with information submitted during the call for evidence. An 85% weighting was then applied to factor in the operational capacity of each facility. This was based upon information submitted through the call for evidence and regarded as a reasonable assumption, as a wide range of different factors and assumptions were provided (see Section 2.6.3).

To factor in pipeline infrastructure becoming operational midway through a given year and also expecting a ramp-up to full commercial operations, the first operational year for each facility was set at 50% capacity and then 100% for the following and subsequent years.

An assumed operational date was then applied to each facility, to model the expected date of commercial operation. This was taken from developer websites and Ricardo's understanding of waste infrastructure development, such as the average time taken in the planning and construction phases in addition to information submitted during the call for evidence. Estimating future operational dates is difficult and can vary depending upon a wide range of certain factors such as unexpected delays within the construction process or prolonged planning determination processes. This is an important factor to understand in the context of this report, because if a facility comes online or closes early, the infrastructure and treatment capacity landscape within Scotland would change.

For facilities where it was not possible to identify the date of commencement of commercial operations through research, the assumptions in Table 8 were used to estimate the date of commencement.

Table 8: Pipeline facilities: years at each stage

Technology	Proposed	Planning	Consented	Permitted	Constructing	Commissioning
EfW	3	2	1	1.5	2	0.5

Ricardo has endeavoured to provide the latest and most complete information to the Scottish Government. The information outlined does not show any preference with regard to which individual facilities should be built.

To provide a sensitivity around the development of pipeline infrastructure, a probability weighting was applied to those in the earlier stages of development. This is to consider the possibility that not all of the infrastructure will proceed to commercial operations, which could be due to a number of factors. The probability weightings applied to each stage is summarised in Table 9.

Table 9: Pipeline facilities: probability weightings based on development stage

Proposed	In Planning	Planning Consent Granted	Planning and Permit Granted (Fully Consented)	In Construction	In Commissioning
15%	25%	60%	65%	100%	100%

2.6.3 Capacity Comparisons

During the call for evidence a range of capacities were provided for different EfW facilities and different assumptions were made for pipeline infrastructure capacity. Within Appendix 4, Ricardo considered the lowest and highest capacity values for each facility and compared them to the capacity values included within this report.

The findings from this comparison indicate that for the operational facilities, the total difference when compared to Ricardo's analysis was approximately:

- 140kt when considering the lowest values submitted during the call for evidence.
- 42kt when considering the highest values submitted during the call for evidence.

It was not possible to compare pipeline facilities on a like for like basis with information submitted during the call for evidence. This is due to some responses only including pipeline facilities up to 2025. However, a range of different figures were provided for the capacity estimates of facilities, compared to consented capacities within responses to the call for evidence. Ricardo's modelled weighting of 85% against a facilities consented capacity broadly sits within the middle of the estimates provided. As a direct comparison is not possible, Ricardo has compared this 85% figure to weightings of 80% and 90%. This takes into account the wide range of capacities provided and results in a capacity difference with a range of approximately 119kt.

When further compared against the total consented capacity, as outlined within a facility's planning and/or permit (outlined in Appendix 4) the difference compared to Ricardo's 85% weighting equates to approximately 498kt. However, as outlined within this report and evidence submitted through the call for evidence, it is unlikely that facilities will operate to their exact consented capacity.

Therefore, these comparisons around available infrastructure capacity should be considered against the findings presented in the capacity analysis results in Section 3.

Ricardo has not undertaken any comparison or sensitivity analysis of the early closure of operational facilities or the early or delayed opening of pipeline infrastructure. Although this report has endeavoured to provide a realistic assessment, it is difficult to predict such future situations. The capacity analysis assessment provided within this report should be reviewed with consideration of the inherent limitations that arise from making assumptions for future situations.

2.6.4 Infrastructure Modelling Limitations

The following factors should be considered when reviewing the capacity analysis findings presented in this report:

- The modelling does not fully take into account the estimated operational hours of each individual facility. As facilities will undergo maintenance and experience periods of planned and potentially unplanned downtime, particularly as facilities age. This should again be considered within the interpretation of the capacity analysis findings.
- Future changes in waste composition may alter the calorific value (CV) of the residual waste which can impact on a facility's throughput and subsequent treatment capacity.
- The operational and pipeline facilities are assumed to manage waste from Scotland. The analysis does not consider any waste being imported to Scotland for treatment and the impact of this on available treatment capacity.

3. Capacity Analysis Results

3.1 Overview

The capacity analysis results are shown in Figure 10 and includes the full pipeline capacity. Figure 10 shows the weighted pipeline capacity in the event that not all of the pipeline facilities progress, based on the probability weightings in Table 9.

The future waste quantities are shown for each of the modelled scenarios and projected forwards to 2050. These are the same for both scenarios and are shown by the different coloured lines:

- Business as usual – **blue line**
- Best efforts – **green line**
- Meeting targets – **red line**

The infrastructure capacity is then shown in the stacked line columns. At the bottom of each column is the operational MBT, ATT and EfW capacity. Over the projected period, some of these capacities decrease as infrastructure is anticipated to close under the infrastructure assumptions. Pipeline infrastructure is then outlined by the current development stages (i.e., those within construction, planning etc.) and each facility's estimated operational commencement date based upon the assumptions provided.

Where there is a gap above the stacked column to the line indicating the waste quantities, this indicates a capacity gap (i.e., where there is not sufficient treatment infrastructure to manage the waste quantities). Where the line of waste quantities intercepts the stacked column, this indicates potential over-supply (i.e., where there is surplus treatment capacity for the modelled waste quantities).

Figure 12 shows the full pipeline capacity with C&D waste excluded. Figure 13 shows the weighted pipeline capacity in the event that not all of the pipeline facilities progress, based upon the probability weightings set out in Table 9.

Figure 10: Capacity Analysis Results (all scenarios and full pipeline)

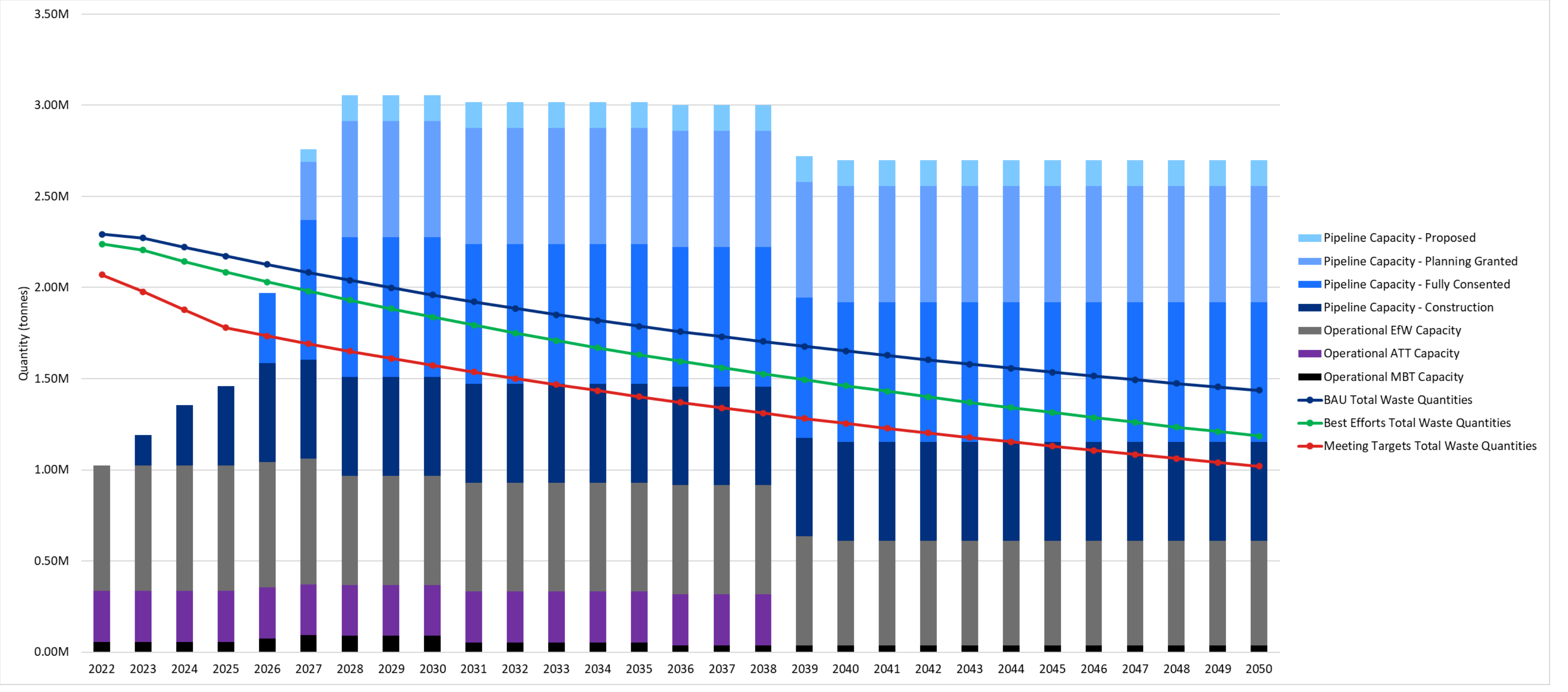


Figure 11: Capacity Analysis Results (all scenarios and weighted pipeline)

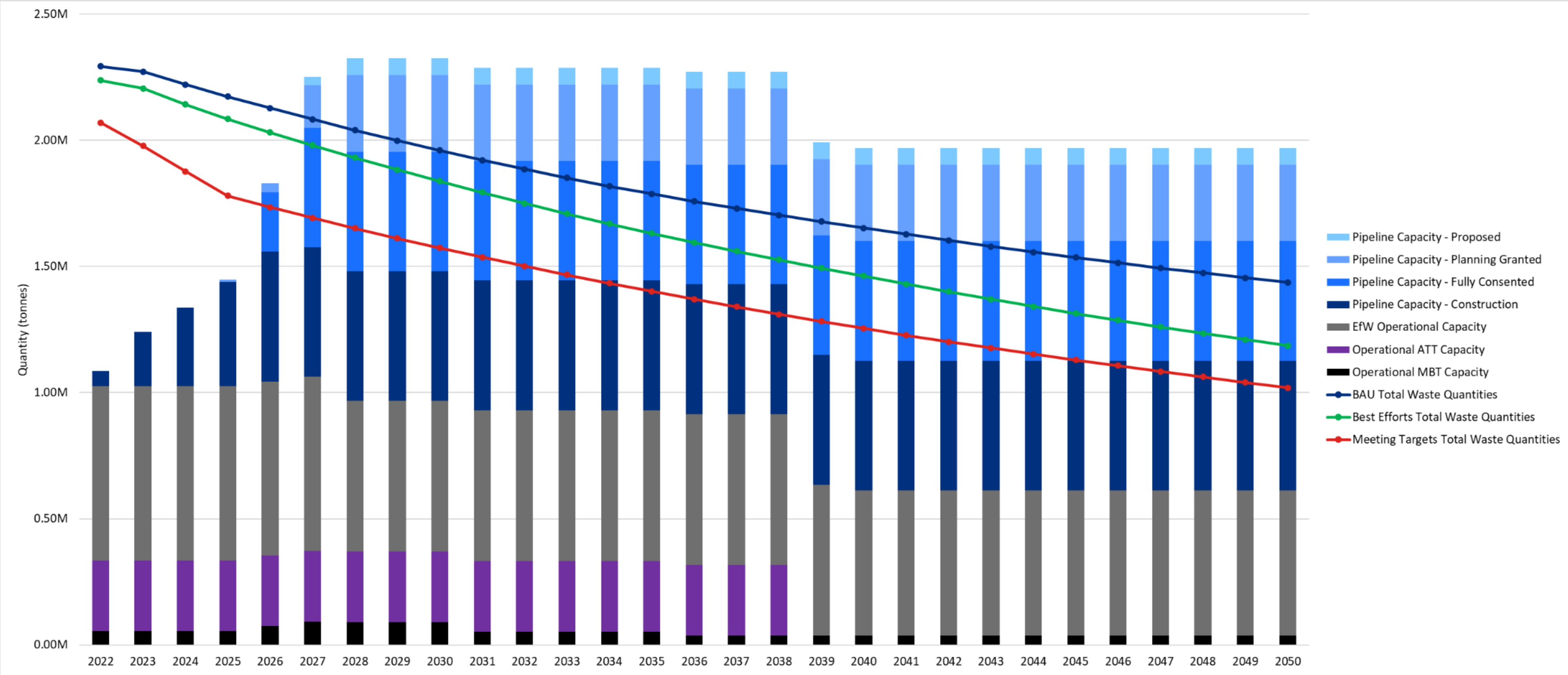


Figure 12: Capacity Analysis Results (all scenarios and full pipeline) Excluding C&D Waste

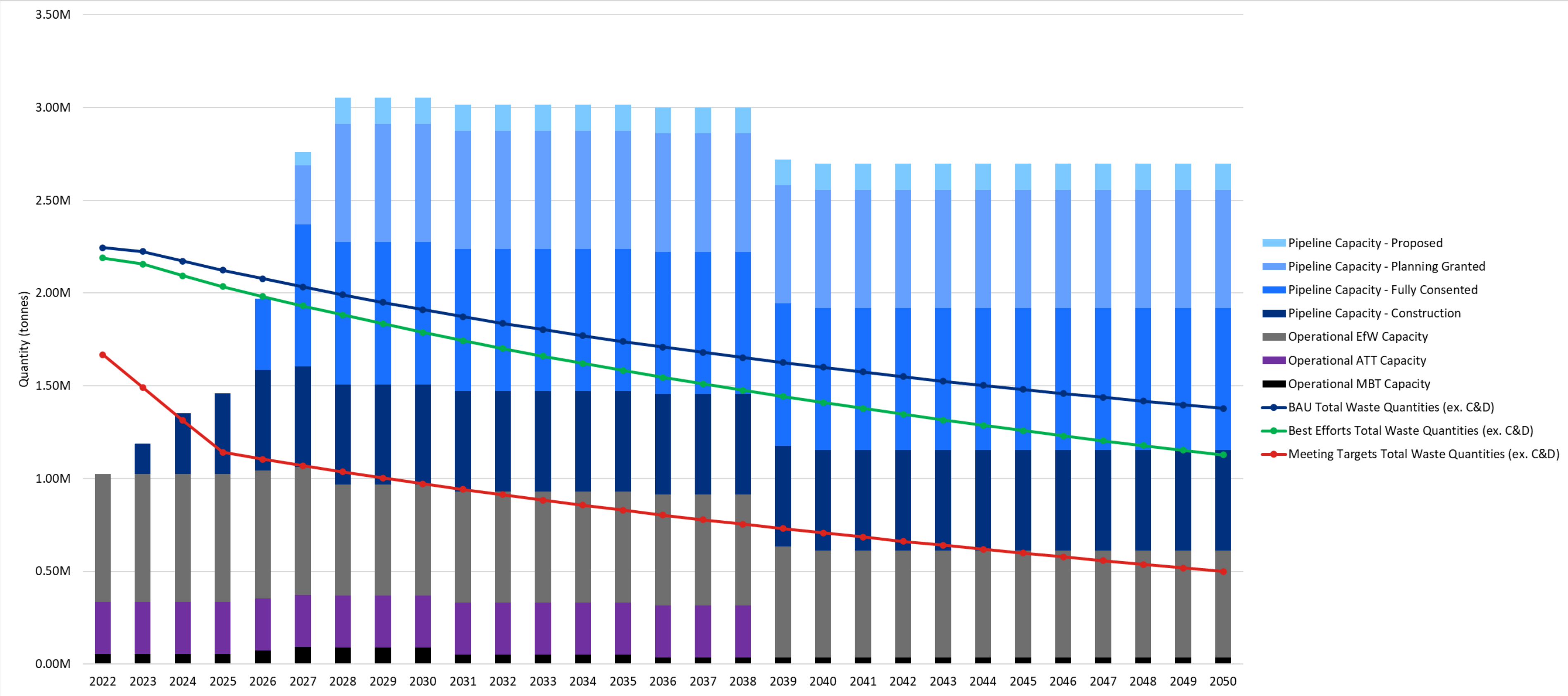
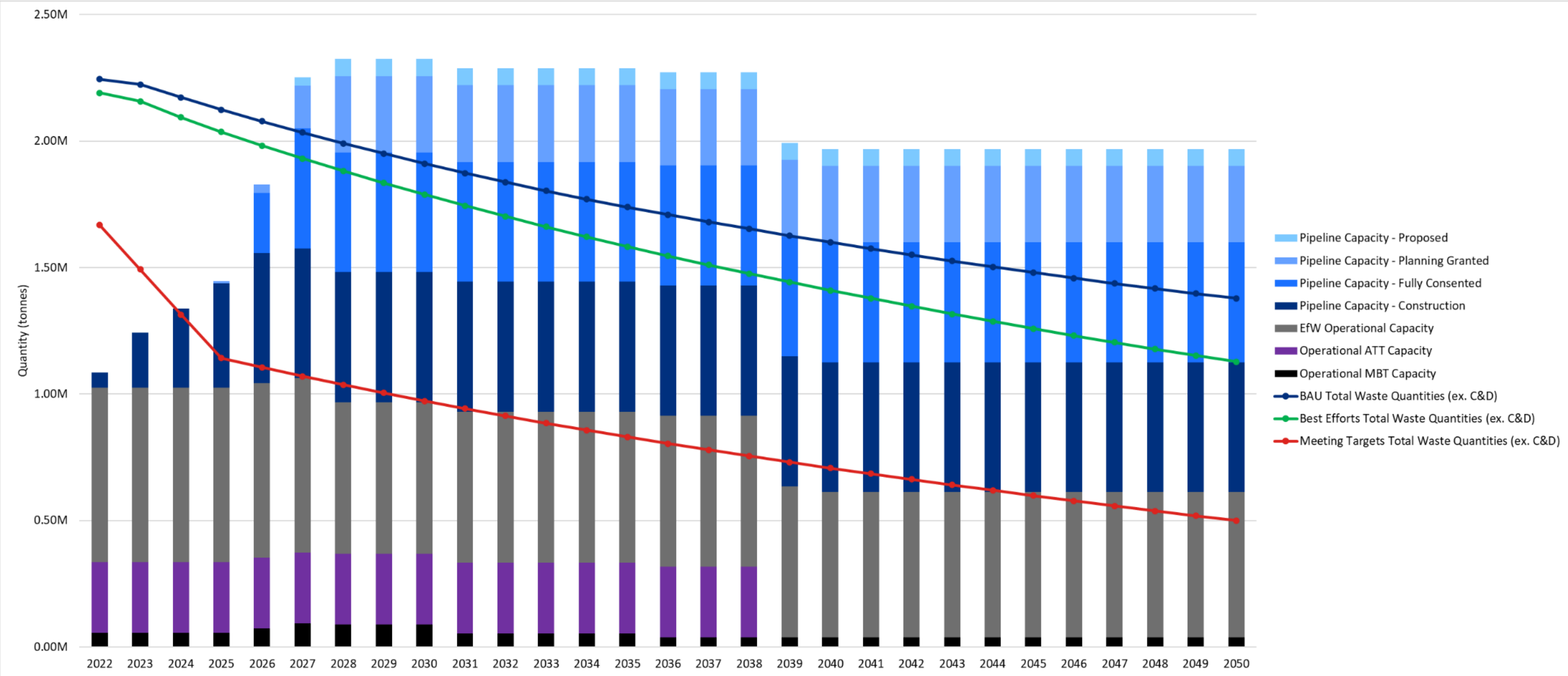


Figure 13: Capacity Analysis Results (all scenarios and weighted pipeline) Excluding C&D Waste



3.2 Capacity Analysis Findings – Full Pipeline

Figure 10 illustrates the capacity projections with the full infrastructure pipeline, which indicates that:

- A capacity gap exists up to 2025 across all future waste projections (Table 10).
- In 2026, there is the potential for a slight over capacity, should Scotland meet its policy targets and if all pipeline facilities become operational by this time.
- In 2027 across all future waste projections there is an estimated over-capacity as additional pipeline infrastructure is anticipated to make it through to commercial operations as per the modelled assumptions.
- As the residual waste quantities are expected to decline under each future projection, the infrastructure capacity requirements are also reduced. There is a noticeable drop in the current operational facilities column as some of these facilities are estimated to close, notably in 2028 and 2039.
- Under all the future waste projections, facilities currently with a status of planning granted and propsoed would not be required to handle any of the estimated residual waste quantities. This is of course entirely dependent upon all the infrastructure within the categories of construction and fully consented being built or whether facilities earlier in the pipeline can be developed more quickly.

Table 10: Capacity Gap Summary (2022 – 2026)

Scenario	2022	2023	2024	2025	2026
BAU	1.21Mt	1.03Mt	0.88Mt	0.73Mt	0.32Mt
BE	1.15Mt	0.96Mt	0.81Mt	0.64Mt	0.22Mt
MT	0.98Mt	0.74Mt	0.54Mt	0.33Mt	n/a

3.3 Capacity Analysis Findings – Weighted Pipeline

Figure 11 illustrates the capacity projections multiplied with a probability weighting. Whilst each facility will either be operational or not (i.e., a binary option), this method of analysis applies a probability, or factor, to each facility's capacity based on the developmental stage it is in. This method of analysis can, therefore, be considered for illustrative purposes only, to show the potential impacts of various facilities not achieving full commercial operation. Figure 11 indicates that:

- A capacity gap is likely to exist under all future waste projections up to 2025.
- In 2026 a potential over-capacity is estimated if Scotland achieves all its waste targets and if the weighted capacity assumptions come to fruition.
- In 2027 there is a potential over capacity across all future waste projections. However, this is to a lesser extent when compared to the full pipeline, where facilities in the earlier stages of development (i.e., those with planning granted) would be required for the BAU projection.
- As residual waste quantities are estimated to decline, in 2039 under the BAU projection, infrastructure in the earlier stages of developed with planning granted

would be required. This is as anticipated operational infrastructure is estimated to close. This treatment capacity requirement would then reduce by 2043 as residual waste quantities are anticipated to reduce further.

3.4 Capacity Analysis Findings Excluding C&D Waste – Full Pipeline

Figure 12 illustrates the capacity projections with the full infrastructure pipeline and with C&D waste excluded, which indicates that:

- A capacity gap exists up to 2026 across the BAU and BE future waste projections (Table 101). Under the MT projection, a capacity gap would be expected in 2023 with slight over capacity in 2024 if Scotland meets its' policy targets and if the anticipated pipeline infrastructure becomes operational.
- In 2027 across all future waste projections there is an estimated over-capacity as additional pipeline infrastructure is anticipated to make it through to commercial operations as per the modelled assumptions.
- As the residual waste quantities are expected to decline under each future projection, the infrastructure capacity requirements are also reduced. There is a noticeable drop in the current operational facilities column as some of these facilities are estimated to close, notably in 2028 and 2039.
- Should Scotland meet its' policy targets in the MT projection, limited pipeline infrastructure would be required to manage the residual waste quantities (excluding C&D waste).
- Under all the future waste projections, facilities currently with a status of planning granted and proposed would not be required to handle any of the estimated residual waste quantities. This is of course entirely dependent upon all the infrastructure within the categories of construction and fully consented being built or whether facilities earlier in the pipeline can be developed more quickly.

Table 11: Capacity Gap Summary – C&D Waste Excluded (2022 – 2026)

Scenario	2022	2023	2024	2025	2026
BAU	1.16Mt	0.98Mt	0.84Mt	0.68Mt	0.27Mt
BE	1.10Mt	0.92Mt	0.76Mt	0.59Mt	0.17Mt
MT	0.58Mt	0.25Mt	n/a	n/a	n/a

3.5 Capacity Analysis Findings Excluding C&D Waste – Weighted Pipeline

Figure 13 illustrates the capacity projections multiplied with a probability weighting for the pipeline infrastructure and with C&D waste also excluded. As mentioned above, whilst each facility will either be operational or not (i.e., a binary option), this method of analysis applies a probability, or factor, to each facility's capacity based on the developmental stage it is in. This method of analysis can, therefore, be considered for illustrative purposes only, to show the potential impacts of various facilities not achieving full commercial operation. Figure 13 indicates that:

- A capacity gap still exists up to 2026 across the BAU and BE future waste projections. Under the MT projection, a capacity gap would be expected in 2023 with slight over capacity in 2024 if Scotland meets its' policy targets and if all the anticipated pipeline infrastructure becomes operational.
- In 2027 across all future waste projections there is an estimated over-capacity as additional pipeline infrastructure is anticipated to progress to commercial operations as per the modelled assumptions. However, this is to a lesser extent when compared to the full pipeline, where facilities in the earlier stages of development (i.e., those with planning granted) are potentially required for the BAU projection.

4. Conclusions And Recommendations

- The future residual waste quantities will ultimately determine the infrastructure capacity requirements. Therefore, close attention should be made to emerging waste data as it becomes available to track progress against the modelled future waste projections under the different scenarios.
- It is recommended that the Scottish Government continues dialogue with the operators of waste treatment infrastructure to understand the available treatment capacity at their facilities and the anticipated facility lifespan. In particular, further investigation into the three composting / MBT facilities highlighted within this report is recommended to fully establish the role they play in managing Scotland's residual waste.
- It is recommended that the Scottish Government liaise closely with developers of pipeline infrastructure. This is important as any changes in estimated residual waste quantities and changes in development timeframes can impact upon the analysis of future capacity requirements. Such liaison may prevent scenarios of under or surplus supply of treatment capacity.
- Further analysis is recommended to quantify the potential changes in waste composition to understand how this may look in the future and the subsequent impact on residual waste treatment. This is applicable to the quantities in terms of the capacity requirements for treatment and the technology solution.
- Consideration should be made for potential buffer capacity for scenarios such as any unexpected changes in waste arisings or in scenarios of planned and unplanned downtime at treatment infrastructure.
- The analysis has been focussed on the national level for Scotland and not at any regional scale or capacity. Therefore, as outlined in the call for evidence this would be a consideration in addition to the economics (and carbon emissions) of transporting waste from rural or isolated areas to the nearest treatment facility.
- The analysis assumes that the facilities identified will only manage waste quantities generated within Scotland. This high-level analysis does not quantify any waste tonnages being managed that are from England or other areas, and other waste types not included within the assessment such as small quantities of hazardous waste.

Appendices

Appendix 1 – Baseline Data

Appendix 2 – Materials in scope of the landfill ban

Appendix 3 – Operational Facilities

Appendix 4 – Capacity Comparison

Appendix 1 - Baseline Data

Baseline Data from SEPA and Zero Waste Scotland.

2018 Scottish Waste Handled, in Tonnes	C&I	C&I	C&I	C&D	C&D	C&D	HHW	HHW	HHW
Waste Fractions	**RRC**	**Recovered**	**Landfilled**	**RRC**	**Recovered**	**Landfilled**	**RRC**	**Recovered**	**Landfilled**
Spent solvents	0	0	0	0	0	0	0	0	0
Acid, alkaline or saline wastes	0	471	597	0	0	0	0	0	0
Used oils	0	0	0	0	0	0	643	0	0
Chemical wastes	0	9,417	0	0	0	0	846	69	6
Industrial effluent sludges	0	5,701	7,218	0	0	0	0	0	0
Sludges and liquid wastes from waste treatment	0	0	0	0	0	0	0	0	0
Health care and biological wastes	0	1,344	7,713	0	0	0	0	0	0
Metallic wastes, ferrous	64,350	687	4,885	137,799	1,471	10,461	11,188	0	0
Metallic wastes, non-ferrous	16,615	460	5,035	12,752	353	3,864	5,926	0	0
Metallic wastes, mixed ferrous and non-ferrous	125,950	0	0	38,094	0	0	45,143	1,219	4
Glass wastes	60,554	0	0	378	0	0	105,849	0	34
Paper and cardboard wastes	40,154	0	0	0	0	0	206,138	0	4,891
Rubber wastes	0	34,590	0	0	0	0	820	7	0
Plastic wastes	42,519	0	868	5,784	0	118	55,779	0	0
Wood wastes	6,245	81,243	0	2,089	27,179	0	93,525	6,265	5
Textile wastes	286	272	1,586	0	0	0	9,867	0	54

2018 Scottish Waste Handled, in Tonnes	C&I	C&I	C&I	C&D	C&D	C&D	HHW	HHW	HHW
Waste containing PCB	0	0	0	0	0	0	0	0	0
Discarded equipment (excluding discarded vehicles, batteries and accumulators wastes)	9,356	0	0	0	0	0	30,506	0	693
Discarded vehicles	38,129	0	0	0	0	0	358	0	0
Batteries and accumulators wastes	111	0	0	0	0	0	515	0	0
Animal and mixed food waste	329,538	0	0	0	0	0	89,894	371	1,707
Vegetal wastes	602,892	0	0	0	0	0	283,212	17,562	3,859
Animal faeces, urine and manure	30,527	72,838	0	0	0	0	0	0	0
Household and similar wastes	2,743	59,277	650,940	0	0	0	3,455	206,450	954,241
Mixed and undifferentiated materials	0	0	151,809	0	0	0	4,431	43,397	7,920
Sorting residues	0	566	1,727	0	0	0	0	0	0
Common sludges	172,984	21,455	2,748	0	0	0	0	0	0
Mineral waste from construction and demolition	212	0	0	1,196,119	0	0	85,744	0	98
Other mineral wastes	6,700	93	5,304	0	0	0	0	0	0
Combustion wastes	0	2,261	3,834	0	0	0	0	18,761	43,238
Soils	20,346	0	10,080	2,831,070	0	1,402,499	25,516	0	11
Dredging spoils	0	0	0	92,347	0	2,572	0	0	0
Mineral wastes from waste treatment and stabilised wastes	0	0	0	0	0	0	0	0	0

2018 Scottish Waste Handled, in Tonnes	C&I	C&I	C&I	C&D	C&D	C&D	HHW	HHW	HHW
Total	**1,570,213**	**290,674**	**854,343**	**4,316,433**	**29,002**	**1,419,514**	**1,059,354**	**294,101**	**1,016,761**

Appendix 2 - Materials within scope of the landfill ban

Materials within the scope of the landfill ban due to be implemented at the end of 2025.

Material	Household Waste		C&I Waste	
	BMW Landfill Ban	Extended BNMW Landfill Ban	BMW Landfill Ban	Extended BNMW Landfill Ban
Spent solvents		X		X
Acid, alkaline or saline wastes				
Used oils	X	X		X
Chemical wastes				
Industrial effluent sludges		X		X
Sludges and liquid wastes from waste treatment	X	X		X
Health care and biological wastes				
Metallic wastes, ferrous				
Metallic wastes, non-ferrous				
Metallic wastes, mixed ferrous and non-ferrous				
Glass wastes				
Paper and cardboard wastes	X	X	X	X
Rubber wastes				
Plastic wastes				

Material	Household Waste		C&I Waste	
	BMW Landfill Ban	Extended BNMW Landfill Ban	BMW Landfill Ban	Extended BNMW Landfill Ban
Wood wastes	X	X	X	X
Textile wastes	X	X	X	X
Waste containing PCB				
Discarded equipment (excluding discarded vehicles, batteries and accumulators wastes)				
Discarded vehicles				
Batteries and accumulators wastes				
Animal and mixed food waste	X	X	X	X
Vegetal wastes	X	X	X	X
Animal faeces, urine and manure	X	X	X	X
Household and similar wastes	X	X	X	X
Mixed and undifferentiated materials	X	X	X	X
Sorting residues	X	X	X	X
Common sludges	X	X		X
Mineral waste from construction and demolition				
Other mineral wastes				

Material	Household Waste		C&I Waste	
	BMW Landfill Ban	Extended BNMW Landfill Ban	BMW Landfill Ban	Extended BNMW Landfill Ban
Combustion wastes				
Soils				
Dredging spoils		X		X
Mineral wastes from waste treatment and stabilised wastes				

Appendix 3 – Waste Treatment Infrastructure

The table below expands upon the operational facilities included within the analysis in Section 2.6.1.

Modelled Capacity

This has been determined through information submitted through the call for evidence, cross referenced with site returns data from SEPA, taking an average value over the past five years. However, it is understood that waste being received onto site does not always equate to the tonnage processed and therefore this was compared for sensitivity to the information received during the call for evidence. Consideration was also given to facilities that had recently become operational. For example, the Dunbar ERF was modelled at a slightly higher capacity when compared to the data for 2019 as the facility only became operational at the start of the year and the data was unlikely to have factored in a full year of full throughput operations and, therefore, may not be truly representative. This consideration is also likely to apply to other facilities that became operational around 2018/2019.

Facility Lifespan

The assumed facility closure dates (no more waste receipt) are provided based upon the lifespan assumptions mentioned within Section 2.6.1. The DERL (MVV Baldovie) facility was adjusted to 2028, which is when the facility is reported to be planned for closure.

Facility Name	Technology Type	Modelled Capacity (tpa)	SEPA Annual Capacity (tpa)	Waste Returns Average (tpa, 2015 - 2019)	Operational Date	Assumed Closure Date
DERL (MVV Baldovie)	EfW	92,000	150,000	91,500	1994	2028
Moleigh	Composting / MBT	3,000	24,999	12,300	1998	2028
Lerwick	EfW	23,000	26,000	22,600	2000	2040
Dalinlongart Compost	Composting / MBT	13,000	20,515	16,000	2001	2031
Lingerton Compost	Composting / MBT	24,000	36,500	26,500	2001	2031
Eco Deco Dumfries	MBT	15,300*	70,000	51,100	2006	2036
Levenseat	MRF and ATT	160,000*	250,000 (MRF) and 130,000 (ATT)	77,000**	2018	2038

Facility Name	Technology Type	Modelled Capacity (tpa)	SEPA Annual Capacity (tpa)	Waste Returns Average (tpa, 2015 - 2019)	Operational Date	Assumed Closure Date
GRREC	MBT and ATT	120,000*	200,000	148,300**	2019	2039
Millerhill	EfW	155,000	189,500	142,500**	2019	2059
Dunbar ERF	EfW	310,000	325,000	262,100**	2019	2059
Dundee ERF	EfW	110,000	n/a	n/a	2021	2061

* Modelled capacity taking into account pre-treatment and waste reduction.
** Facility only recently became operational and therefore, waste return data is unlikely to be a true reflection of the treatment capacity.

The table below expands upon the pipeline facilities included within the analysis in Section 2.6.2. The assumed operational date is the year in which the facility is assumed to first receive waste and is modelled at 50% of the stated capacity for the first year as set out in the modelling assumptions.

Facility Name	Technology Type	Consented Capacity (tpa)	Modelled Capacity (tpa)*	Status	Assumed Operational Date
Earls Gate	EfW	236,500	201,000	In Construction	2023
Aberdeen Recycling & Energy Recovery (NESS)	EfW	150,000	127,500	In Construction	2022
Westfield	EfW	250,000	212,500	In Construction	2025
Glenfarg (Binn Group)	EfW	84,000	71,400	Planning Granted	2025
Oldhall (Dover Yard)	EfW	180,000	153,000	Fully Consented*	2026
South Clyde (Fortum)	EfW	352,000	299,200	Fully Consented	2026
Drumgray (FCC)	EfW	300,000	255,000	Fully Consented	2026
Avondale MRF/MBT	MRF / MBT	200,000	60,000**	Fully Consented	2026
Inverurie (Agile Energy)	EfW	200,000	170,000	Planning Granted	2027

Facility Name	Technology Type	Consented Capacity (tpa)	Modelled Capacity (tpa)*	Status	Assumed Operational Date
Avondale EfW	EfW	150,000	127,500	Planning Granted	2027
Killoch EfW	EfW	166,000	141,100	Planning Granted	2027
Levenseat 2	EfW	315,000	267,800	Planning Granted	2027

* Modelled capacity is an 85% weighting to the consented capacity.

** Factoring in anticipated waste reduction at the facility as this will not be a final treatment solution.

Appendix 4 – Capacity Comparison

The table below outlines the modelled capacity within this report for the operational facilities compared to the lowest and highest capacity details provided within responses to the call for evidence.

Facility	Ricardo Modelled Capacity	Lowest Capacity	Highest Capacity
DERL (MVV Baldovie)	92,000	85,500	92,000
Moleigh	3,000	3,000	5,400
Lerwick	23,000	23,000	25,000
Dalinlongart Compost	13,000	3,000	13,000
Lingerton Compost	24,000	3,000	24,000
Eco Deco Dumfries	15,300	15,300	21,000
Levenseat	160,000	110,000	164,500
GRREC	120,000	115,200	142,500
Millerhill	155,000	147,250	160,000
Dunbar ERF	310,000	280,000	310,000
Dundee ERF	110,000	99,750	110,000
Total	**1,025,300**	**885,000**	**1,067,400**

The table below outlines the modelled capacity within this report for the pipeline facilities. A low (80%) and high (90%) comparison has then been applied against the consented capacity.

Facility	Consented Capacity	Ricardo Modelled Capacity (85%)	80% Comparison	90% Comparison
Earls Gate	236,500	201,000	189,200	212,850
Aberdeen Recycling & Energy Recovery (NESS)	150,000	127,500	120,000	135,000
Westfield	250,000	212,500	200,000	225,000
Glenfarg (Binn Group)	84,000	71,400	67,200	75,600
Oldhall (Dover Yard)	180,000	153,000	144,000	162,000
South Clyde (Fortum)	352,000	299,200	281,600	316,800
Drumgray (FCC)	300,000	255,000	240,000	270,000
Avondale MRF/MBT	200,000	60,000*	60,000*	60,000*

Facility	Consented Capacity	Ricardo Modelled Capacity (85%)	80% Comparison	90% Comparison
Inverurie (Agile Energy)	200,000	170,000	160,000	180,000
Avondale EfW	150,000	127,500	120,000	135,000
Levenseat 2	315,000	267,800	252,000	283,500
Killoch EfW	166,000	141,100	132,800	149,400
Total	**2,583,500**	**2,085,950**	**1,966,800**	**2,205,150**

* The same waste reduction factor has been applied across all three comparisons.

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