Technical report C

Waste and resource management assessment report

Cleanaway Operations Pty Ltd

Western Sydney Energy and Resource Recovery Centre

Waste and Resource Management Assessment Report

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Contents

Abbreviations and glossary

Abbreviations	Definition
BAT BREF	Best Available Techniques Reference Document 2019. The reference document for incineration technologies is referred to as BREF-WI.
C&I	Commercial and industrial waste
CT1/ CT2	Contaminant thresholds Used in the NSW Waste Classification Guidelines.
EfW	Energy from Waste EfW refers to the recovery of energy through the thermal treatment (combustion) of residual waste streams left over after recycling and resource recovery, significantly reducing the volume of waste being sent to landfill while generating baseload energy, part of which is categorised as renewable.
EC	European Commission Sets directives for all member states within the EU.
EPL	Environment protection licence Issued by the NSW EPA for waste facilities in New South Wales.
EU	European Union
FGT	Flue gas treatment
FGTr	Flue gas treatment residue
FOGO	Food and garden organics, collected separated for composting
HDPE	High density polyethylene A common rigid plastic which is a valuable, readily recyclable material.
HP	Hazardous properties Used within UK/EU waste classification guidelines
IED	Industrial Emissions Directive 2010/75/EU EU legislation controlling air emissions from industrial facilities, including waste incineration.
IBA	Incinerator bottom ash
L/S	Liquid:solid ratio Using in leachability testing for waste classification to determine whether heavy metals or other contaminant can leach into the environment.
MBT	Mechanical-biological treatment A waste technology for processing mixed waste to extract recyclable materials and process organics into MWOO for recovery. Also referred to as advanced waste treatment.
MJ	Megajoules A measure of energy
MSW	Municipal solid waste
MW	Megawatts energy output

Abbreviations	Definition
MWOO	Mixed waste organic outputs Organic material extracted from mixed waste and treated to stabilise and remove contaminants as far as possible.
NCV	Net calorific value
NSW EfW Policy	NSW Energy from Waste Policy Statement Establishes a framework and overarching criteria to guide proposals for thermal EfW infrastructure in New South Wales.
NSW EPA	NSW Environment Protection Agency
NSW POEO	Protection of the Environment Operations Act 1997
PCB	Polychlorinated biphenyl Contaminants of potential concern
PET	Polyethylene tetrapthalate A rigid plastic which is a valuable, readily recyclable material commonly used in packaging.
Proposal (the)	The purpose of the proposal is to build an energy-from-waste (EfW) facility that can generate up to 58MW gross of power by thermally treating up to 500,000tpa of residual municipal solid waste (MSW) and residual commercial and industrial (C&I) waste streams that would otherwise be sent to landfill.
PVC	Polyvinyl chloride A rigid plastic most commonly used in piping and construction applications and not suitable for energy recovery.
QA/QC	Quality assurance / quality control
RDF	Refuse-derived fuel The output of mixed waste processing to extract valuable recyclable materials and produce a fuel for combustion in other EfW facilities.
SCC	Specific contaminant concentration Used in the NSW Waste Classification Guidelines.
SEARs	Secretary's environmental assessment requirements
TCLP	Total contaminant leaching potential Used in the NSW Waste Classification Guidelines.
Tpa	Tonnes per year
UK	United Kingdom
WARR Strategy	NSW Waste Avoidance and Resource Recovery Strategy 2014–2021. Sets directions and targets for improving waste management, including increasing recycling and diverting waste from landfill.
WFD	Waste Framework Directive 2008/98/EC6 and amendment 2018/851 Legally binding European directive which sets out fundamental principles for waste management, and targets and requirements for resource recovery.
WSERRC	Western Sydney Energy and Resource Recovery Centre See **Proposal** or Section 1.3 for description.

1 Introduction

This section introduces the proposal and applicant and describes the purpose and structure of this report.

1.1 Document purpose

The purpose of this technical report is to assess the sourcing, handling and fate of wastes managed by the WSERRC proposal for compliance with relevant policies and regulations. This includes feedstocks proposed to be processed by the WSERRC facility and of waste residues from the energy recovery process.

The report does not assess flow-on risks or impacts of waste processing operations, as these are assessed within other technical specialist reports.

The information provided in this report enables assessment of the SEARs relating to waste management and appropriate application of energy from waste (EfW) technology.

The relevant SEARs presented in **Table 1** encompass three distinct aspects of the proposed WSERRC:

- Sourcing of waste feedstock which is appropriate within the current policy context
- Appropriate design and operation of the proposed facility to comply with waste reporting requirements
- Appropriate management of waste streams produced during the operation of the proposed facility.

Aspects of design and operations which prevent environmental harm or human health risks are assessed within other technical specialist reports and referenced in this report where relevant.

Conclusions on several key issues, including overall compliance with the NSW Energy from Waste Policy Statement, are presented in the EIS **Chapter 5 Energy from Waste.**

Figure 1 shows the relationship between this report and the overarching assessment of the proposal against the NSW Energy from Waste Policy Statement. It also indicates other sources of specialist technical input which are not provided within this report.

NSW EfW Policy Requirements	**Public consultation and the "good neighbour" principle** • Genuine consultation • Providing information • Controlling impacts	**Technical criteria** • Complete combustion • Air emissions • Monitoring and reporting	**Thermal efficiency** • Electricity • Heat	**Demonstrating best practice** • Process design and control • Emissions control • Receiving waste • Managing residues	**Resource recovery**
EIS Chapter 5: EfW Policy		Section 5.7: Reference facility emissions performance		Section 5.6: Reference facility summary Section 5.8: Management approach for process residues	Section 5.4: WSERRC Feedstock strategy Section 5.3 Policy context for resource recovery
Related EIS chapters providing further detail	Chapter 8 Air quality and odour Chapter 15 Traffic and transport Chapter 16 Visual Chapter 17 Social Chapter 6 Engagement	Chapter 3 Proposal description		Chapter 14 Hazard and risk	Chapter 2 Strategic context
Described in this report				Section 5: Residues from thermal treatment Section 3.8: Excluding inappropriate waste	Section 2: Strategy and policy settings Section 3: Waste feedstock assessment
Described in other specialist technical reports	Technical Report A: Air quality and odour assessment report Appendix F: Community and stakeholder engagement assessment		Technical Report D: Best available techniques assessment report	Technical Report D: Best available techniques assessment report	Technical Report E: Waste flow analysis for greater Sydney

Figure 1: Role of this technical report and other reports in assessing the WSERRC proposal against the NSW Energy from Waste Policy Statement requirements

1.2 Environmental assessment requirements

Table 1 lists the Secretary's environmental assessment requirements (SEARs) which are addressed within this technical report. Appendix A: SEARs checklist provides a full table identifying where all SEARs have been addressed throughout the EIS and supporting reports.

Table 1: Secretary's environmental assessment requirements (SEARs) addressed in this chapter

Assessment requirements	Reference in EIS and technical reports
Department of Planning and Environments Environmental Assessment Requirements section 4.12(8) of the Environmental Planning and Assessment Act 1979, Schedule 2 of the Environmental Planning and Assessment Regulation 2000	
Addressing the relevant provisions in, and consistency with, the following state and international waste legislation and policy: • NSW Energy from Waste Policy Statement (EPA 2015) • *NSW Protection of the Environment Operations (Waste) Regulations 2014* • NSW Waste Avoidance and Resource Recovery Strategy 2014–2021 • NSW Waste Classification Guidelines • NSW Waste Levy Guidelines (EPA 2018) • European IPPC Bureau Industrial Emissions Directive and BAT (Best Available Techniques) Reference Document (BREF) BREF 2019.	Chapter 4 Statutory context Chapter 8 Air quality and odour Section 2 of Chapter 5 EfW policy Section 2, Section 3.7 and Section 4.2 of Technical report C Waste and Resource Management Assessment Technical report D Best Available Techniques Assessment
Details and a description of the sources, classes, quantities and composition of waste streams that would be thermally treated at the facility	Section 3 of Technical report C Waste and Resource Management Assessment
Demonstrate that waste used as a feedstock in the facility would be the residual from a resource recovery process that maximises the recovery of material in accordance with Environment Protection Authority guidelines and NSW Energy from Waste Policy Statement (2015).	Section 3 of Technical report C Waste and Resource Management Assessment Section 4 of Chapter 5 EfW policy
A detailed description of waste processing procedures for each waste type received at the premises, including the types of pollution which may result from the storage and processing of that waste, mitigation measures for managing any such impacts and contingency measures that would be implemented if inappropriate materials are identified.	Chapter 3 Proposal description Section 3.8 of Technical report C Waste and Resource Management Assessment

Assessment requirements	Reference in EIS and technical reports
Details of how the EPA's record-keeping and reporting requirements will be met	Section 4.2 of Technical report C Waste and Resource Management Assessment
A list and description, including quantities, composition and classification of waste material produced (solid, liquid and gaseous) from the facility, including details of proposed management and disposal of those waste materials	Table 2 of Chapter 10 Waste management Section 8 of Chapter 5 EfW policy Section 5 of Technical report C Waste and Resource Management Assessment
Demonstrate that any waste material produced from the energy from waste facility for land application is fit-for-purpose and poses minimal risk of harm to the environment in order to meet the requirements for consideration of a resource recovery exemption by the Environment Protection Authority.	Section 5.1 of Technical report C Waste and Resource Management Assessment
Identify the measures that would be implemented to ensure that the development is consistent with the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Strategy 2014–2021.	Chapter 2 Strategic context Section 4 of Chapter 5 EfW policy Section 3.2–3.5 of Technical report C Waste and Resource Management Assessment
Blacktown City Council submission to SEARs request for SSD 10395	
Identify, quantify and classify the likely waste streams to be generated and used as source material and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste. Identify appropriate servicing arrangements, including but not limited to waste management, loading zones and mechanical plant for the site.	Section 3 of Technical report C Waste and Resource Management Assessment Section 4 of Chapter 5 EfW policy
Waste management details should include: • A description of the classes and quantities of waste that would be thermally treated at the facility	Chapter 3 Proposal description Section 3 of Technical report C Waste and Resource Management Assessment
• Demonstrate that waste used as feedstock in the plant would be residual waste from a resource recovery process that maximises the recovery of material in accordance with the NSW Energy from Waste policy statement.	Section 3 of Technical report C Waste and Resource Management Assessment Section 4 of Chapter 5 EfW policy
• Procedures that would be implemented to control the inputs to the plant, including contingency measures that would be implemented if inappropriate materials are detected	Chapter 3 Proposal description Section 3.8 of Technical report C Waste and Resource Management Assessment

Assessment requirements	Reference in EIS and technical reports
• An outline as to how foreign objects will be excluded from the waste stream to prevent the need for an abnormal operation allowance that can have an impact on meeting emission criteria	Chapter 3 Proposal description Section 3.8 and 3.9 of Technical report C Waste and Resource Management Assessment
• Details about the location and size of stockpiles of unprocessed and processed recycled waste at the site	Chapter 3 Proposal description
• Demonstrate that any waste material produced from the facility for land application is fit-for-purpose and poses minimal risk of harm to the environment in order to meet the requirements for consideration of a resource recovery exemption by the EPA under Clause 51A of the *Protection of the Environment Operations (Waste) Regulation 2005.*	Section 5.1 of Technical report C Waste and Resource Management Assessment Section 8 of Chapter 5 EfW policy
• Identify the measures that would be implemented to ensure that the development is consistent with the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Strategy 2014–2021.	Chapter 2 Strategic context Section 4 of Chapter 5 EfW policy Section 3.2–3.5 of Technical report C Waste and Resource Management Assessment
• Outline how the resource recovery criteria for mixed wastes as outlined in the NSW Energy from Waste Policy Statement will be achieved.	Section 3 of Technical report C Waste and Resource Management Assessment Section 4 of Chapter 5 EfW policy
EPA recommendations for SEARs for the Western Sydney Energy and Resource Recovery Centre (SSD 10395)	
Demonstrate that the waste used as feedstock in the waste to energy plant would be the residual from a resource recovery process that maximises the recovery of material in accordance with the EPA's NSW Energy from Waste Policy Statement.	Section 3 of Technical report C Waste and Resource Management Assessment Section 4 of Chapter 5 EfW policy
Describe the classes and quantities of waste that would be thermally treated at the facility, including proposed sources, quantities, composition and classes of waste with reference to the data sets relied upon in making these determinations. Note, all waste must be classified in accordance with the EPA's Waste Classification Guidelines.	Section 3 of Technical report C Waste and Resource Management Assessment
Describe the procedures that would be implemented to control the residual waste inputs to the plant, including contingency measures that would be implemented if inappropriate materials are identified.	Chapter 3 Proposal description Section 3.8 of Technical report C Waste and Resource Management Assessment

Assessment requirements	Reference in EIS and technical reports
Detail how the proponent will meet the EPA's record keeping and reporting requirements, including weighing material in and out of the premises (refer to the EPA's Waste Levy Guidelines for more information – available at http://www.epa.nsw.gov.au/your-environment/waste/waste-levy).	Section 4.2 of Technical report C Waste and Resource Management Assessment
Include a list and description, including quantities, of the types of materials (solid liquid and gaseous) or finished products (if any) to be produced and their intended fate.	Chapter 3 Proposal description Table 2 of Chapter 10 Waste management Section 8 of Chapter 5 EfW policy Section 5 of Technical report C Waste and Resource Management Assessment
Describe the procedures to be implemented for the management of all waste materials produced from the waste to energy facility (solid liquid and gaseous).	Table 2 of Chapter 10 Waste management Section 5 of Technical report C Waste and Resource Management Assessment
Include details of all procedures and protocols to be implemented to ensure that any waste accepted to and leaving from the site is transported and disposed of lawfully and does not pose a risk to human health or the environment.	Section 1.3 and 1.4 of Chapter 10 Waste management Section 3.8 of Technical report C Waste and Resource Management Assessment Section 8 of Chapter 5 EfW policy
Demonstrate that any waste material produced from the energy from waste facility for land application is fit-for-purpose and poses minimal risk of harm to the environment in order to meet the requirements for consideration of a resource recovery order and/or exemption by the EPA under Clause 91 of the *Protection of the Environment Operations (Waste) Regulation 2014.* The EIS should list each intended order and exemption by name and set out details as to how the proponent will meet each of these.	Section 5.1 of Technical report C Waste and resource management assessment
NSW Health SEARs	
Include a detailed description of the process of waste classification and onsite management of waste feedstock (including out of specification waste) entering the plant to ensure that the actual feedstock consistently meets the predicted feedstock on which the air quality modelling and the health risk assessment have been based.	Section 7 of Chapter 5 EfW policy Section 3 of Technical report C Waste and Resource Management Assessment Chapter 8 Air quality and odour

1.3 Proposal description

The proposed Western Sydney Energy and Resource Recovery Centre (WSERRC) (the proposal) is an energy from waste (EfW) facility that would thermally treat up to 500,000tpa of residual Municipal Solid Waste (MSW) and residual Commercial and Industrial (C&I) waste streams that would otherwise be sent to landfill. This process is designed to generate 191MW of thermal power, which is converted to 58MW gross of baseload electricity. Some of this energy would be used to power the facility itself, while the majority would be exported to the electricity grid. There is also the potential for the proposal to provide an industrial heat supply to nearby facilities. Diverting waste which would otherwise have been landfilled preserves landfill space for the future, avoids greenhouse gas emissions from decomposition of organic waste in landfill and reduces waste transport distances.

The waste feedstock will be sourced from multiple councils and businesses in the greater Sydney area, through Cleanaway's existing waste collection network, contracts with other waste collection service providers and contracts with councils. Cleanaway will seek contracts with councils and businesses which have at-source systems to separate material for high-quality recycling and will continue education and engagement efforts to increase the uptake of source-separation. Waste feedstock collected from councils without a three-bin food and garden organics (FOGO) collection service and businesses without adequate source separation of recyclable material will be pre-sorted. The pre-sorting would be in line with best practice recovery performance and it is likely to be undertaken at Cleanaway's Erskine Park Waste Transfer Station which will likely trigger the need to increase the approved capacity at this facility (or other similar facilities).

Expansion of this facility to support the WSERRC proposal will be undertaken as a related development.

Pre-sorting will use best-practice technology to recover valuable materials from mixed waste and expects to achieve about 5% recovery. The pre-sorting process will focus on extracting saleable materials for recycling, primarily metals and some hard plastics (PET, PP, HDPE). Other materials such as plastics and paper and card that are mixed with organic waste are too contaminated to have any value in current recycling markets and will form part of the feedstock for energy recovery. Adoption of source separation for recyclable materials, including organics, complemented by energy recovery for residual waste is a waste management approach which offers excellent landfill diversion rates and is the preferred waste management system for the proposal.

The proposal will use established and proven EfW technology. Moving grate technology has been chosen as the means to thermally treat incoming waste to recover energy, and advanced flue gas treatment technology would be implemented to clean the air to stringent emission standards and meet current international best practice techniques.

Moving grate technology is an established and proven EfW technology, with over 2,000 operational examples globally, with many of these examples located in densely populated urban areas. There are roughly 500 operational examples across Europe using similar technology being proposed for the WSERRC.

Advanced flue gas treatment (FGT) technology will be used to clean the flue gas, performing well below both the NSW POEO air emissions standards and European Best Practice standards for emissions control. To future proof the facility against more stringent standards in the future, the proposal will utilise a wet scrubber which is a rigorous flue gas treatment technology able to clean the flue gases to a level that surpasses current standards. The facility has also been designed in a way that allows components to be upgraded in response to advancements in EfW technology and equipment, meaning the facility will keep up with leading best practice.

The energy from waste process generates residues which will be managed offsite at appropriately licenced facilities to maximise recycling and enable treatment and safe disposal of non-recyclable residues. International best practice in mature markets such as the UK sees EfW facilities diverting 100% of incoming waste from landfill. Ultimately, this is the aim for WSERRC.

The proposal involves the building of all onsite infrastructure needed to support the facility including utilities, internal roads, weighbridges, parking and hardstand areas, stormwater infrastructure, fencing and landscaping. The site is located at 339 Wallgrove Road, Eastern Creek, in the Blacktown local government area and on the western part of the Western Sydney Parklands. The area immediately surrounding the site is characterised by industrial and transport infrastructure.

2 Strategy and policy settings

The role of EfW infrastructure within the broader waste and resource management network is governed primarily by state government approvals but is influenced by policy setting at all levels of government. Waste and resource recovery systems have experienced significant disruption in recent years, and the policy landscape is undergoing a period of significant change and renewal.

This section summarises key waste policies which are relevant to the WSERRC proposal and have influenced the development of the WSERRC feedstock strategy. Additional information of the policy context of the proposal, including policy considerations relating to land use and energy, is provided in EIS **Chapter 2 Strategic context.**

2.1 National policy context

The Australian Government has historically had limited involvement in regulating or influencing on waste and resource recovery issues, except on specific topics such as national product stewardship schemes and transboundary transport of waste with hazardous characteristics, which is regulated internationally under the Basel Convention and domestically under the National Environmental Protection (Movement of Controlled Waste between States and Territories) Measure.

However, the Australian Government's involvement in policymaking on waste issues increased significantly from 2018, in response to widespread media attention and concerns from industry and the community over issues such as ocean plastics and disruptions to recycling.

Relevant Australian Government announcements and directions include:

- 2018 announcement of 2025 National Packaging Targets to make all packaging reusable, recyclable or compostable and increase both recycling rates and use of recycled content in packaging
- 2019 announcement of an intended ban on export of waste materials, with phase in from 2020. The measure aims to increase domestic processing capability, jobs and resilience to international market disruptions
- 2018 update of the National Waste Policy, in partnership with state governments, and publication of a National Waste Policy Action Plan in 2019.

Under the National Waste Policy Action Plan, the Australian Government will take responsibility for leading actions related to:

- National specifications and standards for use of recycled construction materials and recycled organic products
- Legislative options to improve product stewards, consumer ‘right to repair’
- Collation, harmonisation and publication of waste and recycling data
- Identifying financial and other incentives to increase use of recycled materials and drive a transition to a circular economy
- Developing a national plastics plan
- Funding research into food waste and plastic
- Improving regulatory frameworks and reporting to manage environmental risks of chemicals and hazardous substances.

These national directions reflect the significant disruption to established recycling supply chains since 2018. Previously dominant recycling pathways including organic recovery from mixed waste and export of recyclable materials have become unavailable or unacceptable.

The drive to significantly increase domestic recycling and use of waste materials reflects a growing sense of responsibility for securing an environmentally sound fate for Australia’s waste.

Australia does not currently have the infrastructure and market outlets to immediately absorb and use mixed recyclable materials which were previously exported. The policy actions for the Australian Government demonstrate an understanding that fundamental changes to practices and business models for managing waste and raw materials use are needed to re-establish secure and responsible supply chains and realise economic opportunities in Australia.

Energy from waste technology can complement this broad direction for change by offering an onshore pathway to manage non-recyclable and challenging-to-recycle wastes and result in a better outcome for waste which would otherwise have been landfilled.

2.2 NSW context

2.2.1 NSW Energy from Waste Policy Statement

The NSW Energy from Waste Policy Statement (NSW EfW policy) was published in 2015. It establishes a framework and overarching criteria to guide proposals for thermal EfW infrastructure in New South Wales. The NSW EfW Policy recognises that energy recovery is a valid pathway for managing residual waste in circumstances where higher-order material recovery is not possible and community acceptance can be secured. It reflects the environmental and human health protection objectives of the *Protection of the Environment Operations Act 1997* and the resource management objectives of the *Waste Avoidance and Resource Recovery Act 2001.*

It aims to uphold the following key principles:

- Higher value resource recovery outcomes are maximised.
- Air quality and human health are protected.
- ‘Mass burn’ disposal outcomes are avoided.
- Scope is provided for industry innovation.

The NSW EfW policy sets requirements for a range of issues which are relevant to energy recovery proposals. There requirements have been a key consideration in the development of the WSERRC proposal, and as a result the proposal is fully compliant with the objectives of the NSW Energy from Waste Policy.

EIS **Chapter 5 Energy from Waste** assesses compliance with the requirements of the NSW EfW policy, and the conclusions are summarised in Table 1 of that chapter.

2.2.2 NSW EPA MWOO position statement

The NSW EPA position statement on land application of organic material from residual waste (mixed waste organic outputs or MWOO) is a key policy document which influences the broader infrastructure network for management and recovery of residual waste in New South Wales and has significant implication in the development of the WSERRC feedstock supply strategy.

Various councils and businesses within the Sydney basin currently direct red-bin residual waste to sorting facilities known as mechanical-biological treatment facilities (MBT) or advanced waste treatment. These facilities are designed to reduce landfilling by separating and recovering the organic fraction of the mixed waste and extracting and some recyclable materials. Organic material was composted to sterilise and stabilise it and reduce its volume through evaporation of moisture.

The resulting material was marketed as various products for application to land in accordance with the resource recovery order and exemption for MWOO. Markets included broadacre cropping, forestry plantations and mine sites undergoing rehabilitation. This was a significant and accepted pathway for residual waste recovery before 2018, with about 500,000tpa of operational processing capacity for mixed MSW from the Sydney basin.

However, in 2018 the NSW EPA revoked the resource recovery exemption order for MWOO for use on agricultural land and suspended its use for forestry or mine site rehabilitation purposes until further notice because more detailed scientific study determined that the risks of using organic material from residual waste on agricultural land outweigh the benefits.

It is impossible to completely remove all fragments of glass and plastic from the processed organic fraction of residual waste, so the recovered organic material remains partially contaminated. This was the primary concern highlighted by the NSW EPA in their decision to revoke the general Resource Recovery Order and Exemption for MWOO. Growing global concern with the environmental pollution, transport and impact of microplastics soils and water is likely to reinforce this position.

In 2019, the NSW EPA confirmed its position, announcing that it does not intend to grant any general exemptions or issue any resource recovery orders allowing MWOO to be used as a soil amendment in any context.[1] The NSW EPA reiterated its strong preference for source separation of organics, making reference to similar trends in European legislation. In May 2020, the NSW Government extended an exemption from the landfill levy for MWOO from existing facilities until May 2021[2], but no long-term solution for the use or repurposing of this infrastructure has been agreed.

Unless an alternative, commercially viable use for mixed waste organics can be identified, this effectively ends the role of mixed waste sorting for organics recovery in New South Wales. The metals and other low-quality, contaminated recyclables which can be extracted from mixed residual waste do not have sufficient value to support dedicated sorting facilities. Negotiations over the next phase of a transition package for existing infrastructure are ongoing. An additional 290,000tpa of MBT processing capacity has been approved between the Lucas Heights landfill and Woodlawn landfill sites but is now unlikely to be constructed.

[1] Available from: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/recycling/mwoo/19p1894-mwoo-position-statement.pdf?la=en&hash=17328331D0BAC93B8D801C37EFB88393578C3CB9
[2] NSW Government Gazette No. 90. Friday 1 May 2020, pages 1667–1668. Available at: https://gazette.legislation.nsw.gov.au/so/download.w3p?id=Gazette_2020_2020-90.pdf

Adoption of separate collection for food and garden organics is supported through grant funding under the Waste Less, Recycle More program to create new organics recovery infrastructure and collection. As a result, 43% of NSW local government areas now have a FOGO service. However, uptake has been highest in regional areas. Within the Sydney basin, only Penrith City Council currently provides a FOGO service. Most councils provide separate collection of garden waste, or are trialling one, with the notable exception of Fairfield and Blacktown. Organics recovery for mixed red-bin waste was seen as an effective alternative to a FOGO service. This is no longer the case, and councils will need to identify alternative resource recovery pathways at the expiry of their current contracts. Adoption of FOGO source separation complemented by energy recovery from residual waste is an option which would offer excellent landfill diversion rates.

2.2.3 Waste Avoidance and Resource Recovery Strategy 2014–2021 (WARR strategy)

The Waste Avoidance and Resource Recovery Strategy 2014–2021 and biennial progress reporting by the EPA fulfils reporting obligations under the *Waste Avoidance and Resource Recovery Act 2001.*

The WARR strategy establishes six objectives, supported by targets, actions and funding. These are:

1. Avoid and reduce waste generation
2. Increase recycling
3. Divert more waste from landfill
4. Manage problem wastes better
5. Reduce litter
6. Reduce illegal dumping.

Objectives two and three are relevant to the WSERRC proposal.

The WARR strategy is based on the principle of the waste hierarchy, which acknowledges that energy recovery from waste is preferable to landfilling, but less desirable than recycling. Energy recovery cannot contribute to achieving recycling targets but can contribute to landfill diversion. Recovery of metals and some rigid plastics in the pre-sorting process will contribute to recycling, as will the extraction of metals and recycling of IBA from the energy recovery process. The distinct targets allow progress to be measured against the different levels of the waste hierarchy.

The 2017–18 WARR Strategy Progress Update reported the following performance against the targets.

Increase recycling	MSW: 70% by 2021/22 C&I: 70% by 2021/22 C&D: 80% by 2021/22	MSW: 42% in 2017/18, steady, but will decline from 2019 due to MWOO ban. C&I: 53% in 2017/18, increasing C&D: 77% in 2017/18, fluctuating
Divert waste from landfill	75% overall landfill diversion	65% landfill diversion in 2017/18

Achieving the recycling targets across all three streams would also achieve the landfill diversion targets, based on the current waste generation profile for New South Wales. However, both the MSW and C&I streams fall significantly short of target recycling rates. Progress in MSW recycling is stagnant and is expected to fall in the short term due to the revocation of the Resource Recovery Order and Exemption for application to land of organics recovered from mixed waste.

Development of EfW capacity in New South Wales would support the rapid achievement of landfill diversion targets, preserve landfill capacity and delay the need to establish new landfill sites, which has proven highly challenging for the Sydney basin over the last two decades. As recycling rates increase over time, EfW operations with flexibility to accommodate changes in waste feedstock can continue to provide landfill diversion of residual waste and help New South Wales exceed the WARR strategy targets on landfill diversion. Once a reuse pathway for IBA has been established, recycling of around 80,000tpa of IBA from the WSERRC facility will contribute about two percentage points to the NSW overall recycling rate for C&I waste, based on 2018 generation figures.

Based on reported 2017/18 waste generation rates, even once the WARR recycling targets are achieved, there will remain around 1,800,000t of MSW and C&I residual waste in the metropolitan levy area which requires disposal or management through energy recovery. The scale of the WSERRC proposal is consistent with this context.

The WSERRC proposal and feedstock strategy is consistent with the objectives and targets of the WARR Strategy. Cleanaway supports increased source separation for high quality recycling and the WSERRC feedstock strategy and process design accommodates increased source separation over time, particularly of organics. In this way, the WSERRC proposal expects to accommodate improvements in both recycling and landfill diversion.

2.2.4 NSW EPA 20 Year Waste Strategy

The NSW EPA is preparing a new 20 Year Waste Strategy, which will follow the WARR Strategy 2014–2021. This may introduce different targets or priority actions. However, the core principle of the waste hierarchy is enshrined in the overarching legislation and will continue to guide NSW EPA in its approach to resource management and landfill diversion.

An issues paper was released for consultation in March 2020 and seeks feedback on various options for reform which are relevant and largely complementary to the WSERRC proposal.

The issues paper recognises that New South Wales currently has a shortfall in resource recovery capacity for both organics recovery and recycling of materials which were previously exported and proposes various options to drive improvement, including:

- Mandatory source separation of food and garden organics by households and/or some businesses
- Standardising collection systems and consolidating commercial and industrial collection services
- Stronger consideration of waste and recycling provisions within commercial buildings and precincts to enable effective separation and recycling
- Recycled content in government procurement, predominantly infrastructure. This targets inert materials which are not feedstock for energy recovery but could support wider source separation practices.
- Standards for recycled content
- Matching markets with suppliers
- Awareness and behaviour change programs for households and businesses.

These options and directions for change are aligned to the WSERRC feedstock strategy and modelling, which allows for a comprehensive transition to source separation of organics by 2030 (FOGO) and general improvements in source separation and recycling by businesses. The proposed scale and technical design of the WSERRC facility can accommodate this change in residual waste over time and continue providing energy recovery and landfill diversion for the changing residual waste stream over the life of the facility.

The issues paper also indicates that the 20 Year Waste Strategy will be used to review and update the NSW Energy from Waste Policy to make sure that it is aligned with international best practice. Importantly, the review will consider landfill requirements, including potential restrictions on certain wastes to landfill.

This potentially realigns resource recovery expectations for both energy from waste and landfill for consistent application of the waste hierarchy and could support diversion of residual waste from landfill to energy recovery, as well as increases in source separation and resource recovery more broadly.

2.3 European Union (EU) context

Various member states in the European Union have a long track record of using EfW and have achieved high energy recovery capacity, low landfilling rates and good social acceptance. Europe is also regarded as a leader in environmental protection and circular economy adoption, and these values are reflected in regulation of EfW.

Technical criteria in the NSW EfW policy draw directly on European legislative requirements, and the NSW EfW policy requirement to demonstrate best practice is recognised as compliance with the EU Industrial Emissions Directive (IED) legislation and supporting technical documentation (BREF-WI).

Policies adopted by the European Commission (EC) set out regulations, measures and long-term targets which are transposed into law within each of the member states. The strategies and fiscal instruments used to implement EC policies and achieve targets typically vary between member states, and waste management outcomes vary dramatically across the European Union.

The key European policies relating to EfW and resource recovery are outlined below.

2.3.1 Waste Framework Directive (WFD) 2008/98/EC6 and amendment 2018/851

The WFD sets out the fundamental waste management principles including the ‘waste hierarchy’, the ‘polluter pays principle’ and ‘extended producer responsibility’. The waste hierarchy concept is fundamental to the EU waste framework.

The WFD also introduced the R1 energy recovery criteria, which distinguishes between incineration primarily for waste disposal and genuine energy recovery. The R1 formula considers energy recovery in the forms of both electricity and heat. This has directly informed the energy efficiency criteria in the NSW EfW policy.

The WFD advocates separate collection to support high-quality material recycling, with consideration of technical, environmental and economic practicality and the relevant quality standards for material recycling sectors.

Specifically, member states were expected to provide households with separate collection of at least paper, metal, plastic and glass by 2015, achieving at least 50% recycling rates for MSW. Energy recovery does not contribute to this target, as energy recovery is less desirable than material recycling under the waste hierarchy. The WFD also includes a 70% landfill diversion target for 2020. Energy from waste facilities contribute to achieving this target.

The 2018 amendment, enacted as part of the Circular Economy package, introduced new measures to drive greater reuse and recycling in line with the European Union's ambition to transition to a circular economy. The amendment strongly promotes separate collection of materials to facilitate high quality recycling, taking into consideration lifecycle benefits and technical and economic factors. It sets phased targets for reuse or recycling of municipal waste, reaching 65% by 2035. Notably, it expands the expectations for separate collection to introduce:

- Separate collection of household hazardous waste by 2025
- Separate collection of textiles by 2025 making sure that separately collected waste is not incinerated
- Separate collection or onsite recycling of bio-waste by 2023, including food and garden organics from households, offices, restaurants, wholesale, canteens, caterers, retails premises and food processing plants
- Separate collection of waste oils.

It also introduces minimum requirements for extended producer responsibility schemes, including clear roles and responsibilities, use of quantitative targets, data collection and reporting. The amendment also addresses the prevention and reuse levels of the waste hierarchy. It does not impose specific actions or targets but requires that member states take various measures to prevent waste generation.

2.3.2 Industrial Emissions Directive (IED) 2010/75/EU

The Industrial Emissions Directive (IED) replaces seven previous directives relating to operation of industrial facilities, including specific regulation of waste incineration.

The IED aims to reduce emissions from industrial activities with a major pollution potential, including EfW installations. The competent authority in each EU member country is responsible for licencing and enforcement, creating subtle variations in application.

However, across all member states, the IED applies the following key principles to industrial facilities:

- Preventing pollution through normal operations
- Limiting the risk and consequence of accidents
- Providing remediation preventing legacy pollution issue
- Prevention, reuse, recycling, recovery or disposal of process waste in accordance with the waste hierarchy
- Efficient use of energy
- Application of best available techniques.

The concept of Best Available Techniques (BAT) is a notable feature of the IED and is intended to offer a flexible tool that balances high environmental protection standards with pragmatic technical and economic factors which vary with scale, location and over time.

Best available techniques for specific industries are defined in a Best Available Techniques Reference Document (BREF), developed by an expert technical working group.

The waste incineration BREF (BREF-WI) encompasses grate incinerators, rotary kilns, fluidised bed incinerators as well as pyrolysis and gasification systems.

2.3.3 BAT BREF and BAT conclusions

Best practice in the design and operation of incineration facilities is defined in the Waste Incineration BREF and summarised in the BAT conclusions, for reference during assessment and permitting.

The BAT BREF has undergone a recent review and update to incorporate operational data into the guidance. The updated BAT conclusions were published on 3 December 2019.

The WSERRC proposal has been designed to the 2019 BAT BREF. Assessment of the WSERRC proposal against best practices as defined in the 2019 BAT conclusions has been undertaken by Ramboll and is provided in Technical report D Best Available Techniques Assessment and found the proposal to be fully compliant.

2.3.4 Landfill Directive 1999/31/EC and Amendment 2018/850

This directive aims to prevent or reduce as far as possible negative effects of the landfilling of waste on the environment.

The Landfill Directive sets technical standards of operation for landfill and sets out a timetable for existing sites to be brought up to standard or close. More stringent controls on landfill design, operation and materials acceptance increased the cost of landfilling and of establishing new landfills. This helped drive an interest in EfW and to conserve landfill space.

The Landfill Directive includes a focus on diverting biodegradable waste from landfill to reduce methane emissions, with binding targets for member states.

In 2018, the Landfill Directive was amended as part of the Circular Economy Package to drive continued reduction in the landfilling of waste and diversion of materials to higher value uses within a circular economy. The changes set a target that by 2035, no more than 10% of municipal waste will be landfilled and establish instruments for incentivising and reporting on this target.

2.3.5 Energy recovery in the circular economy transition

In 2018, the European Commission adopted an ambitious Circular Economy Package, following a 3-year policy development process. This includes a suite of measures implemented under various EU directives, which together protect the environment and human health, make products more energy- and resource-efficient and empower consumers to choose better products.[3] There is a strong focus on shifting resource use up the waste hierarchy, reducing reliance on landfill and incineration and recovering greater value from materials.

In the context of development and ratification of the Circular Economy Package suite of legislative changes, the European Commission published guidance on the role of waste-to-energy in the circular economy (26.1.2017 COM (2017) 34).

Firstly, the European Commission reaffirms commitment to the waste hierarchy. It recommends that member states should prioritise investment in separate collection and processing infrastructure to enable high value recycling within Europe, with a focus on separate collection of organic waste. It recommends that direct public funding and subsidies support for EfW should be phased out, in favour of incentives and investment to establish more circular pathways for resource use.

[3] http://ec.europa.eu/environment/circular-economy/index_en.htm

For member states with high existing EfW capacity and very low landfill rates, the European Commission suggests that measures such as increases in taxation or a moratorium on new EfW facilities could be considered, as EfW approaches a position of direct conflict with higher order reuse and recycling. The low landfilling rates and high EfW adoption in these countries were driven by over two decades of policy designed to promote landfill avoidance. As this policy objective has been successful, a shift in focus to further beneficial use is now appropriate.

It is important to note that many European countries already have regulatory restrictions on waste acceptance for landfilling which have played a role in the uptake of EfW technology. In this context, additional restrictions on waste acceptance for energy recovery can only drive waste to more beneficial uses under the waste hierarchy. This is not the case in Australia. Application of strict waste acceptance restrictions for energy recovery without corresponding restrictions on landfill has the clear potential to drive perverse outcomes, sustaining entrenched landfill practices rather than additional recycling.

For member states with low or non-existent EfW capacity and ongoing reliance on landfill, it indicates that new EfW infrastructure could be an appropriate element of the long-term resource management system and recommends that proposals consider:

- The impact of existing and proposed separate collection obligations and recycling targets on the availability of feedstock to sustain the operation of new incineration plants over their lifespan (20–30 years)
- The available capacity for co-incineration in combustion plants and in cement and lime kilns or in other suitable industrial processes
- Planned or existing capacity in neighbouring countries.

The WSERRC proposal is consistent with this guidance because the facility sizing and proposed feedstock strategy accommodates greatly increased source separation, particularly of organics, over the long term.

Finally, the European Commission acknowledges that EfW plays a role in reducing greenhouse gas emissions and advocates a strong focus energy efficiency through adoption of best practice technology and use of heat wherever possible.

3 Waste feedstock assessment

The WSERRC feedstock strategy is to target waste from source-separated sources where possible and sort waste from sources without adequate source separation to recover materials for which a viable recycling outlet is available. This approach respects the waste hierarchy, maximises resource recovery for high-quality recycling and enables the project to demonstrate compliance with the NSW EfW policy.

The WSERRC facility proposes to accept residual waste from businesses (C&I waste stream) and household waste collections (MSW waste stream) in the Sydney Basin area. The design capacity of the facility is 500,000tpa of residual waste feedstock. Waste feedstock availability and likely changes over time due to policy, demographic and economic factors have been modelled by Arcadis. Details are provided in Technical report E Waste Flow Analysis for Greater Sydney.

Based on this modelling, the WSERRC proposal has developed a feedstock strategy which accommodates greater uptake of source separation over time, particularly for organics. Source separation is the most desirable outcome as it secures high-quality material streams for recycling and reduces the need for less efficient sorting of mixed residual waste. Waste from collection systems without adequate source separation will be pre-sorted to recover valuable recyclables prior to energy recovery.

Once valuable materials have been extracted for recycling, the remaining mixed waste material will have a suitable composition and calorific value for energy recovery.

Cleanaway is seeking approval from the NSW EPA for an increase to the maximum allowable percentage of residual waste from processing facilities receiving mixed MSW and mixed C&I waste, as allowed under Note 1 to Table 1 of the NSW EfW policy. This reflects changes in recycling markets and regulation since the NSW EfW policy was originally published in 2015.

The pre-sorting would be in line with best-practice recovery performance and is likely to be carried out at facilities such as Cleanaway's Erskine Park Waste Transfer Station which may trigger the need to increase the approved capacity at this facility (or other similar facilities). A processing facility is considered related development and is discussed further in **Chapter 22 Related development**.

3.1 Short-term feedstock strategy

Councils are being actively engaged on the role of EfW and the WSERRC but waste supply contracts for MSW have not yet been confirmed. Cleanaway currently collects C&I waste which could be directed to energy recovery. Waste supply agreements with councils and other waste collection companies will be negotiated once development consent is secured. In the short term, the proposal's feedstock mix is expected to include:

- A higher proportion of C&I waste, towards the upper end of the target 50–70% range
- Around 60% of C&I feedstock received from business with source-separation of recyclable material. This residual waste is fully eligible for energy recovery.
- The remaining 40% of C&I feedstock will need additional sorting before use in energy recovery. This waste will need processing at a facility such as the Erskine Park Waste Transfer Station or other similar facilities to recover valuable materials including metals and rigid plastics. This will aim to achieve about 5% recycling rate of input waste from sources without source separation.
- Less than 50% of waste feedstock will be sourced from MSW residual. Multiple councils within the Sydney basin are expected to have started a FOGO service by 2025. Contracts with these councils will be pursued in preference to other councils but if this cannot be secured, MSW will be sorted at a processing facility such as the Erskine Park Waste Transfer Station or another similar facility.
- Some metals within residual waste from source separating collections which does not undergo processing. This will be recovered from IBA in both onsite and offsite ash handling processes.

3.2 Long-term feedstock strategy

Over the long term, the waste supply strategy will change due to expected changes in source separation and recycling practices, and renegotiation of contracts. The WSERRC proposal is designed to safely and efficiently accommodate this variability, as described in more detail in Section 3.9. In the long term, most councils are expected to transition to a 3-bin FOGO collection and residual waste can be directed to EfW without further sorting. The long-term WSERRC feedstock strategy is based on:

- Most councils are expected to have transitioned to a 3-bin FOGO collection and residual waste can be directed to EfW without further sorting. It is the intention of the proposal to source MSW feedstock primarily from councils that have installed a FOGO service.
- Up to 60% of waste sourced from councils with 3-bin FOGO collections with no processing before transport to the WSERRC.
- Prevalence of source separation by business improves as the financial and environmental benefits of EfW over landfill become recognised. WSERRC preferentially seeks contracts with source separating businesses. Residual waste from source-separating collections will not undergo processing. Any metals in this residual waste stream will be recovered from IBA in both onsite and offsite ash handling processes.
- Through-put at the Erskine Park pre-sorting facility reduces, ceases, or is re-purposed to support RDF supply to other EfW facilities.
- Some metals within residual waste from source-separating collections which does not undergo pre-sorting. This will be recovered from IBA in both onsite and offsite ash handling processes.

3.3 Feedstock modelling

The feedstock modelling considers a variety of key drivers of change over time including the degree FOGO uptake by councils, the prevalence of source separation of waste by businesses, MSW waste generation per capita and C&I waste generation per employee. A summary is provided in Technical Report C Waste and Resource Management Assessment and the full modelling report is provided in Technical report E Waste Flow Analysis for Greater Sydney.

The Arcadis modelling explores a range of scenarios and sensitivities for waste feedstock availability, summarised in **Table 2**.

Table 2: Summary of waste availability modelling assumptions

Driver of change	Base case	Modelled scenarios and sensitivities
FOGO uptake	50% of councils transition to FOGO at their next contractual opportunity. The remaining council's transition to FOGO at the following contractual opportunity. Food waste capture rate in FOGO systems is in line with 41% average rate reported for current NSW systems.	Mandatory uptake by all councils at the next contract opportunity Rollout to single unit dwellings only (current Penrith City Council approach) High, medium and low organics capture rate in the FOGO collections.
Source separation by businesses	60% of businesses have adequate source separation by 2024, rising to 75% by 2030, based on Cleanaway customer data.	
Sorting for resource recovery	Waste from sources without adequate source separation is pre-sorted to extract valuable materials for recycling and 5% recovery is achieved under an increase to the maximum allowable percentage of residual waste from facilities receiving mixed MSW and mixed C&I waste under Table 1 of the NSW EfW (as discussed with NSW EPA).	NSW EfW Policy resource recovery criteria applied to MSW and an outlet developed for recovered organics. This is combined with progressive FOGO adoption and converges to the base case scenario.
MSW generation rate per capita	-1.5% per annum decline in MSW generation per capita, plateauing from 2030. This is applied to the NSW Government population projections to model total MSW generation.	-1.5% per annum (decline), which reflects the overall decline in MSW generation in NSW -0.2% per annum (decline), which is based on the more moderate decline in MSW waste to landfill.
C&I waste generation rate per employee	-0.8% per annum decline in C&I waste generation per employee, plateauing from 2030. This is applied to the NSW Government employment projections to model total C&I waste generation.	0.3% per annum (growth) based on the moderate increase in C&I generation in NSW, in a scenario where economic productivity per employee outstrips improvements in resource efficiency. -0.8% per annum (decline), which is reflective of the reduction in C&I waste disposal in NSW and is adopted to simulate potential improvements in resource recovery and disposal practices in the commercial sector.

Two main modelling results are presented across the MSW and C&I streams. The first estimates the quantity of residual waste arising from collection systems that have source separation and are 100% eligible for energy recovery under the NSW EfW policy. The second estimates residual waste arising from collection systems that would need processing before being eligible for energy recovery under the NSW EfW policy.

The total of these two results represents the total potential available feedstock to the WSERRC proposal. Estimated quantities of available residual waste from MSW and C&I streams over the operational life of the WSERRC facility (at 5 year intervals) are summarised in **Table 3** and **Table 4** respectively.

The results demonstrate that there is significantly more waste available in the Sydney Basin than the 500,000tpa design capacity of the WSERRC proposal. These modelling results indicate that the Sydney Basin will generate enough residual waste to support WSERRC and other known EfW facilities proposed in the Sydney Basin, while increasing source separation, recycling and landfill diversion. In this context, the WSERRC proposal has significant flexibility to secure waste from both MSW and C&I sources to achieve optimum commercial and energy recovery outcomes.

Table 3: Estimated residual MSW arising in the greater Sydney region (tpa)[4]

Sydney basin residual waste	2020	2025	2030	2035	2040	2045	2050
Arising from a FOGO collection system	125,460	471,205	711,062	1,253,681	1,572,625	1,691,901	1,799,523
Arising from a collection system that will need pre-processing[5]	1,276,072	970,085	789,586	266,758	14,216	0	0
Total residual waste	1,401,532	1,441,290	1,500,648	1,520,439	1,586,841	1,691,901	1,799,523

Table 4: Estimated residual C&I waste arising in the Greater Sydney region (tpa)[6]

Sydney basin residual waste	2020	2025	2030	2035	2040	2045	2050
Arising from a comprehensive at source separation system	775,735	807,086	1,054,503	1,134,451	1,215,446	1,293,954	1,370,069
Arising from a collection system that will need processing	517,156	538,056	351,500	378,150	405,150	431,378	456,690
Total residual waste[7]	1,292,891	1,345,142	1,406,003	1,512,601	1,620,596	1,725,332	1,826,759

[4] Refer to Technical report E: Waste Flow Analysis for Greater Sydney for further information

[5] Note that this total available feedstock tonnage is back-calculated based on the tonnages arising from different kerbside collection systems, as modelled by Arcadis and presented in Table 10 of Technical report E: Waste Flow Analysis for Greater Sydney. The value presented here reflects the total residual waste tonnage arising, prior to the application of eligibility limits under NSW EfW policy.

[6] Refer to Technical report E: Waste Flow Analysis for Greater Sydney for further information

[7] Note also that the 'MSW Residual Generation' headline figure shown in Table 10 of Technical report E: Waste Flow Analysis for Greater Sydney is modelled based on population growth without FOGO uptake, and so indicates a higher residual waste availability. This was not adopted for feedstock modelling, as source separation is key to the WSERRC feedstock strategy and the applicant is working proactively with councils to encourage and support FOGO transition through their wider collections and resource recovery business.

3.4 Feedstock eligibility and compliance with the NSW EfW policy

Feedstock modelling indicates that there is ample feedstock available to meet WSERRC requirements, maintain competition in the putrescible waste market, and allow flexibility for changes in waste management and resource recovery in the future.

The WSERRC proposal is designed to accept 500,000tpa of waste feedstock for energy recovery. The total tonnage of waste which the applicant will need to secure to meet this feedstock requirement depends on the level of source separation undertaken by contracted waste generators and eligibility conditions under the NSW EfW policy.

The proposal will accept waste from multiple generators, including both MSW and C&I waste collections. The precise sources of waste, including level of source separation cannot be confirmed until contracts are in place. However, the proposal has developed a feedstock strategy which guides the approach to seeking and negotiating feedstock contracts.

3.4.1 Source separation for high-quality recycling

The first priority of the waste feedstock strategy is to target residual waste from councils and businesses which have source-separation systems in place. Source separation is the most effective way to capture clean streams of recoverable materials for high-quality recycling. Table 1 of the NSW EfW policy allows energy recovery of 100% of the residual waste from councils with 3-bin FOGO collection and businesses with source separation in place for all relevant waste stream. This recognises that source separation is the best approach to separating recyclable material from residual waste, and the WSERRC proposal aligns to this philosophy.

3.4.2 Pre-sorting for recycling

The second priority of the waste feedstock strategy is to recover valuable materials from mixed waste for recycling, where market outlets exist. Waste from collection systems without adequate source separation will be sorted to recover valuable materials for which recycling markets exist. The sorting facility is likely to be located at Cleanaway's Erskine Park Waste Transfer Station, which may trigger the need to increase the approved capacity at this facility.

Metals and some rigid plastic will be the main materials recovered. **Table 5** describes how major material streams will be recovered in the pre-sort or EfW process.

The pre-sorting facility will use mechanical sorting equipment such as magnets and optical sorters to extract recyclable materials. This type of facility for mixed waste is typically referred to as a ‘dirty MRF’. It will not include any separation or biological processing of organic materials, as organic materials from mixed waste are contaminated and have no recovery outlet under NSW regulations.

The recovery rate from this sorting process is expected to be around 5%, based on benchmarking of similar facilities using current best-practice technology to extract valuable materials for sale. Technical report E Waste Flow Analysis for Greater Sydney provides further details of this benchmarking and states that the proposed sorting process and a targeted 5% recycling rate is a reasonable technically and economically feasible recovery rate in the current regulatory and market context for recovery of organics and dry recyclable materials.

The waste remaining after this sorting process will consist of mixed and contaminated materials with no viable outlet in the context of the regulatory change in 2018 to ban organics from mixed waste from being applied to land in New South Wales, and significant tightening of contamination limits in global recycling markets, beginning with restrictions imposed by China in 2018. This material has a suitable chemical composition and calorific value for energy recovery at the WSERRC facility.

Table 5: Summary of material recovery in the pre-sort and EfW process

Material	Recovery in pre-sort and EfW process
Metals	Both ferrous and non-ferrous metals can be recovered in the pre-sort and will contribute significantly to the pre-sort recovery rate. The WSERRC will also extract ferrous metals from IBA within the EfW facility and will recover non-ferrous metals at a dedicated offsite IBA processing facility. The highest economic value is in the very fine non-ferrous metals, such as copper, platinum and gold. The very fine non-ferrous metals can only be recovered from the IBA after partial maturation and a screening process, which will be done offsite. Extracting the metals from the EfW IBA is the most common practice in the UK and Europe, rather than extracting the metals in a feedstock pre-sorting facility. It is more efficient to extract the metals from the IBA residue because metals do not combust. Extraction from IBA can produce a higher yield and a cleaner, more marketable product. Extraction of metals only from IBA is the preferred option for waste from collections with source separation because it also saves on capex and opex in the processing facility, resulting in a potential lower cost waste solution for Councils.
Hard plastics	Hard plastics are best recycled through source separation into comingled recycling bins, or container deposit points. WSERRC will not receive these recycling streams. PET and other plastics in the mixed waste stream could be recovered in the pre-sort, but would be highly contaminated, with very limited value. The pre-sort will recover some hard plastics, predominantly PET and HDPE. Most plastic received will form part of the fuel for the EfW process.
Soft plastics	Soft plastics are not suitable for recovery from residual waste and would form part of the fuel for the EfW process.

Material	Recovery in pre-sort and EfW process
Glass	Glass is generally source-separated in comingled recycling bins or container deposit points. The WSERRC will not receive these recycling streams. Glass in residual waste bins is usually broken, contaminated and unsuitable for recovery. It would be processed through the EfW process and form part of the IBA residue. IBA is inert and has excellent engineering properties in unbound pavements. It is regularly used as a construction material in the EU and UK. Options for the offsite recovery and reuse of IBA from the combustion process are also being investigated, building on knowledge and practice elsewhere, and working with industry partners to investigate the feasibility of developing a market for reuse of IBA in construction products.
Paper and cardboard	Paper and cardboard received will be recovered during the pre-sort and sold to recyclers. It is in economic interest of the pre-sort facility operator to recover any marketable recyclables given the value in its sale. However, paper and cardboard which has been mixed with organic waste (MSW red bin waste) is highly contaminated and has no value. It will form part of the fuel for the EfW process, and this fraction of the fuel will generate renewable energy.
Organics (food and garden)	Organics recovered from mixed waste are no longer allowed to be applied to land, following the 2018 NSW EPA MWOO Position Statement. There is no recycling outlet for this material once it is contaminated with other waste in a mixed collection. Cleanaway will work with councils and business customers to support uptake of source-separated collections for food and garden organics. All organic material received will form part of the fuel mix for the EfW process, and this fraction of the fuel will generate renewable energy.

3.4.3 Feedstock strategy Scenario 1

Residual waste from the pre-sorting process will either be directed to WSERRC as feedstock for energy recovery, or landfilled, as no higher-order outlet is available. The WSERRC proposal has considered two scenarios regarding EfW-eligibility of this material under the NSW EfW policy.

Feedstock strategy Scenario 1 is consistent with Table 1 of the NSW EfW policy.

Residual mixed waste from source separated business collection and councils operating 3-bin FOGO kerbside collection service is 100% eligible for energy recovery and will be directed to WSERRC without any further processing.

Waste from a collection system without adequate source separation will be directed to a pre-sorting facility. After sorting to extract and recycle valuable materials, mixed residual waste would be directed either to energy recovery at WSERRC or to landfill, with no further sorting or separation for either stream.

The maximum quantity of waste eligible under Table 1 of the NSW EfW policy would be directed to the WSERRC facility for energy recovery. The remaining waste would be directed to landfill disposal, as no other outlet is available. Scenario 1 is summarised in **Figure 2**.

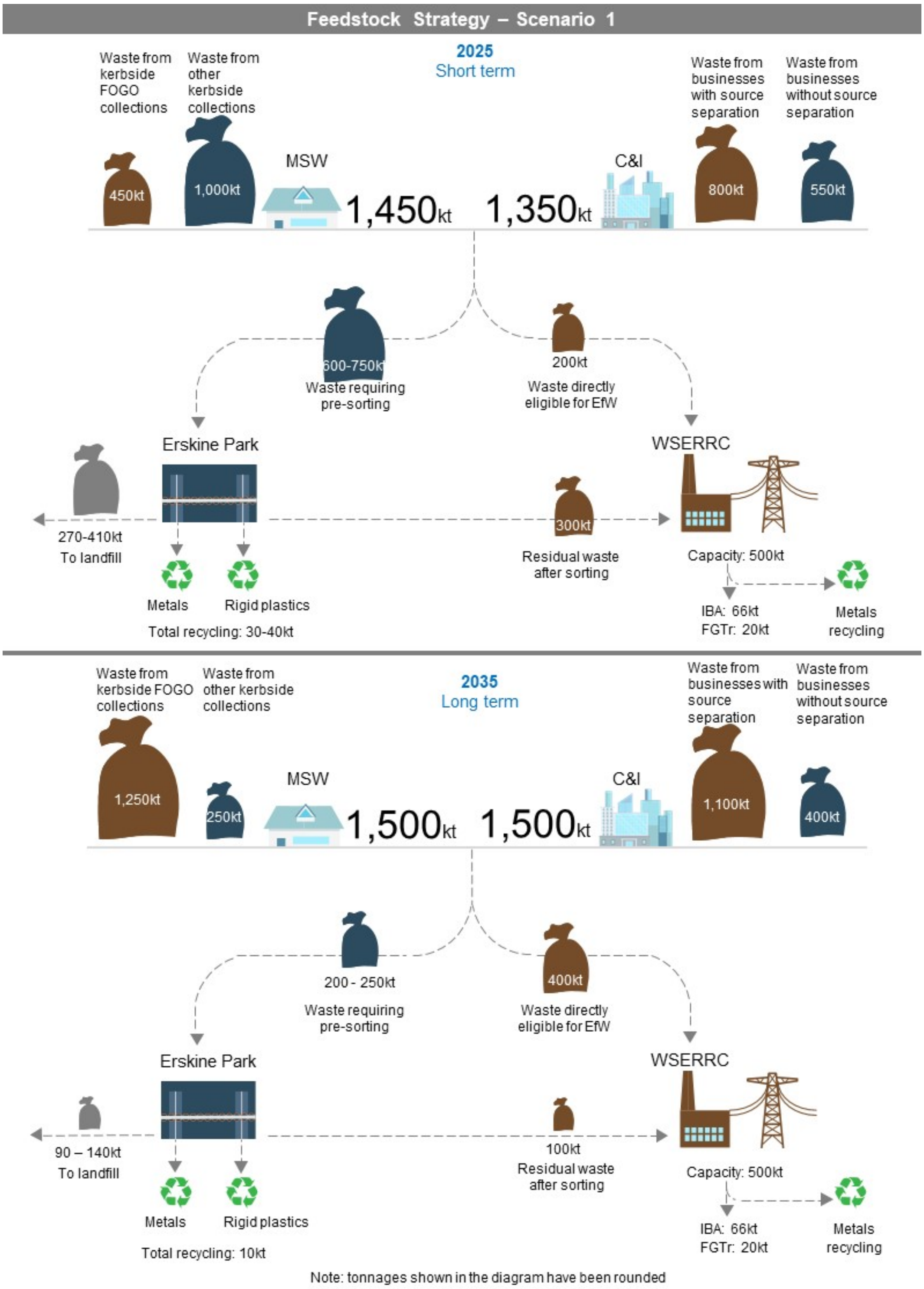

Figure 2: WSERRC proposed short-term and long-term feedstock strategy based on waste availability modelling.

Figures reflect the Scenario 1 feedstock supply, consistent with Table 1 of NSW EfW policy in the absence of any Note 1 approval. A calculation sheet explaining the sources and assumptions for each of the waste flows is provided below.

3.4.4 Feedstock strategy Scenario 2

Residual waste from the pre-sorting process will either be directed to WSERRC as feedstock for energy recovery, or landfilled, as no higher-order outlet is available. The WSERRC proposal has considered two scenarios regarding EfW-eligibility of this material under the NSW EfW policy.

Feedstock strategy Scenario 2 is consistent with the NSW EfW policy. It meets the requirements of Table 1 for waste for source separated collections and reflects an approval from the NSW EPA to increase the allowable percentage of mixed residual waste which is eligible for energy recovery after sorting. Note 1 to Table 1 of the NSW EfW policy states:

'The EPA may give consideration to increases to the maximum allowable percentage of residuals from facilities receiving mixed municipal and commercial and industrial waste where a facility intends to use the biomass component from that process for energy recovery, rather than land application and the facility can demonstrate they are using best available technologies for material recovery of that stream.'

This provision within the NSW EfW policy allows flexibility to accommodate changes such as the ban on land application of organics from mixed waste which the NSW EPA implemented in 2018 and confirmed in 2019. **Figure 4** illustrates how the 2018 ban on land application of organics from mixed waste has impacted the resource recovery outcomes when applying Table 1 of the NSW EfW policy to mixed putrescible waste. It focuses on MSW mixed residual waste from a 3-bin GO collection system for illustrative purposes and is not necessarily reflective of overall WSERRC feedstock.

If granted, this increase to EfW-eligibility for the pre-sorted waste stream would improve overall landfill diversion without undermining the recovery of valuable materials that have a genuine market outlet. Overall, less mixed waste feedstock would need to be directed through the pre-sorting facility, potentially allowing more space for other resource recovery operations at this site and supporting competition in the putrescible waste management market.

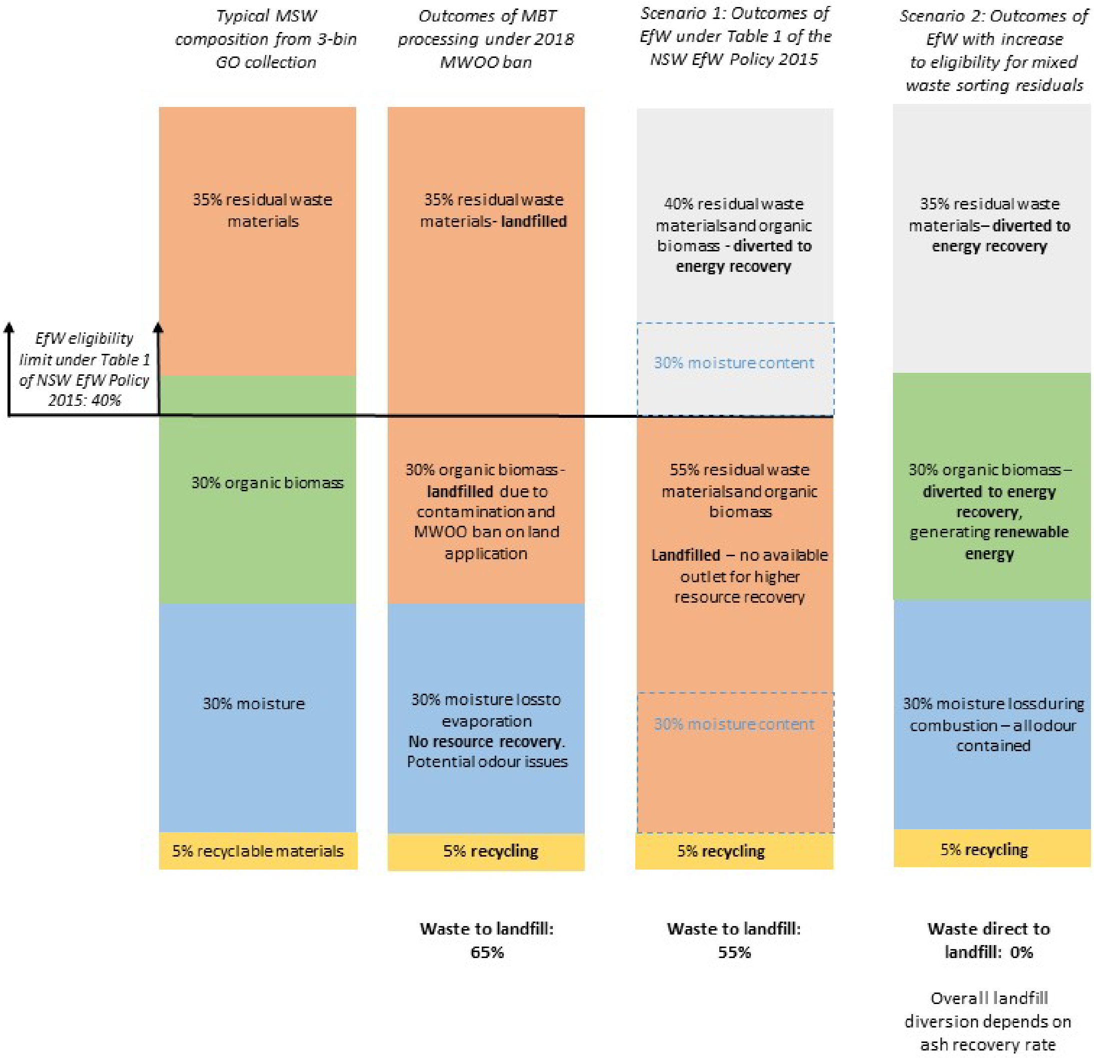

Figure 3: Resource recovery outcomes for mixed residual waste from a 3-bin GO kerbside collection, illustrating the impact of regulatory change on the application of the NSW EfW policy.

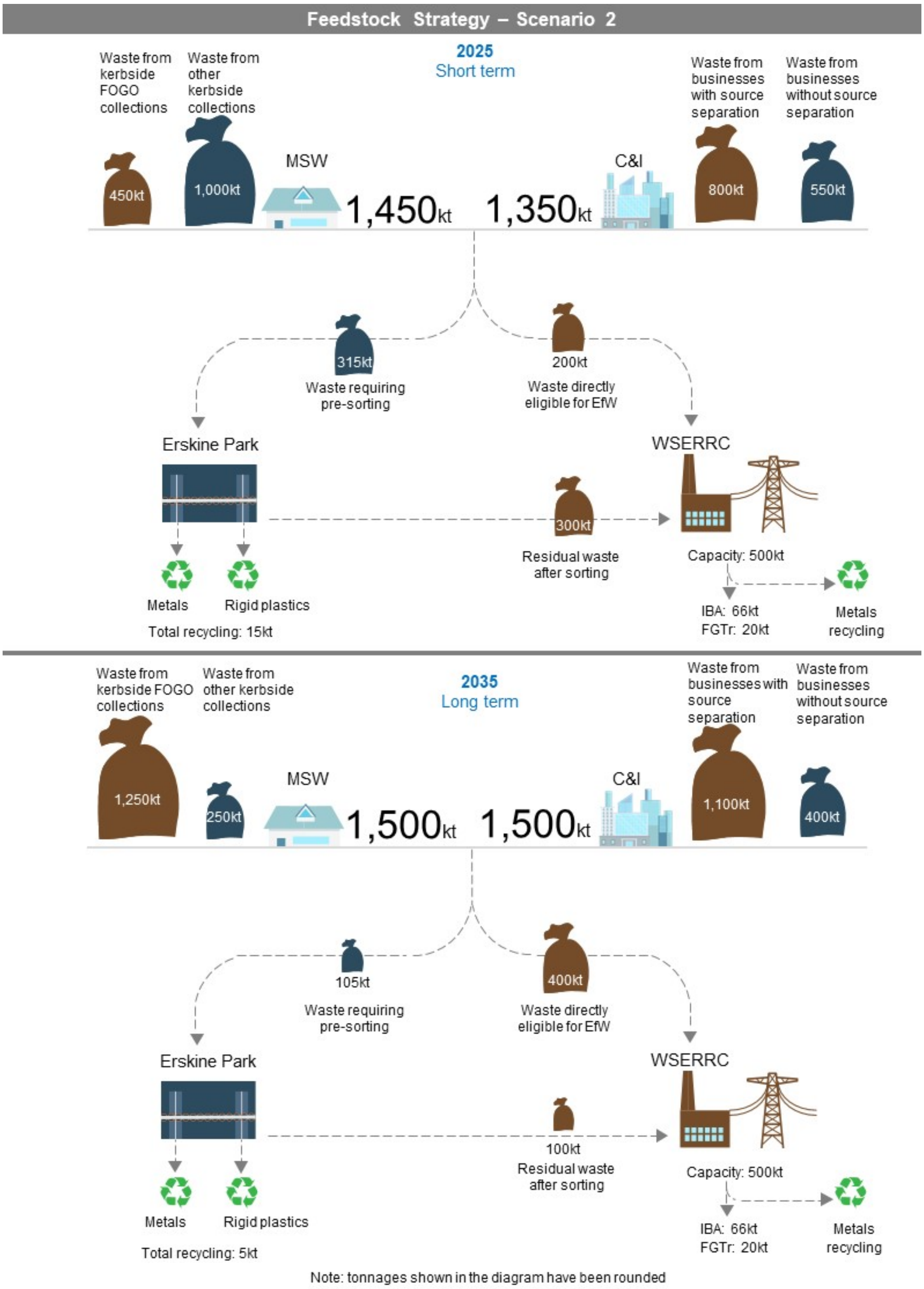

Figure 4: WSERRC proposed short-term and long-term feedstock strategy based on waste availability modelling.

Figures reflect the Scenario 2 feedstock supply, which is consistent with the NSW EfW policy if approval is granted under Note 1 to increase the EfW-eligible fraction of sorted material and avoid landfilling of mixed and contaminated waste for which no market exists. A calculation sheet explaining the sources and assumptions for each of the waste flows is provided below.

3.4.5 Scenario implications

Scenario 2 would affect about 60% of the WSERRC target feedstock in the short term, decreasing to about 20% of WSERRC expected feedstock in the longer term, as both councils and businesses move towards greater source separation.

Scenario 2 would not affect the recycling rate for materials which can be mechanically extracted for recycling and have a viable market. The recycling rate for these materials, predominantly metals and some rigid plastics, is expected to be around 5% of the mixed waste stream regardless of whether or not an increase to EfW-eligibility limits is approved, as described in Section 3.4.2 of this report. This is based on benchmarking of other facilities undertaking mechanical sorting of mixed waste, as detailed in Technical report E Waste Flow Analysis for Greater Sydney.

Scenario 2 would make sure that all mixed residual waste for which no higher-order resource recovery outlet is available is directed to energy recovery and diverted from landfill disposal.

In the context of the 2018 ban on land application of MWOO, Scenario 2 provides a flexible response to the prescriptive application of the resource recovery criteria to mixed putrescible waste which achieves better resource recovery and environmental outcomes in line with the waste hierarchy.

Both Scenario 1 and Scenario 2 are considered viable for the purposes of this Environmental Impact Statement, however, would have implications for the volume of waste received at a pre-processing facility. Any application to provide additional capacity at a pre-processing facility is not part of the scope of this application as described in **Chapter 22 Related development**. However, it will have no flow-on impact to either the quantity or composition of waste feedstock accepted for energy recovery at WSERRC.

3.4.6 Calculation sheet

The key assumptions and relationships between the summary waste flow figures are presented in **Table 6**. **Figure 5** maps the value identifiers within the waste flow diagram. Note that figures have been rounded to the nearest 50,000t for overall waste generation estimates, and to the nearest 5,000t for WSERRC pre-sorting and recycling estimates.

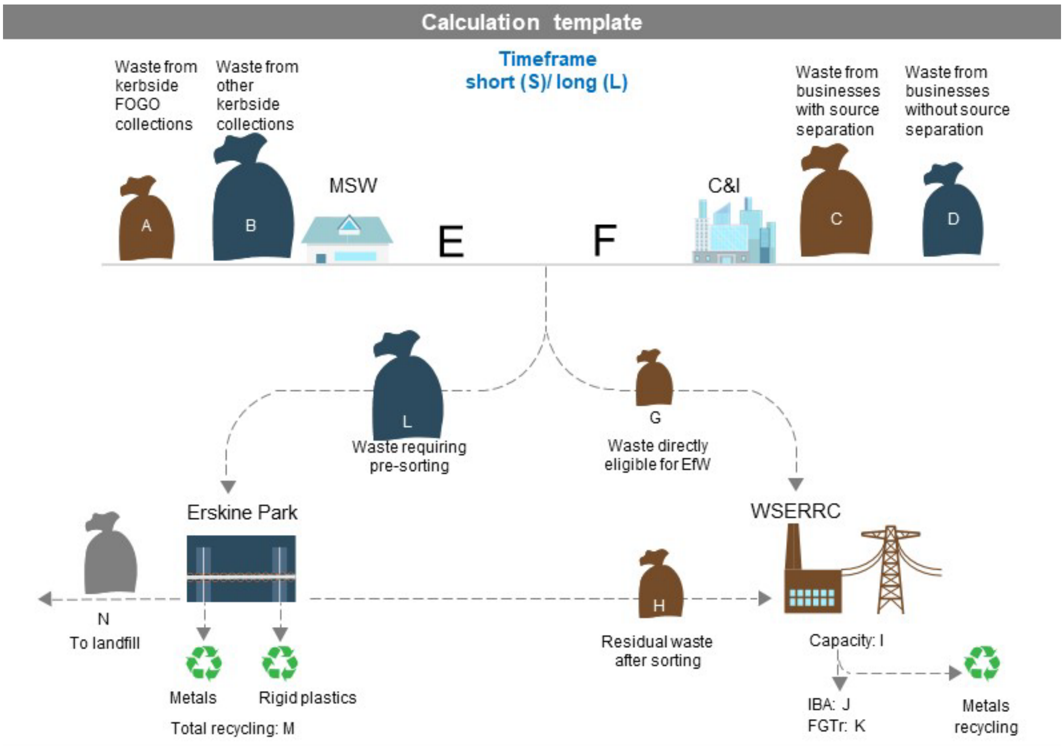

Figure 5: Value mapping for calculation sheet

The following naming convention is used in the calculation sheet:

Values which do not change between scenarios over time are simply labelled with a letter, for example 'I' is the design capacity of the WSERRC facility.

Values that change over time but are not impacted by the scenarios of mixed-waste eligibility are labelled with a suffix S for short-term or L for long-term, for example, F(S) being the total C&I residual waste arising in the Greater Sydney area in 2025, or G(L) being the residual waste from source-separating generators which is directly eligible as WSERRC feedstock in the long term.

Values which change both over time and between scenarios are labelled with an alpha-numeric suffix, for example N(S1) being the waste directed to landfill after pre-sorting in the short term, under Scenario 1 in which no increase to the EfW eligibility of this material is granted.

Table 6: Key assumptions and relationships between waste flow estimates

Item	Description	Value (tpa)	Assumptions and rationale	Waste flow calculation
Design parameters				
I	WSERRC capacity	500,000	This is the design feedstock throughput for WSERRC. It does not change between scenarios or over time.	n/a WSERRC design value
J	Incinerator bottom ash (IBA) – dry weight	66,000 (rounded) 65,800 presented elsewhere	This is the design value as presented in the Proposal Description and summarised in **Section 5.3** of this report. It does not change between scenarios or over time. This includes metals which are subsequently extracted for recycling at a dedicated offsite facility.	n/a WSERRC design value
K	Flue gas treatment residue (FGTr)	20,000	This is the design value as presented in the Proposal Description and summarised in **Section 5.3** of this report. It does not change between scenarios or over time.	n/a WSERRC design value
Short-term feedstock supply (2025). Scenario 1: No approved increase to EfW-eligibility of residuals from mixed waste after pre-sorting to extract valuable materials.				
A(S)	MSW residual waste arising from kerbside FOGO collections	450,000	Arcadis waste modelling summarised in **Section 3.3**, Table 3 of this report.	n/a Modelled input. Rounded to nearest 50,000t.
B(S)	MSW residual waste arising from other kerbside collections	1,000,000	See **Section 3.3**, **Table 3** of this report. Council uptake of FOGO collections was modelled by Arcadis and further details are available in Technical report E: Waste Flow Analysis for Greater Sydney. The total available feedstock tonnage is back-calculated by applying the NSW EfW policy eligibility criteria to the tonnages arising from different kerbside collection systems, as modelled by Arcadis and presented in Table 10 of Technical report E: Waste Flow Analysis for Greater Sydney.	Back calculation from modelled input and rounded to nearest 50,000t. Eligible waste arising from 3-bin GO system ÷ 40% EfW eligibility. Eligible waste arising from 2-bin system ÷ 25% EfW eligibility.

Item	Description	Value (tpa)	Assumptions and rationale	Waste flow calculation
			Note that the 'MSW Residual Generation' headline figure shown in Table 3 of Technical report E: Waste Flow Analysis for Greater Sydney is modelled based on population growth without FOGO uptake, and consequently indicates a higher residual waste availability. This was not adopted for feedstock modelling, as source separation is key to the WSERRC feedstock strategy and the applicant is working proactively with councils to encourage and support FOGO transition through their wider collections and resource recovery business.	
C(S)	Residual waste arising from businesses with adequate source separation	800,000	Arcadis waste modelling summarised in **Section 3.3**, **Table 4** of this report.	n/a Modelled input
D(S)	Residual waste arising from businesses without adequate source separation	550,000	Arcadis waste modelling summarised in **Section 3.3**, **Table 4** of this report.	n/a Modelled input
E(S)	Total MSW residual waste arising in the greater Sydney region in 2025	1,450,000	Sum of residual waste arising from all councils in the greater Sydney area.	A(S)+B(S)
F(S)	Total C&I residual waste arising in the greater Sydney region in 2025	1,350,000	Sum of residual waste arising from all C&I generators in the greater Sydney area.	C(S)+D(S)
G(S)	Waste feedstock directed to WSERRC without pre-sorting	200,000	Feedstock blend 60% C&I (300,000t) and 40% MSW (200,000t) For WSERRC suppliers, the ratio of source-separating generators and mixed-waste generators is identical to the expected proportion in the Greater Sydney basin, as presented in Arcadis waste modelling and summarised in **Section 3.3**, **Table 3**. MSW tonnage conservatively selected below the Greater Sydney average to prevent under-sizing of the pre-sorting facility. C&I waste: 60% of C&I residual tonnes from generators with adequate source separation. Resulting eligible waste direct to WSERRC: 180,000t.	G(S)C&I: I x 60% C&I waste x 60% source separating collections = 180,000t G(S)MSW: I x 40% MSW waste x 30% arising from FOGO collections = 60,000t Then rounded down to nearest 100,000t.

Item	Description	Value (tpa)	Assumptions and rationale	Waste flow calculation
			MSW waste: 30% of MSW residual tonnes arising from a FOGO system, based on modelling assumption that 50% of councils in the Greater Sydney area move to a FOGO system at their next contract opportunity. There is a cluster of contracts due for renegotiation in 2024. However, modelling does not identify specific councils for FOG transition and contracting with WSERRC, as this will be a commercial negotiation process. Resulting eligible waste direct to WSERRC: up to 60,000t. WSERRC will seek contracts with source-separating councils, but there remains some uncertainty in the process of negotiating and securing contracts. Estimated tonnage direct to WSERRC conservatively rounded down to prevent undersizing of the pre-sort facility.	
H(S)	Waste feedstock accepted at WSERRC after pre-sorting	300,000	Balance of 500,000 design feedstock input.	I – G(S) = 300,000t
L(S1)	Waste requiring pre-sorting	600,000–750,000	NSW EfW Table 1 criteria applied. Given that waste supply contracts have not been confirmed, a specific blend of MSW and C&I waste has not been nominated. Instead, an input range is identified based on the EfW policy Table 1 residual waste eligibility for mixed C&I (up to 50%) and MSW residual from a 3-bin GO collection. If MSW residual from a 2-bin collection system were accepted, a higher input tonnage would be required. However, this is undesirable from a commercial and operational perspective under Scenario 1 and is not shown included in this indicative waste flow diagram.	Upper bound: H(S) ÷ 40% (MSW value) Lower bound: H(S) ÷ 50% (C&I value)
M(S1)	Total recycling from pre-sorting process	30,000–40,000	5% recovery of materials with a viable recycling outlet is expected, based on benchmarking of similar facilities, as described in Section 3.4.2 of this report and detailed in Technical report E: Waste Flow Analysis for Greater Sydney.	L(S1) x 0.05

Item	Description	Value (tpa)	Assumptions and rationale	Waste flow calculation
N(S1)	Waste to landfill	270,000–410,000	Expected gap between the recovery rate achievable through extraction of materials for recycling and the Table 1 EfW eligibility limits for mixed MSW and C&I waste. This material will be directed to landfill disposal, as no higher order outlet is available.	L(S1) – H(S) – M(S1)
Long-term feedstock supply (2035). Scenario 1: No approved increase to EfW-eligibility of residuals from mixed waste after pre-sorting to extract valuable materials.				
A(L)	Residual waste arising from kerbside FOGO collections	1,250,000	Arcadis waste modelling summarised in **Section 3.3**, **Table 3** of this report.	n/a Modelled input
B(L)	Residual waste arising from other kerbside collections	250,000	See **Section 3.3**, **Table 3** of this report. Council uptake of FOGO collections was modelled by Arcadis and further details are available in Technical report E: Waste Flow Analysis for Greater Sydney. The total available feedstock tonnage is back-calculated by applying the NSW EfW policy eligibility criteria to the tonnages arising from different kerbside collection systems, as modelled by Arcadis and presented in Table 10 of Technical report E: Waste Flow Analysis for Greater Sydney. Note that the 'MSW Residual Generation' headline figure shown in Table 3 of Technical report E: Waste Flow Analysis for Greater Sydney is modelled based on population growth without FOGO uptake, and consequently indicates a higher residual waste availability. This was not adopted for feedstock modelling, as source separation is key to the WSERRC feedstock strategy and the applicant is working proactively with councils to encourage and support FOGO transition through their wider collections and resource recovery business.	Back calculation from modelled input: Eligible waste arising from 3-bin GO system ÷ 40% EfW eligibility Eligible waste arising from 2-bin system ÷ 25% EfW eligibility
C(L)	Residual waste arising from businesses with adequate source separation	1,100,000	Arcadis waste modelling summarised in **Section 3.3**, **Table 4** of this report.	n/a Modelled input

Item	Description	Value (tpa)	Assumptions and rationale	Waste flow calculation
D(L)	Residual waste arising from businesses without adequate source separation	400,000	Arcadis waste modelling summarised in **Section 3.3**, **Table 4** of this report.	n/a Modelled input
E(L)	Total MSW residual waste arising in the greater Sydney region in 2025	1,500,000	Sum of residual waste arising from all councils in the greater Sydney area.	A(L)+B(L)
F(L)	Total C&I residual waste arising in the greater Sydney region in 2025	1,500,000	Sum of residual waste arising from all generators	C(L)+D(L)
G(L)	Waste feedstock directed to WSERRC without pre-sorting	400,000	Feedstock blend trends towards 40% C&I (200,000t) and 60% MSW (300,000t). Across the Greater Sydney area, the prevalence of source-separation among C&I generators is modelled to increase to around 75% and MSW residual arising from FOGO collections rises to about 75% of all MSW residual, based on modelling assumption that 50% of councils in the Greater Sydney area move to a FOGO system at their next contract opportunity. See Arcadis waste modelling summarised in **Section 3.3**, **Table 4** and **Table 3** of this report. 80% of WSERRC feedstock expected to come from source-separating generators in the long term. For WSERRC suppliers, the ratio of source-separating generators and mixed-waste generators is expected to be broadly similar to the overall profile in the Greater Sydney basin. Given the applicant's clear strategy to proactively pursue feedstock from source-separating generators, and particularly to support councils in transitioning to FOGO collections, the waste flow summary for the long-term feedstock strategy assumes that the applicant will be able to secure feedstock from source separating generators at slightly above the average modelled source separation rate.	I x 80%

Item	Description	Value (tpa)	Assumptions and rationale	Waste flow calculation
H(L)	Waste feedstock accepted at WSERRC after pre-sorting	100,000	Balance of 500,000 design feedstock input.	I – G(L)
L(L1)	Waste requiring pre-sorting	200,000–250,000	NSW EfW Table 1 criteria applied. Given that waste supply contracts have not been confirmed, a specific blend of MSW and C&I waste has not been nominated. Instead, an input range is identified based on the Table 1 residual waste eligibility for mixed C&I (50% EfW eligible) and MSW residual from a 3-bin GO collection (40% EfW eligible) If MSW residual from a 2-bin collection system were accepted, a higher input tonnage would be required. However, 2-bin collections are expected to be phased out in the long term and are undesirable from a commercial and operational perspective under Scenario 1, so this is not shown included in this indicative waste flow diagram.	Upper bound: H(L) ÷ 40% (MSW value) Lower bound: H(L) ÷ 50% (C&I value)
M(L1)	Total recycling from pre-sorting process	10,000	5% recovery of materials with a viable recycling outlet is expected, based on benchmarking of similar facilities, as described in **Section 3.4.2** of this report and detailed in Technical report E: Waste Flow Analysis for Greater Sydney.	L(L1) x 0.05
N(L1)	Waste to landfill	90,000–140,000	Expected gap between the recovery rate achievable through extraction of materials for recycling and the Table 1 EfW eligibility limits for mixed MSW and C&I waste. This material will be directed to landfill, as no higher order outlet is available.	L(L1) – H(L) – M(L1)

Item	Description	Value (tpa)	Assumptions and rationale	Waste flow calculation
Short-term feedstock supply (2025). Scenario 2: Approval granted for an increase to EfW-eligibility of residuals from mixed waste after pre-sorting to extract valuable materials.				
Values A(S) through H(S) are identical to Scenario 1. Approval for an increase to EfW-eligibility of residuals from mixed waste pre-sorting has no impact on total waste availability or the applicant's approach to securing feedstock from source-separating waste generators.				
L(S2)	Waste requiring pre-sorting	315,000	A resource recovery rate of around 5% is expected to be achievable using best-practice mechanical sorting processes to extract valuable materials for recycling.	H(S) ÷ 95%
M(S2)	Total recycling from pre-sorting process	15,000	5% extraction of materials with a viable recycling outlet is expected, based on benchmarking of similar facilities, as described in **Section 3.4.2** of this report and detailed in Technical report E: Waste Flow Analysis for Greater Sydney.	L(S2) x 5%
N(S2)	Waste to landfill disposal	0	The applicant is seeking approval to allow all residual materials from the pre-sorting process which has no viable outlet to be directed to energy recovery at WSERRC. This would prioritise energy recovery over landfilling, in accordance with the waste hierarchy.	n/a
Values A(L) through H(L) are identical to Scenario 1. Approval for an increase to EfW-eligibility of residuals from mixed waste pre-sorting has no impact on total waste availability or the applicant's approach to securing feedstock from source-separating waste generators.				
L(L2)	Waste requiring pre-sorting	105,000	A resource recovery rate if around 5% is expected to be achievable using best-practice mechanical sorting processes to extract valuable materials for recycling.	H(L) ÷ 95%
M(L2)	Total recycling from pre-sorting process	5,000	5% extraction of materials with a viable recycling outlet is expected, based on benchmarking of similar facilities, as described in **Section 3.4.2** of this report and detailed in Technical report E: Waste Flow Analysis for Greater Sydney.	L(L2) x 5%
N(L2)	Waste to landfill	0	The applicant is seeking approval to allow all residual materials from the pre-sorting process which has no viable outlet to be directed to energy recovery at WSERRC. This would prioritise energy recovery over landfilling, in accordance with the waste hierarchy.	n/a

3.5 Supporting source separation

Cleanaway will encourage uptake of source separation for high-quality resource recovery and expects the prevalence of source separation, particularly FOGO collection services for households, to increase over time. This is consistent with the preference for source separation under the NSW EfW policy, consideration of mandatory FOGO transition within the NSW EPA 20-year Waste Strategy, and funding for new FOGO infrastructure under the Waste Less, Recycle More program.

Cleanaway can support source separation through:

- Offering competitive commercial rates for collection of separate recycling streams to complement collection of residual waste for energy recovery at WSERRC
- Education resources to support correct separation and disposal practices, including continuation of existing programs such as kNOw waste, provision of resource recovery officers, Greenius online learning platform and supporting the NSW EPA bin trim program
- Investment in dedicated collection vehicles for source-separated collections, such as specialist vehicles for organics, and infrastructure for high-quality recycling of source separated materials such as FOGO organics and plastics collected through the container deposit schemes
- Review of logistics and route planning for residual waste collection, providing separate collection routes for waste from source-separating customers where feasible
- Developing and operating processing infrastructure for FOGO organics, where needed to support new contracts for source-separated collections.

Currently, Penrith is the only council within the Sydney metropolitan areas which offers FOGO collections from households. However, various council waste contracts will be due for renegotiation over the period 2020–2024, and Cleanaway expects a strong transition to FOGO collections. Cleanaway will work with councils to encourage FOGO transition and preferentially secure residual waste contracts from councils with FOGO collections. By 2030, Cleanaway expects that most councils will have adopted source separation for food and garden organics, and it will be possible to secure MSW feedstock exclusively from councils with FOGO collection.

3.6 Waste composition

Residual waste is heterogenous and composition varies between sources, loads and seasonally. This typical variation is accommodated within the energy recovery process.

Cleanaway has conducted quarterly waste audits at their Erskine Park transfer station to build and understanding of the expected feedstock composition. In addition, the Technical report E Waste Flow Analysis for Greater Sydney discusses publicly available composition data for relevant waste streams in Section 4.3. In Appendix 1, it presents the composition audit data for MSW received at Erskine Park along with commentary on the resource recovery potential through proposed pre-sorting operations to be conducted at Erskine Park. **Table 7** and **Table 8** summarise the results of the Erskine Park composition audits and the likely composition of waste combusted in the short and long term, drawing on the assessment of best practice resource recovery from mixed waste in the short term and modelling of long-term increases in source separation of high-quality recycling, available in Technical report E Waste Flow Analysis for Greater Sydney. Long-term composition values contain greater uncertainty, as policy changes will impact waste generation and residual waste composition over time, including changes to packaging, single use plastics and waste avoidance.
The WSERRC has been designed to manage the short-term and long-term variations in residual MSW and C&I waste.

Table 7: Expected MSW composition based on Erskine Park waste audits

Waste material	Waste received: average composition	Waste received: composition range	Waste combusted: short-term composition	Waste combusted: long-term composition
Paper and card	14.8%	13.5–16.2%	15.5%	18.8%
Plastic film	9.9%	9–11.3%	10.4%	11.4%
Dense plastic	8.6%	6.8–9.8%	6.3%	9.8%
Textiles	5.1%	3.8–6.5%	5.3%	6.4%
Glass	2.3%	1.8–2.7%	2.4%	2.9%
Inert material (concrete, rock, ceramics etc)	2.3%	0.8–4%	2.5%	3.0%
Food and kitchen waste	33.4%	28.8–39.5%	35.1%	23.4%
Garden waste	8.7%	5.9–12.1%	9.2%	5.5%
Other organics	3.3%	2.3–4%	3.4%	4.1%
Ferrous metal	2.3%	1.8–3%	0.4%	2.9%
Non-ferrous metal	0.5%	0.4–0.7%	0.2%	0.7%

Waste material	Waste received: average composition	Waste received: composition range	Waste combusted: short-term composition	Waste combusted: long-term composition
Electronic equipment, household chemicals and pharmaceuticals	1.1%	0.4–2.4%	1.1%	1.3%
Fine material <10mm	0.4%	0–1.3%	0.4%	0.5%
Absorbent hygiene products	5.8%	5–6.9%	6.1%	7.4%
Wood	1.5%	1–1.9%	1.6%	1.9%

Table 8: Expected C&I composition based on Erskine Park waste audits

Waste material	Waste received: average composition	Waste received: composition range	Waste combusted: likely composition
Paper and card	25.7%	16.9–32.8%	26.0%
Plastic film	14.9%	13–17.5%	15.2%
Dense plastic	8.2%	7.4–9.1%	7.7%
Textiles	3.4%	2–6.3%	3.5%
Glass	2.0%	1.1–2.6%	2.0%
Inert material (concrete, rock, ceramics etc)	2.1%	0.9–3.3%	2.1%
Food and Kitchen waste	23.7%	14.5–34.9%	24.0%
Garden waste	0.9%	0.1–1.4%	0.9%
Other Organics	1.6%	1.1–1.9%	1.6%
Ferrous metal	3.1%	2.6–3.7%	2.5%
Non-ferrous metal	0.4%	0.3–0.5%	0.3%
Electronic equipment, household chemicals and pharmaceuticals	0.7%	0.4–0.9%	0.7%
Fine material <10mm	1.4%	0.5–2.3%	1.4%
Absorbent hygiene products	6.0%	3.9–11.1%	6.1%
Wood	5.8%	1.1–15.3%	5.9%

The following assumptions were applied to reach the numerical composition estimates in **Table 7** and **Table 8**:

- Red-bin residual waste from councils with FOGO services is combusted without pre-sorting.
- All MSW is sourced from FOGO collection in the long term.
- FOGO collections divert 45% of food organics compared to current MSW, in line with average performance of FOGO collections operating for longer than one year.[8]
- FOGO collections divert 50% of garden waste compared to audited waste, reflecting an improvement in current incomplete or optional garden waste collection.
- Total diversion to new FOGO bin about 20% of the current residual waste bin for MSW under current collection systems.
- 10% of plastics are diverted in the long term, as a result of changes to packaging, policy on single use plastics and education.
- Pre-sorting of mixed waste recovers 85% of ferrous metals, 65% of non-ferrous metals and 30% or rigid plastics. This equates to an overall recycling rate of about 5%.

The C&I waste audits show significantly higher compositional variation, due to the diversity of businesses involved in generating this stream. Modelling of waste availability assumes an increase in source separation by businesses over time and a corresponding reduction in the need for pre-sorting of waste before combustion. However, the granularity regarding the types of businesses and level of existing source separation represented in the audit data does not allow conclusions to be made regarding changes to the average composition of C&I waste over time.
The likely composition of waste combusted reflects the application of best practice pre-sorting to the waste as-received at Erskine Park, combined with Cleanaway estimates that 60% of their current customers have source separation systems in place. Both short- and long-term variability in waste composition is accommodated within the technical design of the WSERRC proposal (see **Section 3.9**).

[8] https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/managewaste/nsw-fogo-analysis.pdf?la=en&hash=F2F341DB7CF6C517801CD04DBBCFA389C03DF82A

3.6.1 Chlorine content

Chlorine levels in waste feedstock are an important parameter because excessive chlorine levels can accelerate corrosion in the boiler and chlorine-containing PCBs can react with some compounds, most commonly present only in hazardous waste, to form air pollutants of concern.

The IED requires that facilities which accept hazardous waste with greater than 1% of halogenated organic substances, expressed as chlorine, are designed to undertake more intensive thermal treatment. The gas resulting from the process must be raised to a temperature of 1100°C for at least two seconds after the last injection of air, rather than the typical 850°C. This requirement has been translated into the technical criteria in the NSW EfW policy as a limit of 1% halogenated organic substances, expressed as chlorine, in any waste feedstock.

Waste feedstock will be thoroughly mixed in the waste bunker to homogenise the incoming material. This prevents isolated loads from causing unacceptable short-term spikes in chlorine content or other waste constituents within the combustion chamber.

Cleanaway conducted a series of waste audits and laboratory testing of MSW and C&I waste received at the Erskine Park transfer station in 2019. The lab test results for subsamples of separate material components (paper/cardboard, food and garden organics, wood and building materials, textiles, plastics potentially hazardous items and PVC) are combined with audited waste composition to determine the average chlorine content of the overall waste feedstock. The facility is designed to process 31.3t per hour average throughput, while compositional audits are based on around 600kg of waste for each stream (MSW or C&I), with further sub-sampling for chemical testing, including chlorine content. The sample size and auditing regime were carefully designed to be as representative as possible, but given the natural heterogeneity of waste, mixing remains an important stage in the energy recovery process and average chlorine content is the most appropriate value for comparison with the EfW policy threshold.

The following average results were determined for the Erskine Park waste:

- MSW average chlorine content (% w/w dry basis): 0.94%
- C&I average chlorine content (% w/w dry basis): 0.43 %
- Overall feedstock mix at 50% C&I, 50% MSW, average chlorine content (% w/w dry basis): 0.69%.

As the average chlorine content for the intended feedstock mix remains less than 1%, the design temperature of 850°C is appropriate.

Waste acceptance criteria and QA/QC procedures will be in place to identify and exclude loads containing unacceptable contamination, such as large concentrations of PVC containing materials. As described in **Section 3.8**, waste will only be accepted from pre-qualified suppliers. As part of the pre-qualification process, a contractual agreement will be put in place between WSERRC and its waste suppliers which identifies a list of unacceptable wastes and waste characteristics and established rights for WSERRC to sample, test and reject the waste, rights for WSERRC to inspect the suppliers facility and a requirement to deliver waste in line with the environmental permit for WSERRC. Unacceptable wastes will include hazardous waste, as defined by the NSW waste classification guidelines, and waste with a chlorine content greater than 1%.

3.7 Waste classification

The sources, availability and composition of suitable waste feedstocks are analysed in Technical report E Waste Flow Analysis for Greater Sydney and summarised in **Paragraph 3.1 24** and **Section 3.6** of this report.

Table 9 presents the conclusions of the WSERRC feedstock strategy in terms of the sources, quantities, classification and composition of wastes which are expected to be accepted for energy recovery in the short and long term.

Waste classifications are determined according to the NSW Waste Classification Guidelines.

Note that tonnage ranged provide for the long and short term do not define a single, intended mix of feedstock sources because the facility has flexibility to adjust its waste mix based on availability and contractual arrangements. WSERRC will secure a total of about 500,000tpa of waste feedstock from a combination of the sources described below, in order to achieve an average calorific value close to the optimum design point. Further discussion is provided in **Section 3.6**.

Table 9: Sources, classification and composition of waste feedstock for energy recovery

Waste feedstock	Classification under the NSW Waste Classification Guidelines	Composition
MSW red-bin residual from councils without FOGO collection	General solid waste (putrescible) (pre-classified)	See **Table 7**: Short-term composition
MSW red-bin residual from councils with FOGO collection	General solid waste (putrescible) (pre-classified)	See **Table 7:** Long-term composition
C&I residual from businesses with source separation.	General solid waste (putrescible). Some waste sources will generate only non-putrescible waste, but the collection process introduces putrescible materials, as demonstrated by waste audit data from the Cleanaway Erskine Park Waste acceptance criteria and QA/QC procedures will exclude hazardous, restricted and special waste, including clinical waste, tyres and asbestos-related waste.	See **Table 8**
C&I waste from businesses without source separation.	General solid waste (putrescible) Some waste sources will generate only non-putrescible waste, but the collection process introduces putrescible materials, as demonstrated by waste audit data from the Cleanaway Erskine Park transfer station. Waste acceptance criteria and QA/QC procedures will exclude hazardous, restricted and special waste, including clinical waste, tyres and asbestos-related waste.	See **Table 8**

3.8 Excluding inappropriate waste

The WSERRC will implement a waste acceptance protocol to control waste feedstock acceptance through pre-qualification of suppliers, contractual arrangements and onsite QA/QC procedures, to make sure that the waste feedstock composition remains well within the parameters which can be safely and reliably processed by the thermal treatment process and flue gas treatment process.

The purpose of this Waste Acceptance Protocol is to:

- Set out the scheduling and mechanics for the delivery of received waste feedstock to WSERRC
- Assist the operator to determine whether waste delivered to the facility is acceptable waste.

It is acknowledged that there will be reporting and auditing requirements defined within the Development Consent and the EPL for the facility.

3.8.1 Acceptable wastes

As described in detail throughout **Section 3**, WSERRC will accept the following waste streams:

- Residual Municipal Solid Waste from Council sponsored collection services
- Residual Commercial and Industrial Waste (from schools, offices, etc.).

3.8.2 Unacceptable wastes or non–compliant wastes

This EIS refers to unacceptable or non-compliant waste which will not be acceptable for delivery to WSERRC. For clarity, a list of unacceptable wastes has been provided below:

- Hazardous waste, as defined by the NSW waste classification guidelines
- Medical waste
- Asbestos
- Liquid and oily wastes
- Contaminated soils
- Tyres
- Animal carcasses
- Waste with a chlorine content of greater than 1%
- Separated recyclable materials or separated food and garden organic waste
- Any car or industrial batteries or concentrations of disposable batteries
- Concentrations of lightbulbs or other electrical wastes
- Materials excluded from the facility by any operating license or approvals provided by a regulatory body in New South Wales
- Highly corrosive or toxic liquids or gases such as strong acids or chlorine or fluorine
- Construction and demolition wastes.

3.8.3 Contamination

Operational procedures and systems will be used to minimise the likelihood of unacceptable waste being received at the facility. This will include:

- Pre-qualification procedures for waste suppliers
- Sorting of waste from sources that have not been adequately source separated
- Periodic sampling and testing
- Onsite quality control and quality assurance procedures.

The nature of residual municipal and commercial and industrial waste is that it is heterogenous in composition and is reliant on human behaviour for its composition. While every effort will be made, including supporting education and awareness of the community on what waste should be presented in what bin, it should be appreciated however that not all contamination can practicably be removed from a heterogenous waste stream. For example, it is possible that a consignment of MSW residual waste could contain a single AA battery that had been disposed of incorrectly by a resident.

While every effort will be made and supported by the project to control the quality of the incoming waste streams, the facility has been designed and will be operated to international best practice, to be able to safely accommodate and manage any underlying levels of contamination in the waste feedstock. The flue gas cleaning equipment has been appropriately designed, so that emissions from waste combustion process, including potential contaminants, are kept below the limits set out in the Air Quality Modelling chapter of this EIS. Energy-from-waste facilities globally, including the reference facilities discussed in this EIS, are designed in line with best practice (defined in the European Union Best Available Techniques Reference Document) to deal with contamination within a waste stream.

3.8.4 Pre-qualification procedures

This EIS has discussed pre-qualification procedures as a mitigant to receiving unacceptable waste. The pre-qualification procedure will include several stages that the waste supplier must pass before being allowed to deliver waste to the site.

Firstly, to deliver waste to the site, a contractual agreement between WSERRC and the waste supplier will be in place. This contractual agreement will set out the terms and conditions of waste supply including wastes that are accepted by WSERRC, wastes that cannot be delivered to WSERRC, rights for WSERRC to sample, test and reject the waste, rights for WSERRC to inspect the suppliers facility and a requirement to deliver waste in line with the environmental permit for WSERRC. The waste supplier will have to agree to the terms of the contract to be deemed acceptable to deliver waste to WSERRC.

Secondly, the supplier will have to provide proof that the waste is appropriate for delivery to WSERRC. This will include:

- Provision of information showing that the waste that is processed within the supplier’s site and destined for WSERRC does not include unacceptable wastes and meets the criteria described in this EIS
- Provision of chemical analysis and compositional analysis of waste that leaves the suppliers facility

- Assuring that commercial and industrial waste is sourced from generators that have adequate source separation processes in place as approved by the EPA
- Having suitable systems and documents that record the type of waste included within each consignment, source, truck identification, supplier identification and so on, to allow source of waste loads to be tracked and identification of the supplier
- Being suitably licensed by the EPA to transport waste
- Having suitable facilities for transfer and resource recovery of waste to make sure that waste delivered to the facility can be combusted in compliance with the facility licence and relevant legislation.

These procedures will mitigate the risk of receiving unacceptable wastes from the project suppliers.

3.8.5 Onsite acceptance, quality assurance and quality control procedures

All waste deliveries will come from suppliers approved by the project. This means that all suppliers will have to pre-qualify before they can enter the site. Unacceptable waste will be excluded through the pre-qualification process, which includes contractual agreements with waste suppliers.

However, it is recognised that best practice includes onsite procedures for waste acceptance. The following section describes the onsite waste acceptance protocol which forms the QA/QC procedures. Procedures will be detailed into an operational plan during the detailed design process in line with any requirements that may be included in permits and licenses.

3.8.6 Scheduling of deliveries

Waste deliveries will be scheduled before arrival at site with the site operations team. Schedules for waste consignments to be delivered will be prepared on an annual, quarterly, monthly, weekly and daily basis and agreed between all parties to make sure that there is sufficient storage capacity in the bunker to accommodate the nominated waste deliveries. This will avoid overfilling of the waste bunker. Deliveries will be scheduled to enable on site operational staff to monitor the delivery process.

3.8.7 Process on arrival

When a delivery vehicle arrives at the facility it will immediately proceed to the weighbridge. The operator will record the gross weight of the delivery vehicle and will direct the delivery vehicle to the designated tipping area or to the waste inspection bay (if chosen for inspection).

Radiation detection will be housed adjacent to the weighbridge to make sure radioactive material is not delivered to site. The radiation detection system will trigger an alarm if the level of radiation is 5 standard deviations above background radiation levels. This threshold will be tested and adjusted, if necessary, during commissioning for proper operation. If a radiation alarm is raised, the vehicle will be directed to quarantine for inspection and assessment. A portable survey meter will be used to inspect the load. If a load is found to contain a source of radiation, that load will be rejected and will remain the responsibility of the supplier for proper disposal at a suitably licensed facility.

If the vehicle is directed to the inspection bay, as soon as practicable after the delivery vehicle has been received in the waste inspection bay, the operator will inspect the paperwork and will release the delivery vehicle to the designated tipping area or direct the delivery vehicle to the dedicated tipping area for inspection in the tipping hall for further investigation.

As soon as practicable after the load has been tipped in the dedicated inspection bay for inspection, the operator will inspect the load and will release the delivery vehicle to the designated tipping area or declare the load as unacceptable waste.

If the vehicle is not directed to the inspection bay, once the delivery vehicle has tipped its load at the designated tipping bay the delivery vehicle is to exit the facility via the designated exit points. **Figure 6** indicates the locations of the entry and exit weighbridges.

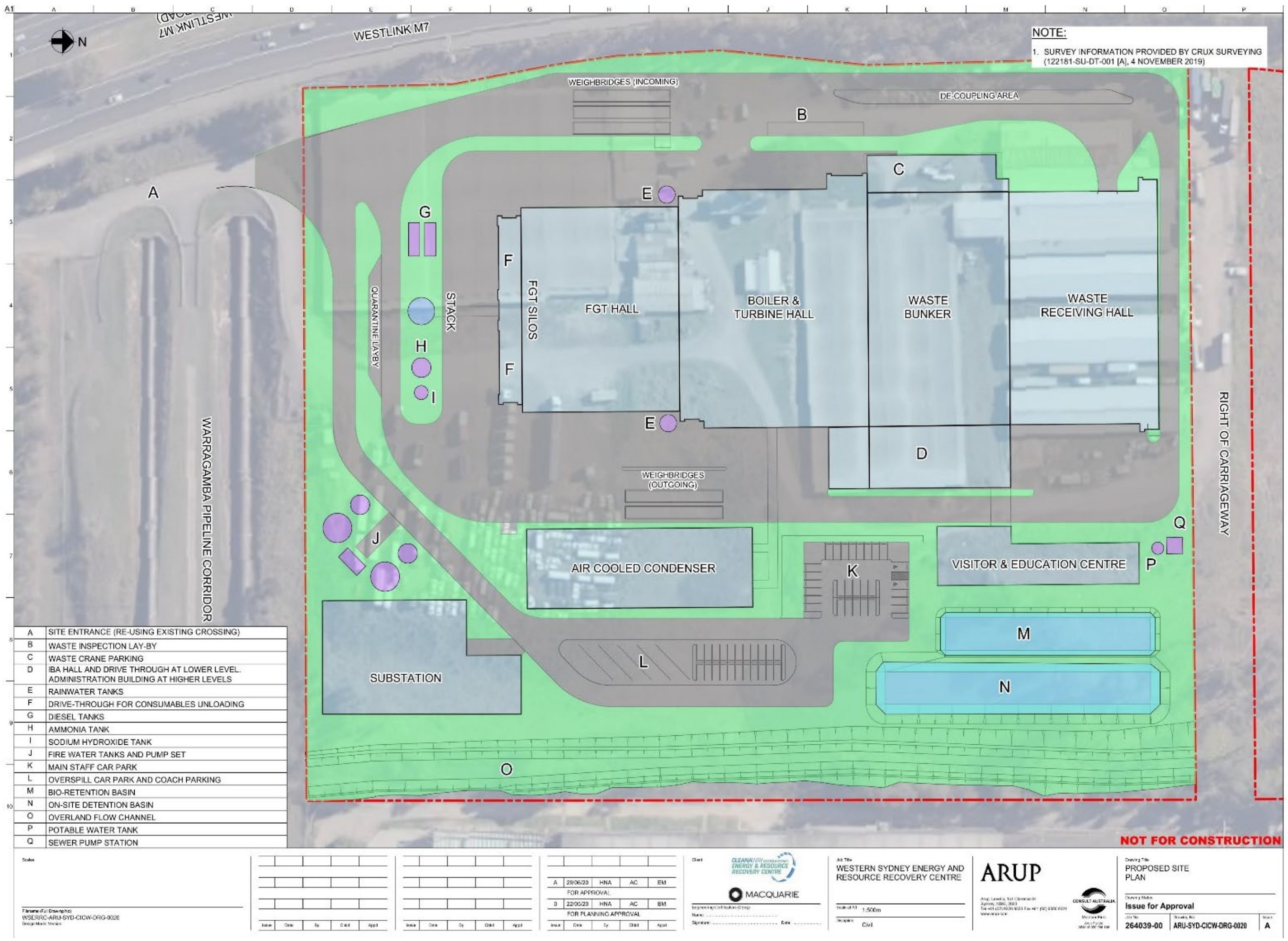

Figure 6: Site layout

3.8.8 Periodic visual inspection

WSERRC will commit to visual inspection of a random waste load at minimum on a daily basis. An operator trained to visually analyse tipped waste loads will inspect the load in line with the procedures above. In addition to the random inspections, if there is doubt as to the suitability of the waste being delivered, a delivery can be inspected at any time. Furthermore, if any supplier is found to have significant quantities of unacceptable wastes within a load, the inspection frequency for that supplier will be increased and discussions will be held with the supplier to identify and ongoing issues and possible solutions.

Initial visual spot checks will be carried out on all new waste suppliers that have passed the pre-qualification stage. These initial visual spot checks will make sure that the waste supplied to WSERRC is acceptable.

3.8.9 Separation of unacceptable waste (pre-tipping)

The load will be rejected if:

- A contaminant detection alarm (radioactivity) rings.
- The operator determines that a load contains unacceptable wastes or that the paperwork is incorrect.
- The load is found to be contaminated upon visual inspection, and the contamination cannot be removed or is contained throughout the waste load.

Rejection of the load will require the waste supplier to return the waste to its facility and dispose of it as required by law. This will remain the responsibility of the waste supplier.

3.8.10 Separation of waste (post-tipping)

Crane operators will provide monitoring of the waste bunker itself using CCTV that monitors the bunker and the tipping bays and will be able to control the waste that is picked up and fed to the boiler.

In the unlikely event that unacceptable waste is observed within the bunker itself, the operator will be able to pick the waste from the bunker using the waste crane and deposit it within a dedicated quarantine area.

Waste within the quarantine area will then be transported offsite and disposed of in line with the legislative requirements, dependent on the type of rejected waste.

3.8.11 Sampling and testing

During facility operations, sampling and testing of the waste material will be carried out on a periodic basis. There is no specific guidance provided in Australia for waste sampling for waste to energy purposes. However, WSERRC proposes that sampling frequency will be quarterly as a minimum, which will allow any seasonal variation (which is in itself unlikely) to be accounted for. A detailed sampling procedure will be set out as part of the operational plan for the facility later and will include:

- Composition (constituents of the waste)
- Chemical analysis to determine calorific value, moisture content, sulphur content, chlorine content and ash yield.

Sampling will be carried out by a skilled operative within the inspection bay adjacent to the bunker. If a vehicle is selected for random sampling, it will be directed to the inspection bay after passing over the weighbridge. During sampling periods, samples of waste will be taken from multiple vehicles, combined and mixed to present as homogenous a sample as possible. A portion of this will then be sent to a laboratory for testing. If it is found during the testing process that waste supplied includes unacceptable waste, a correction plan will be put in place with the supplier (detailed later dependent upon the issue).
In addition, the sampling and testing frequency of the offending suppliers' loads will be increased providing a proactive approach to sampling and testing.

3.9 Accommodating variability

The facility will thoroughly mix waste in the waste bunker to homogenise the material and prevent rapid spikes in contaminant levels or changes in calorific value associated with individual loads. The facility will also vary the waste feed rate in response to calorific value in order to maintain an optimum energy input for efficient energy recovery.

In addition, over the operational life of the WSERRC facility, it is likely that both technical advancement and policy changes will result in changes to the residual waste stream. This will cause long-term changes to the waste mix that would be combusted. The WSERRC facility has been designed to be flexible to these changes.

Changes to waste composition primarily influence the overall energy content of the waste entering the facility. The EIS **Chapter 3 Proposal description** outlines the facility firing diagram. The firing diagram has been designed to accept a variety of waste types over a range of energy contents.

The technical design of the WSERRC proposal allows the facility to operate continuously on waste with a calorific value in the range 7.7–14.3 MJ/kg. During operation, the waste feed rate is frequently adjusted to maintain an optimum energy load to the boiler for efficient power generation. As the calorific value of waste increases, the throughput decreases, while lower calorific value waste requires a higher throughput. In this way, the facility can reliably provide electricity from a range of different feedstocks.

Lab testing of subsamples for the waste audits at Erskine Park provide data to understand the expected calorific value of waste materials. This has been combined with waste composition to determine the expected calorific net value (NCV) of the waste feedstock. Benchmarking of typical NCV of wastes in other locations has also been used as a comparison to lab test results. There difference between these values reflects the inherent variability in waste materials and moisture content in tested sub-samples. The operation of the plant will adapt to the calorific value of the waste received.

As shown in **Table 10**, the optimum design point of a NCV of 11 MJ/kg is expected to be provided by a feedstock blend of about 60% C&I waste and 40% MSW in the short term. The calorific value of MSW is expected to increase over time as organic material is diverted to FOGO collections. This is consistent with the WSERRC feedstock strategy to increase the proportion of MSW over time and remains within the design NCV range.

Table 10: Impact of feedstock sourcing on expected calorific value

% C&I	% MSW (short-term composition)	Benchmark NCV	Lab Test NCV	Lab test NCV-long-term MSW composition
0%	100%	9.0	9.2	11.1
20%	80%	9.6	10.1	11.6
40%	60%	10.3	11.0	12.1
50%	50%	10.6	11.4	12.3
60%	40%	10.9	11.8	12.6
70%	30%	11.3	12.3	12.8
80%	20%	11.6	12.7	13.1
100%	0%	12.3	13.6	13.60

If the future waste mix changes, the facility has inherent flexibility to adapt, while continuing to deliver acceptable technical performance in complete combustion of waste and control of emissions to air.

4 Facility operations

4.1 WSERRC proposed operations

EIS **Chapter 3 Proposal description** provides details of the energy recovery process, site infrastructure and procedures for operating the site in a way that minimises and mitigates potential impacts on human health, amenity and the environment.

Technical report D Best Available Techniques Assessment was prepared by Ramboll and confirms compliance of the proposed design against best practise as defined in the EU Best Available Techniques Reference Document.

A hazard identification process has also been carried out to identify potential risks to health, safety and the environment as a result of a range of exogenous factors such as equipment malfunction, extreme weather or fire. These findings of this process have informed facility design to minimise and mitigate these risks, as presented in the Technical report J Preliminary Hazard Assessment.

Based on these technical assessments, the proposed facility is expected to operate in a safe and environmentally acceptable manner, accommodating both routine variability and exogenous shocks.

4.2 NSW Waste Levy Guidelines

The WSERRC will be required to report information about waste received and waste transported off site to the NSW EPA. This reporting will comply with the requirements for resource recovery facilities set out in section 5 of the NSW Waste Levy Guidelines. The WSERRC facility will not incur levy payments, as no waste is disposed at the site. However, reporting at resource recovery facilities is essential to maintain the integrity of the waste levy system. Solids residues from the energy recovery process will incur levy liability if disposed to landfill.

Cleanaway is familiar with the routine waste levy reporting requirements through their operations is other areas of the waste treatment and resource recovery supply chain in New South Wales.

All waste received at the facility will be measured using a weighbridge and recorded in the reporting system. Waste delivery vehicles will be weighed via the weighbridge on arrival and electronically catalogued, including information on the type and source of waste. The weighbridges will be equipped with card reader, licence plate scanner and intercom equipment. All ingoing and outgoing traffic will be registered by automated licence plate recognition and linked to the truck management system. Trucks regularly visiting the facility can be pre-registered via the management system.

The site will have 3 entry weighbridges and 2 exit weighbridges, providing efficiency under normal conditions and redundancy against temporary weighbridge malfunction.

This reporting will enable WSERRC to demonstrate that waste has been processed for energy recovery and that no waste is inappropriately stockpiled at the site. It will also enable the NSW EPA to record the contribution of energy recovery to meeting landfill diversion targets for New South Wales.

5 Residues from thermal treatment

Combustion of waste creates solid residues (ash) that must be managed appropriately. WSERRC will produce three types of waste residues from the energy recovery process:

1. IBA – IBA is the primarily inert, non-combustible component of the waste that is left on the grate at the end of the combustion process and is collected at the bottom of the grate and contains non-ferrous and ferrous metals that can be recovered. The expected generation for this stream is 65,800tpa (dry weight), or 80,000tpa (wet weight) after quenching.
2. Boiler fly ash – Some of the ash from the combustion process becomes entrained in the flue gases and makes its way up into the main boiler section. Boiler fly ash is the name given to this ash that is then deposited in the boiler sections before any flue gas treatment reagents are injected into the process. Boiler fly ash collected in boiler passes 2 and 3 is potentially suitable for recovery in construction applications and will be mixed with IBA. Boiler fly ash captured downstream of pass 3 contains higher concentrations of metals and will be diverted to the flue gas treatment residue stream for treatment and disposal. The expected generation from this stream is 9,200tpa (dry weight), to be distributed between the IBA and FGTr streams for handling and management.
3. Flue gas treatment residues (FGTr) – FGTr is the name given to any residues that are extracted from the process after the addition of flue gas treatment reagents. FGTr is a combination of spent reagents and the leftover entrained ash within the flue gases that did not become deposited in the boiler section. FGTr will be extracted from the flue gases within the bag house section of the treatment plant. FGTr represents a very small proportion of the total residues collected. The expected generation for this stream is 20,000tpa (dry weight).

Water is used within FGT process and for ash quenching. However, no effluent is produced because WSERRC is designed as a zero-discharge facility. Excess water is recycled within the system and leave the process only within quenched IBA (about 20% moisture content) and cleaned flue gasses.

5.1 Pathways to greater resource recovery

In other jurisdictions, IBA from waste combustion is recovered and used as a construction material, improving the overall resource recovery of EfW operations. The proposal will seek to establish a similar recovery pathway for IBA from the WSERRC facility, maximising diversion from landfill.

However, this will involve product testing and characterisation to support a new Resource Recovery Order and Exemption within the Resource Recovery Framework under the *POEO (Waste) Regulation 2014.*

Resource Recovery orders apply to the generation and processing of waste for recovery, and include conditions such as:

- Material specifications
- Record keeping requirements
- Reporting requirements.

Resource recovery exemptions contain conditions which consumers must meet in order to use the recovered material as a resource. The exemptions list regulatory requirements which apply to waste materials, but do not apply to the recovered material. These include requirements such as:

- Holding an environmental protection licence
- Paying the waste disposal levy.

Resource recovery exemptions may also include conditions for appropriate use of the recovered product.

The NSW EPA has produced guidelines on new applications for resource recovery Orders and Exemptions for land application of waste materials. This provides a useful foundation to develop a resource recovery pathway for IBA, although some aspects are not relevant to the recovery of IBA in specific construction uses.

In summary, the application process requires the following information:

- Applicant contact details
- Background information about the source of the waste
- Physical and chemical characterisation of the waste
- Information about mixing or blending of the waste with other materials
- Proposed use or application – including properties of the material that make it fit for purpose
- Information about the receiving environment
- Quality assurance and controls
- Specifications and standards for the recovered product – a new specification may be proposed by the applicant if no relevant specification currently exists.

The NSW EPA also asks applicants to discuss new proposals with the EPA before beginning an application, particularly regarding testing and characterisation of the waste product.

Chemical testing of the WSERRC IBA will be essential to demonstrate that it does not pose an environmental risk through leaching and contamination of land or water, in terms of the intended use for the material.

IBA processing and physical testing will be essential to demonstrate that the IBA product is has suitable strength, durability and grading characteristics for use as a recovered aggregate in construction applications, and to support market development.

Cleanaway will commence testing during the commissioning phase of the WSERRC proposal and work to establish resource recovery pathways for the IBA and FGTr.

5.2 Composition and classification of residues

The characteristics and classification of these residue streams informs appropriate onsite handling and pathways for recovery or disposal.

The WSERRC preferred approach is to establish recycling pathways where possible, while also identifying appropriate disposal options, so that environmental protection is maintained while recycling outlets are unavailable for any reason.

5.2.1 NSW Waste Classification Guidelines

The NSW Waste Classification Guidelines are used to determine appropriate management and disposal pathways for waste materials based on the risk that they pose to environmental and human health.

The NSW Waste Classification Guidelines use two tests:

- The specific contaminant concentration (SCC) of any chemical contaminant in the waste, expressed as milligrams per kilogram (mg/kg)
- The leachable concentration of any chemical contaminant using TCLP, expressed as milligrams per litre (mg/L).

The leaching test is not required if the waste is classed as ‘general solid waste’ using the SCC test and applying lower contaminant thresholds (CT1/CT2 values). If this initial test indicates a ‘restricted’ or ‘hazardous’ classification, then leachability testing is also performed.

Classification using the leachability testing is based both on the toxicity characteristics leaching procedure (TCLP, in mg/L) and the specific contaminant concentration (SCC, in mg/kg). The SCC threshold values for this classification route are higher than for waste classified using contaminant thresholds (CT1/CT2) alone.

The NSW Waste Classification Guidelines adopt methods described in the United States Environmental Protection Agency's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (USEPA 2007) and Updates I, II, IIIA, IIIB, IVA and IVB.[9]

There are currently no EfW facilities operating in Australia. Consequently, direct sampling and testing of IBA arising from Australian waste streams was not possible. The expected classification of thermal treatment residues is based on the residue composition information for the Dublin reference facility.

The test procedures prescribed for waste testing in Ireland differ from standard procedures prescribed in New South Wales. In some cases, this creates uncertainty in the interpretation of results against the NSW Waste Classification Guidelines. Potential sources of uncertainty are identified and discussed.

Direct testing of WSERRC residues using the NSW Waste Classification Guidelines prescribed standard testing procedures is recommended during the commissioning phase, to confirm the expected classifications determined using reference facility data.

5.2.2 IBA

The composition of IBA residues from the Dublin reference facility was obtained through the EPA Ireland. A detailed report on Characterisation and Classification of IBA was submitted to the regulator on 20 November 2019 in support of IBA classification as non-hazardous waste and is publicly available for download.[10]

The IBA characterisation and classification report is based on a full suite of 'hazardous property test' for waste classification, performed by WRc laboratories on 11 samples of IBA collected from the Dublin reference facility in 2018. The ash was representative of material at it is transported of the Dublin site and prior to any maturation processes which are undertaken at an overseas IBA recycling facility.

[9] Available from: https://www.epa.gov/hw-sw846/sw-846-compendium
[10] Available from: http://www.epa.ie/licences/lic_eDMS/090151b280733e4b.pdf

Of these 11 samples:

- 1 sample was tested against all 15 HP characteristics.
- 7 samples were tested against the 4 HP characteristics which are most relevant to IBA (HP 4/8 -irritancy/corrosivity, HP7 – carcinogenicity, HP 14 – ecotoxicity).
- 4 samples were submitted to detailed minerology testing, which informed the assessment of ecotoxic fractions of some metals for which the total metal content exceeded the basic HP14 threshold.
- Further testing was performed involving chemical speciation and thermodynamic modelling, to allow the assessment of HP14 ecotoxicity to be refined. This was particularly important for copper and zinc, neither of which are tested under the NSW Waste Classification Guidelines.

Leachability testing is not part of the HP14 test procedure. It is a requirement for acceptance at different classes of landfill. Dublin does not send any residues to landfill disposal. However, leachability testing was conducted to provide greater understanding of the speciation of key compounds. Water leachability was assessed using the standard BS EN 12457-3 two-step liquid to solid leaching methodology.

The NSW Waste Classification Guidelines prescribe leachability testing using US EPA SW-846 Test Method 1331 toxicity characteristic leaching procedure TCLP. This differs from the BS EN 12457-3 procedure conduct on reference facility IBA in several notable aspects, including the liquid: solid ratio and pH correction. So, results cannot be directly compared with a high degree of accuracy. However, where the reference facility test results are well below the NSW waste classification thresholds, the expected classification can still be determined.

There are also differences in the suite of compounds required to be tested in each jurisdiction. **Table 11** compares the total contaminant concentration for all compounds which were tested at the Dublin reference facility and for which a contaminant threshold is specified in the NSW Waste Classification Guidelines.

Table 12 then compares the leachability test results from the Dublin reference facility to the NSW Waste Classification Guidelines for those compounds which are expected to require leachability testing under the NSW Waste Classification approach due to unacceptably high total contaminant concentration based on the CT1 threshold for preliminary testing.

Table 11: Comparison of NSW Waste Classification thresholds to Dublin IBA testing data for total contaminant concentration

	Dublin IBA 1st phase testing	Dublin IBA 2nd phase testing	IBA benchmark data 2014–2019 (average)	IBA benchmark data 2014–2019 (95% percentile)	NSW General solid waste – maximum value			NSW Restricted solid waste – maximum value		
	Maximum 'as received' mg/kg	Maximum 'as received' mg/kg	mg/kg	mg/kg	CT1(mg/kg) – no leaching test	TCLP1 (mg/L)	SCC1 (mg/kg)	CT1 (mg/kg) – no leaching test	TCLP2 (mg/L)	SCC1 (mg/kg)
Arsenic (As)	8.65	15.5	7.44	13.7	100	5	500	400	20	2000
Beryllium (Be)	0.87	0.92	0.72	0.99	20	1	100	80	4	400
Cadmium (Cd)	14.8	21.3	12.0	27.1	20	1.0	100	80	4	400
Chromium VI (Cr)	<0.09	nd	0.14	0.20	100	5	1900	400	20	7600
Cyanide (free)	<0.82	nd	0.83	0.88	70	3.5	300	280	14	1,200
Cyanide (total)	<0.82	nd	1.05	1.00	320	16	5,900	1,280	64	23,600
Fluoride	Tested for leachability only				3,000	150	10,000	12,000	600	40,000
Lead	1,254	1,316	637	1,296	20	5	1,500	400	20	6,000
Mercury (Hg)	0.42	0.46	0.48	0.84	4	0.2	50	16	0.8	200
Molybdenum (Mo)	14.7	13.8	9.61	22.9	100	5	1,000	400	20	4,000
Nickel (Ni)	94.9	107	98.4	194	40	2	1,050	160	8	4,200
Polycyclic aromatic hydrocarbons (total)	6.98 (one sample. All others nd)	nd	0.81	4.56	200	n/a	200	800	n/a	800
PCBs	0.000008	nd	0.0001	0.0001	<50	<50	n/a	<50	n/a	<50
Phenol (total)	1.07	nd	0.78	1.74	288	14.4	518	1,152	57.6	2.073
Silver (Ag)	5.05	7.25	4.91	11.6	100	5	180	400	20	720
Selenium (Se)	0.45	0.46	0.54	0.85	20	1	50	80	4	200

Table 12: Comparison of NSW Waste Classification thresholds to Dublin IBA testing data for contaminant leachability

	Dublin IBA L/S2 result Dec 2018	**Dublin IBA L/S10 result Dec 2018**	**IBA L/S10 benchmarking data 2014–2019 (average)**	**IBA L/S10 benchmarking data 2014–2019 (95% percentile)**	**NSW General solid waste – maximum value**			**NSW Restricted solid waste – maximum value**		
	mg/L	mg/L	mg/L	mg/L	CT1(mg/kg) – no leaching test	TCLP1 (mg/L)	SCC1 (mg/kg)	CT1 (mg/kg) – no leaching test	TCLP2 (mg/L)	SCC1 (mg/kg)
Cadmium (Cd)	<0.005	<0.005	0.005	0.001	20	1.0	100	80	4	400
Fluoride	<1	0.3	0.808	3	3,000	150	10,000	12,000	600	40,000
Lead	6.25	3.65	0.988	3.52	20	5	1,500	400	20	6,000
Nickel (Ni)	0.055	0.013	0.011	0.022	40	2	1,050	160	8	4,200

Note that leachability test results for IBA from the Dublin reference facility were originally published in unit of mg/kg, normalised to the mass of IBA tested. For comparison with the NSW Waste Classification Guidelines, these results have been converted to mg/L based on the liquid:solid ratio of each test.

All Dublin and benchmarking values are below the threshold	
Dublin values and benchmarking values exceed the threshold	
One Dublin value exceeds the threshold. All other Dublin values and average benchmark value are below the threshold.	

Based on the IBA testing results for the Dublin reference facility and the accompanying IBA benchmarking values indicating the range of typical results for other moving grate facilities processing MSW in the UK, it is expected that lead content will govern the classification of the IBA stream at WSERRC.

The reference facility data indicates with a high degree of confidence that the concentration of all other compounds can be accepted in 'general solid waste' based on either the CT1 contaminant concentration, or the refined SCC1 contaminant concentration threshold and TCLP1 threshold from leachability testing.

Reference facility and benchmarking data based on the BS EN 12457-3 method at a liquid:solid ratio of ten (L/S10 test) also indicated a 'general solid waste' classification. Leachable lead levels measured using the BS EN 12457-3 method at a liquid:solid ratio of 2 (L/S2 test) suggested that the IBA could potentially be classified as 'restricted solid waste' in New South Wales. However, the Dublin sample were tested before maturation. The maturation process for IBA involved chemical changes which partially immobilise contaminants, reducing leachability during ultimate reuse or disposal. IBA from the WSERRC facility will undergo maturation and metals recovery at a dedicated offsite ash-handling facility. In addition, there is significant uncertainty in interpreting the leachability test results from the Dublin reference facility conclusion the leachability test procedures differ between jurisdictions. Notably:

- The method prescribed for NSW is conducted at an L/S 20 liquid:solid ratio. As demonstrated by the difference between the reference facility L/S 2 and L/S 10 results, this can impact leachability behaviour.
- The method prescribed for NSW included pH standardisation whereas the method used on the reference facility IBA does not. This can significantly influence leaching behaviour.

So, the results are similar but not directly comparable with a high degree of confidence.

It is possible that the Dublin IBA samples tested at L/S2 reached saturation for lead during the leaching process. This would explain the lower total contaminant concentration (mg/kg of solid sample) but higher leachate concentration (mg/L of leachate). In this case, the leachate lead concentration could be expected to decrease at the liquid:solid ratio of the leachate test increases and testing at L/S20 as prescribed in New South Wales would likely yields a result well below the threshold for a 'restricted' classification.

WSERRC may be able to consistently achieve acceptable lead levels to justify a 'general solid waste' classification based on direct testing of their IBA using the US EPA SW-846 Test Method 1331, particularly noting that IBA will undergo maturation prior to reuse or disposal, reducing the leachability of contaminants.

It is expected that IBA from the WSERRC facility will be classified as general solid waste and managed accordingly. However, given there remains some uncertainty about the lead levels, direct laboratory testing of matured IBA should be conducted during the commissioning phase.

Testing should be conducted according to the standard procedures outlines in the NSW Waste Classification Guidelines during the commissioning phase and it is expected that this will confirm the 'general solid waste' classification.

It is possible that a 'restricted solid waste' classification may be indicated. Alternative residue handling and management pathways will be prepared for this possibility and would be enacted based on testing results.

5.2.3 Flue gas treatment residues (FGTr)

Data has been obtained through a Freedom of Information Request on the analysis of FGTr for the Dublin reference facility. The dataset analyses the key elements of the waste that could be classified as hazardous. The dataset does not include typical major constituents such as calcium or silicon as these are inherent in any ash stream thus did not need to be analysed.

Table 13 compares the maximum concentration of compounds which were tested at the Dublin reference facility with the corresponding contaminant threshold stated in the NSW Waste Classification Guidelines. The maximum values were chosen from the data set to be as conservative as possible in the analysis.

The Dublin reference facility tested for twenty contaminants; only six of the contaminants correlate with the thresholds stated in the NSW Waste Classification Guidelines.

Table 13: Comparison of NSW Waste Classification thresholds to Dublin FGTr testing data for maximum contaminant concentration

	Dublin FGTr testing	**NSW General solid waste – maximum value**			**NSW Restricted solid waste – maximum value**		
Contaminant	Maximum mg/kg (dry basis)	CT1(mg/kg) – no leaching test	TCLP1 (mg/L)	SCC1 (mg/kg)	CT2 (mg/kg) – no leaching test	TCLP2 (mg/L)	SCC2 (mg/kg)
Arsenic (As)	67	100	5	500	400	20	2,000
Cadmium (Cd)	180	20	1.0	100	80	4	400
Fluoride	170	3,000	150	10,000	12,000	600	40,000
Lead	2,200	100	5	1,500	400	20	6,000
Mercury (Hg)	8	4	0.2	50	16	0.8	200
Molybdenum	33	100	5	1,000	400	20	4,000
Nickel (Ni)	150	40	2	1,050	160	8	4,200

The Dublin value is below the threshold	
The Dublin value exceeds the threshold	
No Dublin test value available	

Based on the FGTr results from the Dublin reference facility, it is expected Cadmium and Lead content will govern the classification of the FGTr stream at WSERRC. These compounds exceed the CT2 threshold value, so cannot be classified as restricted solid waste based on total contaminant levels alone. The measured lead and cadmium levels are less than SCC2. This means that the waste could potentially be classified as restricted solid waste if leachability is also found to be below the TCLP2 threshold.

Leachability test results for Dublin were not available, so could not be compared. As no leachability data is available, it is not possible to provide a conclusive classification of the reference facility FGTr material under NSW Waste Classification Guidelines. Direct testing of FGTr from the WSERRC facility using the NSW Waste Classification Guidelines will be essential during the commissioning phase to confirm the waste classification. For the purposes of this assessment WSERRC has assumed a worst case that the waste will be above the TCLP2 threshold and thus have set out an appropriate treatment philosophy below.

Detailed composition data from FGTr was not publicly available from the Filborna reference facility therefore could not be provided for reference.

5.3 Proposed management pathways for process residues

5.3.1 IBA

IBA will be the largest residue stream generated by the WSERRC energy recovery operations. Boiler fly ash collected from boiler passes 2 and 3 will be combined with the IBA stream.

The IBA stream contains metals, which can be recovered for recycling. The preferred pathway for the remaining inert material is to establish a new Resource Recovery Order and Exemption and develop recycling markets in the construction sector. However, in the short term a disposal pathway may be required and the IBA is expected to be classified as general solid waste.

A ferrous metal separator will recovery ferrous metals from IBA at the WSERRC facility. The stage is known as primary metals recovery. The recovered metals will be transported off site for storage and sale.

IBA will then be transported to an offsite facility for further processing. The location and design of this facility have not yet been confirmed, but a preliminary consideration of requirements and potential environmental impacts is provided in EIS **Chapter 22 Related development**.

At the offsite facility, the IBA will be matured and processed to recover non-ferrous metals for recycling. In future, further processing will be undertaken to enable additional recycling of inert material, for example size grading for use as aggregate in construction applications. However, a resource recovery order and exemption will first need to be obtained and market development will need to be undertaken to enable this reuse pathway.

In the interim, IBA will be disposed to a suitably licenced landfill as general solid waste (non-putrescible). Suitably licenced landfills in the surrounding area include:

- Cleanaway Erskine Park Landfill, Erskine Park (EPL 4865)
- Suez Elizabeth Drive Landfill, Kemps Creek (EPL 4068)
- Penrith Waste Services Mulgoa Road Landfill, Mulgoa (EPL 3438)
- Dial-a-Dump Genesis landfill, Eastern Creek (EPL 13426)
- Blacktown Waste Services Marsden Park Landfill, Blacktown (EPL 11497).

5.3.2 FGTr

FGTr, combined with boiler fly ash recovered downstream of boiler pass 3 is likely to contain hazardous levels of heavy metals and treatment will be required to immobilise contaminants in accordance with the NSW EPA Environmental Guidance for Solid Waste Landfills (2nd edition, 2016).

If testing during the commissioning phase demonstrates that FGTr from WSERRC is classified as restricted solid waste, is can be disposed to appropriately classified landfill, such as the Suez Kemps Creek landfill (EPL: 4068). If leachability if found to exceed the TCLP2 threshold, the FGTr will need to be further treated to immobilise these contaminants prior to disposal. The Cleanaway Bulk Hazardous Solid Waste Treatment facility at St Mary’s can perform this waste treatment. The treated FGTr would be disposed to an appropriately licenced landfill as restricted solid waste.

The St Mary’s facility typically uses the following chemical immobilisation process to treat waste with high lead levels:

1. The waste is wetted to about 10–20% moisture content to facilitate reagent dissolution and reduce dust.
2. A phosphate-based reagent is mixed with the waste and allowed to sit for at least 24 hours. The phosphate chemically bonds with the lead, making it insoluble in water and reducing leachable concentrations to meet either the ‘restricted solid waste’ or ‘general solid waste’ classification.
3. After 24 hours the waste is mixed with a magnesium oxide-based reagent which adjusts the pH of the treated waste to resist elevated acidity of leachate within the landfill.
4. After treatment the waste is assessed chemically to meet conditions set by NSW EPA within an immobilisation approval. Once successful treatment is confirmed, the waste can be reclassified and disposed of to an appropriate landfill.